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ABSTRACT

Competition and Subsequent Risk-Taking Behaviour: Heterogeneity across Gender and Outcomes*

This paper studies if competition affects subsequent risk-taking behaviour by means of a laboratory experiment that manipulates the degree of competitiveness of the environment under equivalent monetary incentives. We find that competition increases risk aversion, especially for males, but not in a significant manner. When conditioning on the outcome, we find that males become significantly more risk averse after losing the tournament than after randomly earning the same low payoff. In contrast, males do not become more risk-seeking after winning the tournament, while females' average risk-taking behaviour is unaffected by tournament participation and outcomes. We interpret our findings in terms of males' reaction to negative outcomes driven by intrinsic motives, such as emotions or a shift in the locus of control from internal to external.

JEL Classification: C81, C91, D81
Keywords: competition, risk attitudes, gender

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1. Introduction

Every day people are faced with many decisions involving risk. Most of such decisions have economic relevance and affect not only individuals' immediate well-being but also their long-term situation. Recent research in economics has shown that risk attitudes, rather than immutable, are shaped by life experiences and by the characteristics of the environment.[1] Our paper contributes to this emerging literature by studying the effect of competition on subsequent risk behaviour and its heterogeneity along the gender dimension.

People compete for better paid jobs, for career advancements, for mates, and for monetary and non-monetary rewards. In general, competition is widely used as incentive scheme and constitutes an important motivating device especially in situations where measuring absolute performance is difficult, for instance when shocks affect productivity or when performance evaluation is subjective. The fact that risk attitudes and competitiveness may correlate is rather intuitive, as tournaments typically imply uncertain outcomes. Thus, the decision to enter the competition and the behaviour in a competitive environment are naturally influenced by subjects' risk attitudes.

In this paper we go one step further analysing the possible consequences of competitive endeavours on risk attitudes. Being exposed to some risk while competing, due to the random component of the outcomes, may have carryover effects on future decisions involving risk, even without competitive incentives. However, the uncertainty of the outcome is not the only link between competition and subsequent risk taking behaviour. Competitive pressure in the lab also involves stress (Buckert et al., 2015; Zhong et al., 2016), and acute stress has been shown to affect decisions under risk (Starcke and Brand, 2012). Competitive endeavours may also trigger a set of different emotions and feelings (Cerin and Barnett, 2006; Kräkel, 2008), and emotions have been shown to play an important role in decision-making under risk. Finally, subjects performing in a competitive environment know that the outcome is not a pure chance event because their ability and effort also matter. How subjects weight the role played by their characteristics with that played by luck may have carryover effects as long as their locus of control gets affected.

Whatever the cause, investigating whether the competitiveness of the environment can in turn shape subsequent decisions under risk is important because the analysis of competition is usually focused only on its immediate effects on productivity. Competition as a one-shot phenomenon is mainly an abstraction of laboratory experiments, while choices are usually taken in situations where competition occurs repeatedly or is followed by other decisions.[2] Hence, besides short-run effects on performance, the exposure to competition may have long-run consequences and the change in risk attitudes may constitute a transmission

[1] For instance, Booth and Nolen (2012) find that women's risk preferences react to the gender composition of the education environment. Eckel et al. (2009) show that Hurricane Katrina evacuees exhibit risk-loving behaviour shortly after the disaster, while an opposite reaction is reported by Cameron and Shah (2015), who instead find that individuals in Indonesian villages that suffered a flood or an earthquake exhibit a long-lasting increase of risk aversion.

[2] Gill and Prowse (2014) study how the outcome of competition affects the productivity of men and women in subsequent competitive interactions. They find that for women losing per se is detrimental to productivity, while for men such an effect is observed only when the prize at stake is big enough. Haenni (2016) finds in a sample of amateur tennis players that it takes on average 10% longer to compete again after losing than after winning.

mechanism.

We answer our research question through a laboratory experiment in which competition occurs in the Coin Task (Gioia, 2016), a real effort task that consists in recognizing the value and the country of Euro coins. We measure participants' risk preferences by using the Bomb Risk Elicitation Task (Crosetto and Filippin, 2013), where subjects have to choose how many boxes to collect out of 100, 99 of which contain 10 Euro cents while one contains a bomb that destroys the earnings. We compare the risk preferences in a treatment in which the rewards in the Coin Task are determined in a tournament against a baseline condition where comparable payoffs are instead predetermined. Such a (between-subject) design allows us to control for another reason why competition may affect subsequent risk taking, namely social comparison. Competition induces ex post inequality, thereby making relative earnings salient in models such as Fehr and Schmidt (1999) and Charness and Rabin (2002). There is a growing literature showing that social comparison plays indeed a relevant role in decisions under risk (Fafchamps et al., 2015; Gamba et al., 2014; Linde and Sonnemans, 2012; Schmidt et al., 2015). Our design allows us to control for wealth effects and focus on the effect of competition on risk taking net of any social comparison consideration.

