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THE EFFECT OF CROSS-NATIONALITY EXPOSURE ON COMPETITIVE TOURNAMENT ENTRY AND OVERCONFIDENCE

A Laboratory Experiment

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Abstract

Overconfidence is a persistent bias that entails less-than-optimal decision making. Reducing overconfidence is of high interest to increase efficiency. Conducting a laboratory experiment at Nova SBE, this research proposes a novel information-based treatment on over-entry in a competitive setting. Participants receive information on their competitor ahead of decision making, including nationality. It is hypothesized that this information raises participants awareness of cross-nationality exposure as in- and out-groups which alters decision making. Findings are suggestive that treatment exposure reduces over-entry within the laboratory experiment. This outcome advocates that promoting multicultural environments could be beneficial to improve efficient decision making.
Keywords: *Laboratory experiment, overconfidence, tournament entry*

1 Introduction

De Bondt and Thaler (1995) state that *"perhaps the most robust finding in the psychology of judgment is that people are overconfident"* (p. 389).

The existence of overconfidence has been an established finding in behavioural economics as well as psychology literature in past decades and been observed in a variety of topics. Svenson's (1981) seminal study on self-perception of one's driving skills pioneered the range of research pertaining to this topic, exhibiting people's tendencies towards overconfidence. Overconfidence, in general, has been linked to a wide range of issues from labour strikes (Neale and Bazerman, 1985) to war (Johnson, 2009).

The existence and importance of overconfidence have also been discussed within the field of economics. Overconfidence has been suggested as an explanation to excessive trading and subsequent monetary losses (Odean, 1998), to over-entry into markets (Camerer and Lovallo, 1999), and to an excess number of corporate mergers (Malmendier and Tate, 2005). These show that overconfidence can entail losses in efficiency. To increase efficiency and improve decision making, it is therefore of interest to reduce the overconfidence that individuals express in their choices. Conducting an experiment following Niederle and Vesterlund (2007) this thesis investigates the effect of cross-nationality exposure on overconfident tournament entry in a competitive tournament setting.

Conducting a laboratory experiment at Nova SBE, a novel information-based treatment was developed to study how competing against an individual from another nationality alters entry choices compared to competing against a compatriot. This thesis shows that results are suggestive that cross-nationality exposure lowers excess entry, reduces expressed overconfidence and could contribute to more optimal decision making. These findings support the argument that multicultural teams can bring along more efficient decision making and are thus of high potential interest to businesses, corporations, and public bodies.

This thesis is structured the following way: First, a literature review introduces the context of this research within the literature and how it can add insight. Second, the experimental approach is introduced including the participant pool, the experimental mechanism, how the treatment was introduced, payment, matching, and belief elicitation. Third, ex-ante predictions of tournament entry of rational decision makers and the observed, actual behaviour of participants are discussed. A discussion on descriptive performance and belief measures follows. Fourth, a probit model of tournament entry is introduced using established predictors which are, fifth, expanded to assess the impact the suggested treatment has on tournament entry. The treatment is analysed under different specifications within the experimental setting. It is shown that results are suggestive that cross-nationality exposure reduces tournament entry and could be a valid mean to lower overconfident over-entry.

2 Literature review

The notion of overconfidence originally stems from psychology. The issue was introduced by Svenson (1981) with the famous remark that 90% of drivers consider themselves above average. Overconfidence has been studied outside psychology as well, three examples include: perception of performances (Clayson and Healy, 2005), expectations of the speed at which tasks can be completed (Buehler, Griffin, and Ross, 1994), and people's inability to judge frequencies and probabilities correctly (Brenner et al., 1996). Overconfidence describes a persistent and highly significant bias in decision making (Plous, 1993) and is nowadays a standard part of behavioural finance textbooks (See, e.g., Barberis and Thaler, 2003). In economics, overconfidence has been linked to a wide range of phenomena such as speculative bubbles (Scheinkman and Xiong, 2003) and compensation schemes of CEOs (Gervais, Heaton, and Odeon, 2011). Moore and Healy (2008) provide an extensive overview of the areas in Economics to which the notion of overconfidence has been applied.

Usually, overconfidence is understood as a negative that leads to less efficient decision outcomes. Malmendier and Tate (2005) use CEO overconfidence to explain an excess of mergers and show that those with overconfident CEOs are more penalised by the market. Camerer and Lovallo (1999) show that overconfidence leads to excess entry into competitive markets in laboratory experiments, reducing profits or even incurring losses.

Odean (1998) links overconfidence to excessive trading and subsequent monetary losses of traders. Barber and Odean (2001) put a number on this and compute that overconfidence in male investors costs them more than 2.5% in yearly average returns. All this research suggests that reducing overconfidence is clearly desirable to increase efficiency in entry, mergers, and trading.

This thesis relies on recent experimental literature which investigates on the importance of group composition, such as Charness, Luca, and Rustichini (2007), Chen and Li (2009), and Charness and Rustichini (2011), who have found that group composition and opponents characteristic can alter both an individual's decision making and preferences, which can also influence overconfidence.

Expanding on findings of Healy and Pate (2011), that exposure to another person as a team member within a competitive, individual decision can reduce overconfidence, the experiment will expose participants to another person as a competitor in a competitive, individual decision to assess whether such direct, competitive, exposure can also reduce overconfidence. Arkes et al. (1987) also show that exposure to people reduces overconfidence. Research on the importance of group composition for decision making has been recent and is still developing, leaving room for a further understanding of how group characteristics influence decisions.

Gneezy et al. (2009) performed a field experiment on differences in behaviour amongst genders in a strictly patriarchal society and a matrilineal one. They find that while a gender gap in overconfidence exists in both societies, the gender exhibiting it differs across cultures. Their findings doubted the idea of mere biological determinants of overconfidence (as expressed in Niederle and Vesterlund (2007)) and gave rise to the question of the importance of cultural background and its influence on the behaviour of individuals respective of group membership. The treatment suggested builds on the idea that overconfidence can differ across groups and culture, proxied by nationality.

Based on previous research showing that culture and an individual's characteristic matter for preferences and decision making, especially for in- and out-group behaviour, it seems plausible to expect differences in competitive behaviour by nationality as a group characteristic. This thesis will investigate the following research question: *Does exposure to another nationality reduce overconfident over-entry in a competitive tournament environment?* To assess overconfidence, this thesis will adapt an experiment proposed by