We also aim at investigating whether the relationship between the competitiveness of the environment and risk attitudes is different for men and women. Some contributions in the literature claim that women are more risk averse than men (Croson and Gneezy, 2009; Eckel and Grossman, 2008) although the estimated gender difference in risk attitudes depends on the method used to measure risk attitudes (Filippin and Crosetto, 2016). On the other hand, the literature has documented significant gender differences in fondness for competition and in performance in competitive situations (Gneezy et al., 2003). At least since Niederle and Vesterlund (2007) it has been shown that women tend to shy away from competition. The combination of these two strands of the literature suggested that even unequal outcomes in the labour market can be rationalized by the fact that women are less willing to engage in competitive endeavours because they are more risk averse (Booth and Nolen, 2012). However, while the gender gap in tournament entry has been largely replicated, the role played by risk attitudes has been further investigated showing a limited impact.[3] In light of this evidence, we believe that it is worth investigating whether competition affects risk preferences differently for men and women. For example, if women are both more risk averse and less willing to engage in competition than men, after being exposed to the risk of a competitive endeavour they may be more likely to avoid further - although independent - risk. Similarly, since men like competition more and tend to perform better, after the competitive experience, they may be more likely to take on further risk.[4]

Overall, our results suggest that on average competition does not affect risk-taking behaviour. Performing the Coin Task in a tournament slightly increases risk aversion as compared to the baseline condition, but not significantly so. When investigating gender hetero-

[3]See Niederle (2016) and references therein.

[4]Some papers have documented that also stress may have an effect on choices under risk that is different for men and women. Lighthall et al. (2009) run an experiment where participants play the Balloon Analogue Risk Task (Lejuez et al., 2002), a computer game measuring risk attitudes, fifteen minutes after completing a stressful challenge or a control task. They find that acute stress amplifies sex differences in risk seeking: men take more risk under stress while women become more risk averse. Similarly, Ceccato et al. (2015) find that women report slightly higher stress levels than men and are more risk averse.

geneity, we find that the slightly higher risk aversion after tournaments masks a potentially important effect for males, whose difference in the risky choice in the baseline and after competing is quite large though not significant at conventional levels.

An interesting evidence for males' behaviour emerges when disaggregating the results by both gender and outcomes: males become significantly more risk averse after losing the tournament than after earning the same payoff in the baseline treatment. There is instead no evidence of a more risk-seeking behaviour after winning the tournament. As regards females, their risk attitudes are unaffected by participating to the tournament and by its outcome. Several mechanisms may explain the pattern of observed results. On one hand, since winning or losing is not only a pure chance event but also relies upon individual characteristics such as ability or effort, losing a tournament may trigger a feeling of loss of control over one's outcomes, or in other words is likely to shift the locus of control from internal to external. By thinking that their decisions are controlled by environmental factors which they cannot influence, males who lose may become less confident in their probability of succeeding even in a pure chance task and therefore more risk averse. Beisswingert et al. (2016) indeed show that exogenously determining a loss of control induces a more risk averse behaviour.[5] On the other hand, the relationship between losing the competition and having a higher degree of risk aversion may be explained by the emotions induced by tournaments. Subjects feel joy, pride, self-esteem when outperforming their opponent, whereas they feel sadness, disappointment, anger and low self-esteem when falling behind.[6]

Up to our knowledge, very few contributions in the literature are related to effect of competition on subsequent decisions under risk. Gioia (2016) studies the impact of peer effects on risk-taking behaviour under different incentive schemes, including tournaments. She finds that competition more than halves the magnitude of peer influence on a subsequent individual decision under risk, but its effect does not reach statistical significance. Apicella et al. (2014) study the effect of changes in the level of testosterone induced by winning or losing a rock-paper-scissors tournament on subsequent willingness to take risk. They report an increase in testosterone levels after the tournament, higher for winners than for losers, and greater for subjects who win by a tighter margin. The authors find that testosterone significantly correlates with the decision of taking more risk in a multiple price list task. However, Apicella et al. (2014) do not study the behaviour of females and their task is based on pure chance, while ability and effort do not matter. Finally, Buser (2016) studies the effect of competition on the willingness to seek further challenges. He finds that when subjects perform at the individual level the same task (adding two-digit numbers) in which they have previously lost in a winner-takes-all tournament, they tend to set a higher performance target to meet for payment but also to perform worse. In Buser (2016) risk attitudes act as a mediator

[5]Beisswingert et al. (2016) propose a computer game in which participants have to predict where an object would be displayed on a circle by recognizing the systematic pattern underlying the previously displayed objects. They show that manipulating the degree of difficulty of the task induces significantly more risk averse choices in the Devil's task (Slovic, 1966), a risk elicitation method that has many features in common with the Bomb Risk Elicitation Task (BRET) that we use.

[6]Conte et al. (2013) find that four specific emotional states (joviality, sadness, fear, and anger) induce risk-seeking behaviour, while Campos-Vazquez and Cuilty (2014) report that risk aversion increases with sadness. Bassi et al. (2013) attribute to subjects mood the role of mediator between weather conditions and risk taking behaviour.

between competition and the decisions in the second stage. However, decisions also depend on ability and effort, which instead do not play any role in our setting as we administer a pure risk task.

The structure of the paper is as follows. Section 2 describes the tasks adopted as well as the experimental design and procedures. In Section 3 we present the results of the experiment, first at the aggregate level, and then disaggregated by gender and outcome in the tournament. Section 4 concludes.

2. Experimental design

The experiment entails the exogenous manipulation of the degree of competitiveness of a real effort task performed before eliciting subjects' risk preferences. We implement two conditions in a between-subject design: a treatment in which the rewards in the real effort task are decided by a tournament within pairs of subjects (Competition), and a control condition in which comparable payoffs are instead exogenously assigned (Baseline).

The real effort task that subjects perform is the Coin Task (Gioia, 2016). The Coin Task consists of recognizing the value and the country of Euro coins. Participants see on the left-hand side of their computer screen a table with Euro coins of different values from several countries, and on the right-hand side a coin randomly drawn from the table (see Figure 1). The task of the subjects is to identify the value and the country of the selected coin. After the answer is submitted, a new table and a new coin to identify appear on the subject's screen. Participants have five minutes to recognize as many coins as possible. The score is the number of coins successfully recognized, with no penalty for wrong answers.[7]

The main advantage of this task in comparison to other real effort tasks is that in the Coin Task subjects may in principle get all answers correct, provided they exert enough effort. This doesn't of course mean that ability or knowledge do not help as people who are very good may be faster at the task and have lower costs of effort, but no specific knowledge is required to answer correctly. Also, the task does not carry any gender stereotype and is very easy to understand and perform.

The Coin Task is always played in groups of two and the rules for the payment determine our treatment conditions. Treated participants are in competition with their randomly determined opponent: the subject reaching the higher score gets 8 euro while the other one gets 2 euro.[8] Participants in the Baseline receive the same monetary payoffs (one player 2 euro, the other 8 euro), which are however predetermined, so that there is no competition. Subjects are told that they are randomly matched in pairs, and before playing the Coin Task they are also told whether their randomly determined reward is 2 or 8 euro. Monetary rewards in both treatments are conditional upon identifying at least 5 coins, otherwise the payoff is zero. We do so for the effort task to be perceived as incentivized in both conditions and therefore to avoid house-money effects (Kahneman et al., 1990, 1991; Thaler and

[7] A similar task has been used by (Belot and Schröder, 2013, 2015) to study counterproductive behaviour and monitoring.

[8] Possible ties are broken first looking at the total number of attempts, i.e. also including wrong answers in the score, and in case of a further tie at the time taken to identify the coins correctly.

Figure 1: The Coin Task

Johnson, 1990). The chosen threshold is low in order to avoid losing observations because subjects do not earn a positive amount.

The focus of our research is the pure effect of competition on subsequent risk-taking behaviour and therefore we want to avoid the possible confound represented by wealth effects. Wealth effects may affect risk taking both in absolute and in relative terms.First, previous earning can shape participants' willingness to take risks by cushioning the impact of bad outcomes in the BRET. Higher earnings in the Coin Task could induce a more risk-seeking behaviour in the BRET and such an effect do not need to be linear.[9] For the sake of minimizing the heterogeneity in the outcomes we opt for fixed prizes in the tournament (either 2 or 8 euro), rather than for rewards that change at the margin with individual productivity. To be salient, however, competition needs to map into different outcomes for winners and losers and this leads to the second concern. Earning different amounts may affect choices under risk via social comparison. For this reason we add the Baseline condition in which subjects are randomly matched in pairs and receive the same rewards that are however randomly assigned instead of determined by the relative performance. Social comparison based on monetary outcomes is therefore identical in the two treatments. Thus, the comparison across conditions allows us to isolate the pure effect of competition on risk attitudes.

[9]For instance, Crosetto and Filippin (2013) show that earnings in previous tasks have a U-shape effect on subsequent choices in the BRET. The most risk averse choice follows a payoff of about 2 Euro, while higher and lower earnings are associated to more risk seeking decisions.

After the completion of the Coin Task, we elicit subjects' risk preferences by using the BRET (Crosetto and Filippin, 2013). The BRET is a simple risk elicitation method in which participants see on their computer screen a field containing of 100 boxes, as shown in Figure 2. A subject has to choose how many boxes to collect knowing that 99 boxes contain 10 Euro cents while one contains a bomb that, if collected, destroys the earnings. Boxes are collected in numerical order starting from the top-left corner and ending at the box corresponding to participant's chosen number. The bomb can be in any box with the same probability and its position is randomly determined at the end of the experiment, i.e. after the choice is made, in order to avoid truncation of the data. The BRET allows to span the whole domain of risk preferences, with a risk neutral choice (under CRRA preferences) corresponding to 50 boxes. A higher (lower) choice identifies risk seeking (aversion). After selecting a number of boxes, subjects are informed about the lottery they are going to play. The chosen number of boxes is shown in light grey and the potential earnings and their corresponding probabilities are explicitly described. Participants may change their choice as many times as they like before confirming it.

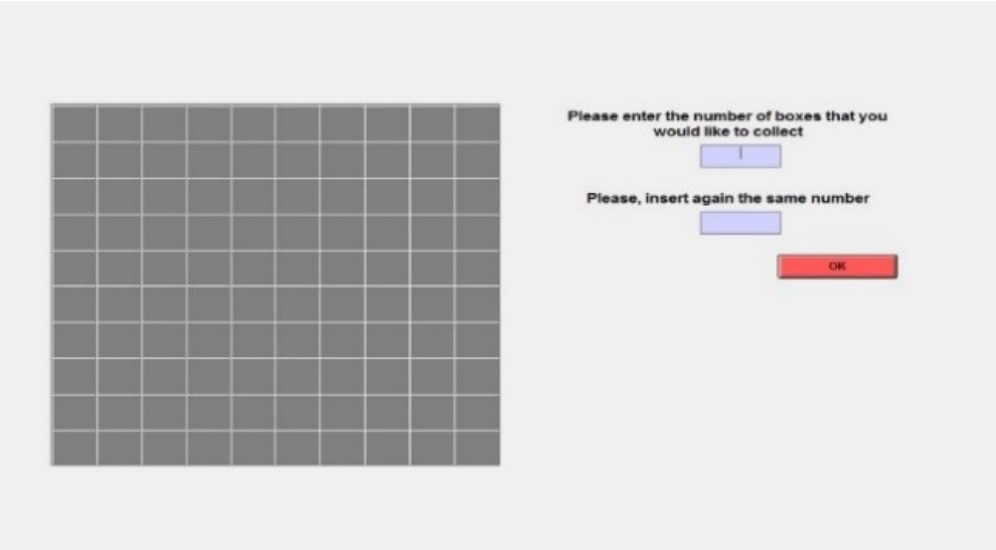

Figure 2: The Bomb Riks Elicitation Task

We elicit risk attitudes only once, after the effort task. The reason is that we want to avoid confounds such as hedging, possible violations of the Reduction Axiom, or even a roller coaster behaviour across subsequent choices. In Crosetto and Filippin (2013), the authors suggest to implement a one-shot versions of the BRET, stressing that a lower risk aversion could be observed when the salience of the single decision is diluted by the repetitions of the task.

Experimental Procedures. The experiment took place at the University of Milan in March 2016. It was programmed using z-Tree (Fischbacher, 2007). Subjects were recruited using the ORSEE software (Greiner, 2015) ensuring a balanced representation by gender.

Upon their arrival subjects entered the laboratory and were randomly assigned to computer terminals, separated by partitions. After reading aloud the instructions illustrating the

Coin Task, participants were solicited to raise questions. Once all doubts had been privately dispelled, the first stage of the experiment began.

Participants were randomly matched in pairs and were given the chance to practice for one minute in order to familiarize with the Coin Task. Coins identified during this minute did not add to the final score. They had then five minutes to perform the incentivized task, which consisted in recognizing as many coins as possible. Before starting, subjects were asked to guess the number of coins they were going to correctly identify and whether this number was higher, equal, or lower than the average of the other participants. We ask these questions in order to elicit subjects' expectations and be able to build a proxy for overconfidence. At the end of the real effort task, subjects were told their own score and in the Competition treatment also the outcome of the tournament. Subjects were not told their peer's score.

The experimenter then read aloud the instructions of the BRET and participants were given again the opportunity to clear up any doubts individually. Subjects played the BRET and, after submitting their choice, completed a short questionnaire. The position of the bomb was then randomly determined at the individual level. Subjects were notified about their final earnings (2.5 euro of show-up fee, plus their earnings in both the Coin Task and the BRET), received their payment in a sealed envelope and left the laboratory.

3. Results

A total of 130 subjects took part in the experiment: 62 in the baseline and 68 in the competition treatment. Table 1 presents summary statistics of our main variables separately for the two conditions. The last column of the table reports the p-value of a Mann-Whitney test for the equality of the variables across the two conditions.

Subjects in the two conditions are homogeneous in terms of individual characteristics such as gender, age and ability. Females represent 42 percent of subjects in the baseline and 53 percent of treated subjects but the difference is not statistically significant. Participants in the whole sample are on average 21 years old.

In order to perform the Coin Task subjects do not need any specific cognitive ability. A sufficient amount of effort is enough to get a correct answer. However, subjects endowed with higher levels of speed of thought, patience and ability to focus may be faster than other subjects and thus more likely to win.[10] In order to control for the effect of differences in ability, in the final questionnaire we ask the average grade obtained over the first semester of the academic year (*Average Grade*). Grades range from 18 to 31 (30 cum laude) and participants report an average grade of 25.4 in the baseline and 26 in the treatment (not significant difference).

In what follows we present the results of our experiment starting from the real effort task, then moving on subjects' expectations and finally focusing on our main variable of interest, i.e. risk attitudes.

Coin task. A comparison of the performance in the Coin Task across treatments allows us to check the effectiveness of our incentive scheme. In the Baseline participants have to correctly

[10]Different knowledge of Euro Coins is not an issue in our dataset because all students have the Euro as national currency.

Table 1: **Summary statistics by treatment**

	Baseline		Competition		Mann-Whitney
Variable	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**p-value**
Female	0.419	0.497	0.529	0.503	0.2113
Age	21.177	2.440	21.294	3.686	0.8558
Average Grade	25.419	4.091	25.985	2.668	0.5923
Coin Task					
Total Coins	23.645	5.204	26.868	6.601	0.0048
Correct	21.597	4.792	24.309	6.611	0.0035
Wrong	2.048	3.07	2.559	3.312	0.0960
Expectations					
Expected Guessed Coins	12.935	6.563	14.706	7.704	0.2332
Risk Behaviour					
BRET choice	43.452	19.018	39.471	14.878	0.3588
N	62		68		

identify only five coins in order to earn their payoff, while in the competition treatment their earnings also depend on their relative performance. Table 1 shows that competition improves subjects' performance, as expected. Subjects in the Baseline try on average 23.6 coins, 21.6 of which are correctly identified. The corresponding figures are significantly higher when subjects perform the Coin Task in competition: the number of coins attempted on average is 26.8 with an average of 24.3 correct answers.[11]

As regards the gender dimension, we find that females perform significantly worse than males (Table 2). However, differences in the performance are significant both in the Baseline and in the Competition treatment and are of similar size.[12] Hence, gender differences in competitiveness do not seem to play any role.[13]

Expectations. Part of the literature on the gender gap in performance ascribes differences in competitive endeavours to overconfidence for males and underconfidence for females (Niederle and Vesterlund, 2007). In order to check whether confidence has explanatory power in our setting, before performing the effort task, we elicit subjects' expectations on their performance. We then use the difference between expected and realized score to measure their confidence, as commonly done in the literature on overconfidence (De Paola et al.,

[11]The high performance in the Baseline conditions can be rationalized by the fact that subjects dislike inactivity in the lab and tend to avoid it even at a cost such as exerting effort (see Jensenius, 2017, and references therein).

[12]Estimating a diff-in-diff model we find that the gender differences across conditions (0.8) do not statistically differ.

[13]Many studies have shown that the competitiveness of the environment may induce a gender gap in performance. Starting from Gneezy et al. (2003) this result has been largely replicated particularly in mixed-gender competition and using stereotypical male endeavours, such as solving mazes and math tasks (Shurchkov, 2012). Niederle (2016) also notes that not all the tasks are suitable to measure changes in performance under different incentive schemes. For instance, no change in performance is observed using the task of adding five two-digit numbers as in Niederle and Vesterlund (2007). This is likely the case of the Coin task, too, as a similar effects of competition on performance across gender is also found by Gioia (2016).

Table 2: **Performance in the Coin Task by Treatment and Gender**

	All	**Baseline**	**Competition**	Difference	Mann-Whitney
Males	24.12	22.53	25.91	1.59	p=0.008
Females	21.81	20.31	22.89	1.5	p=0.041
Difference	2.31	2.22	3.02		
Mann-Whitney	p=0.027	p=0.080	p=0.035		

2014; Ifcher and Zarghamee, 2014). A negative number means that subjects are underconfident, as they identify more coins than what they expected. Viceversa, positive values indicate overconfidence.

Subjects in our sample are underconfident on average, as the mean of the *Confidence* variable is equal to -9.15. Table 1 shows that the expected performance is lower than the actual one both in the Baseline ($12.9 - 21.6 = -8.7$) and in the Competition treatment ($14.7 - 24.3 = -9.6$). Confidence does not significantly differ either by treatment or by gender (Table 3).

Table 3: **Confidence by treatment and by gender**

	Confidence		**Confidence**
Baseline	-8.66	Males	-9.79
Competition	-9.60	Females	-8.45
Difference	0.94		-1.34
Mann-Whitney	p=0.291		p=0.301

As far as risk attitudes are concerned, a positive correlation emerges between confidence and the choice in the BRET (corr=0.152, p=0.085): forecasts improve with risk seeking. This result is driven by the competition treatment (corr=0.238, p=0.051) while no correlation emerges for the baseline.

Although far from the observed performance on average, subjects' expectations in the effort task turn out to be quite reliable, as they significantly correlate with the actual performance. Rather surprisingly, the correlation is stronger in the Baseline (correlation coefficient 0.54, significant at the 1% level) than in the Competition (0.21, significant at the 10% level).

Risk attitudes. In this section we answer our main research question, namely whether competition affects risk attitudes, possibly in a different way along a gender perspective.

Table 1 reports the descriptive statistics of our main variables of interest and shows that on average subjects are risk averse in both conditions.[14] Competition seems to increase risk aversion: subjects in the Baseline collect about 43.5 boxes on average, while the corresponding figure for the treated is about 39.5, but the difference is not significant.

As already described in the introduction, there are several reasons why competition may affect subsequent risk attitudes, such as uncertainty of the outcomes, stress, loss/gain of

[14] A risk neutral choice in the BRET corresponds to choosing 50 boxes.

control, emotions and social comparison. By comparing decisions of individuals who experienced competition with those of individuals ending up in the same financial situation without competing, our design allows us to control for the randomness in the outcomes, wealth effects as well as for what the payoffs trigger in terms of emotions or superstition.[15] We can therefore isolate the pure effect of competition that can be outcome dependent, over and above its monetary consequences.

We do so in Table 4 reporting the average decision in the BRET separately by treatment and outcome. Data show a higher degree of risk aversion in both outcomes under competition as well as when facing a bad outcome in both treatments. However, none of the differences reaches traditional significance levels.

Table 4: **Risk attitudes by treatment and outcome**

	Bad Outcome	**Good Outcome**	Difference	Mann-Whitney
Baseline	42.23	44.68	-2.45	p=0.587
Competition	38.21	40.74	-2.53	p=0.547
Difference	4.02	3.94		
Mann-Whitney	p=0.385	p= 0.385		

At first glance, competition does not seem to produce additional effects as compared to the Baseline condition. However, the gender dimension has been shown to be relevant in the literature about both competition and risk preferences. Hence, we split our sample by gender considering first the overall data by treatment. We find that the slightly higher risk aversion previously found in Competition masks a potentially important effect for males, whose difference in the BRET choice (46.61 in the Baseline *vs* 39.25 in Competition) is quite large though not significant at conventional levels (Table 5). In contrast, females' behaviour is not affected by the treatment.

Table 5: **Risk attitudes by treatment and gender**

	Males	**Females**	Difference	Mann-Whitney
Baseline	46.61	39.08	7.53	p=0.136
Obs.	36	26		
Competition	39.25	39.67	-0.42	p=0.668
Obs.	32	36		
Difference	7.36	-0.59		
Mann-Whitney	p=0.126	p= 0.848		

Results with aggregate data may hide important effects that are outcome-dependent. Losers may become more risk averse if, for example, a bad outcome induces a shift in their locus of control. In contrast, winners may become more risk seeking if they think to be better able to beat the odds. Such effects can also be gender-specific, so in Table 6 we further break down the data both by gender and by outcome in the effort task.

[15]Here by superstition we mean thoughts like "I have got the bad outcome, so I will be unlucky again" or

Table 6: **Risk attitudes by treatment, gender and outcome**

	Males			**Females**		
	Bad Outcome	**Good Outcome**	M-W	**Bad Outcome**	**Good Outcome**	M-W
Baseline	44.35	48.63	p=0.407	39.64	38.42	p=0.980
Obs.	17	19		14	12	
Competition	35.14	42.44	p=0.177	40.35	38.81	p=0.620
Obs.	14	18		20	16	
M-W	p=0.058	p=0.183		p=0.699	p=0.870	

By conditioning the gender analysis on the level of payoffs, we find that nothing emerges for females, whose average choice is rather stable across conditions and outcomes. In contrast, an interesting pattern emerges for males, who become significantly more risk averse when losing the tournament as compared to receiving the low payoff in the Baseline. No statistically significant effect is instead observed when they win the tournament as compared to earning the same amount of money in the Baseline.

Note that by focusing only on the choices in the tournament, one could be tempted to infer that males are affected by the outcome of the competition becoming more risk seeking after winning than after losing (42.44 *vs.* 35.14). However, the design of the experiment allows us to exclude that competition induces a more risk seeking behaviour for winners once wealth effects are taken into account. If we compare the choices in competition with the corresponding choices in the baseline we see that winning the tournament does not make males more risk seeking.[16] In other words, winners become relatively less risk averse than losers, but competition does not increase their risk tolerance as compared to subjects earning the same amount of money without competing.

Our results are not compatible with stress being the link between competition and risk taking. Other mechanisms may rationalize why males become more risk averse when losing the tournament. One possible explanation is that the negative outcome in the tournament may arouse emotions (over and above those triggered by the level of the payoffs) that in turn affect the subsequent decision under risk. Alternatively, the negative outcome may induce a shift in the locus of control. Losing may reduce the extent to which one believes that he can predict or influence future events and this may, in turn, increase risk aversion.

Competition is not a pure chance event because outcomes are also influenced by ability or effort. Therefore, a negative outcome may have a stronger effect for males who perform better. The reason is that losing despite an effective completion of the effort task may raise more intense emotions or induce a stronger shift in the locus of control. Indeed, we find that the higher the performance in the Coin task of males losing the competition, the higher their risk aversion (correlation coefficient -0.63, p=0.0153). We are aware that a possible reverse causality link may exist between the two variables, as a higher risk aversion may simply

instead "I have been unlucky the first time, I will be lucky the second time".

[16]We cannot exclude a false negative in the Good Outcome case, possibly because of the low number of observations, but note that the point estimate goes in the opposite direction as what one might expect.

induce to optimally choose a higher level of effort in the Coin task. If purely endogenous, however, such a relationship should hold in general, while we observe it only for males losing the tournament. Figure 3 shows that a negative correlation between risk seeking behaviour and performance in the Coin task does not characterize males who win the tournament (left hand panel).[17] Since one could argue that this comparison is made difficult by a different average performance, the right hand panel compares all the subjects losing the tournament, showing that females' choices under risk are not related to their performance.

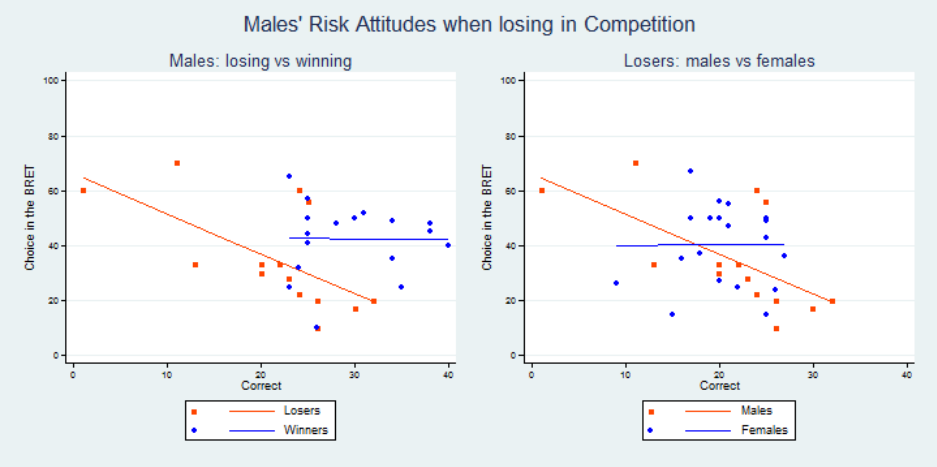

Figure 3: Males' Risk Attitudes when losing in Competition

Table 7 provides an econometric representation of the same fact. Choices under risk negatively correlate with the performance in the Coin Task only for males losing the tournament, even in a multivariate framework controlling for the degree of confidence and ability.[18]

Further suggestive evidence that the relationship highlighted above is genuine can be derived in Gioia (2016), who elicits risk attitudes also before the Coin Task, without finding any significant correlation between risk attitudes ex-ante and performance in the competitive endeavour.

4. Conclusion

Competition is important in a wide range of economic decisions, and this paper contributes to the literature by analysing the consequence of being exposed to competitive environments on subsequent individual risk-taking behaviour. The economics literature typically evaluates relative performance pay schemes only through their direct impact on productivity. However, competition is seldom a one-shot phenomenon, as individuals face

[17] When we restrict the observations to the performance range where we observe both males winning and males losing, we still find evidence of a negative relationship between performance and risk seeking behaviour for males losing and we find a weakly positive relationship for males winning the tournament.

[18] Results in columns (1) and (2) are robust when we restrict the observations to the performance range where we observe both males winning and males losing the competition.

Table 7: Risk attitudes and Performance in Competition

	BRET choice			
	Males		Losers	
	(1)	(2)	(3)	(4)
Correct(Male,lose)	-1.4602***	-1.7035***	-1.4602***	-1.6214***
	(0.3795)	(0.5124)	(0.3779)	(0.4522)
Correct(Male,win)	-0.0323	-0.2047		
	(0.5304)	(0.6595)		
Winner	-22.7209	-25.9121		
	(19.7591)	(18.7123)		
Correct(Female,lose)			0.0137	0.1973
			(0.7969)	(0.6751)
Female			-26.0464	-31.9327*
			(19.0715)	(17.9474)
Overconfidence		-0.1983		-0.0884
		(0.3014)		(0.2696)
Ability		1.5852		2.9573***
		(1.1964)		(0.8325)
Constant	66.1194***	71.0617***	66.1194***	68.2202***
	(8.7244)	(10.3456)	(8.6880)	(8.9368)
Observations	32	32	34	34
Adjusted R^2	0.208	0.219	0.157	0.301

Heteroskedastic-robust standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The difference in the effect of *Correct* for *Winner* and *Loser* in the subsample of males is always significant at the 5% level (columns 1 and 2). The difference in the effect of *Correct* for *Male* and *Female* in the subsample of losers has *p*-value=0.105 in column 3 and is significant at the 5% level in column 4.

many situations involving competitive pressure and make relevant decisions even after competition is over. Therefore, besides short-run effects on performance, competitive pressure may induce other effects that can affect subsequent decisions adding to its long run impact. From this point of view risk attitudes are a natural candidate as a transmission mechanism.

We investigate the causal effect of competition on subsequent risk-taking behaviour by running a lab experiment eliciting the risk attitudes of a sample of subjects that have performed a real effort task exogenously manipulated in terms of the degree of competitiveness. We find that, overall, treated subjects display a more risk-averse behaviour. However, such a positive relationship between competition and risk aversion is not statistically significant, even conditioning on the outcome of the tournament. We devote particular attention to the analysis of the effects across gender because several studies find that women differ from men in terms of both risk aversion and fondness for competition. Indeed, we find a novel and counter-intuitive result: while females' behaviour is stable across treatments and outcomes, males become more risk averse after losing in the competitive environment. There is instead

no evidence of a symmetric more risk-seeking behaviour after winning the tournament.

The design of the experiment carefully controls for wealth effects and any other payoff-related determinant, thereby isolating the pure effect of competition at the individual level and excluding social comparison considerations. We interpret our findings in terms of males' reaction to negative outcomes driven by intrinsic motives. One possible explanation is that the negative outcome may arouse emotions that in turn affect the subsequent decision under risk. Alternatively, the negative outcome may induce a shift in the locus of control. Losing may reduce the extent to which one believes that he can predict or influence future events and this may, in turn, increase risk aversion.

When losing in a competitive task males may have an inclination to project their inability to control events even on subsequent decisions involving merely random outcomes. Our explanation is consistent with previous findings in the literature, e.g. that a shift in the locus of control causes an increase of risk aversion (Beisswingert et al., 2016). Identifying in a controlled manner the ultimate cause why losing a competitive endeavour increases male's risk aversion goes beyond the scope of this paper, but we believe that it constitutes an interesting goal for future research.

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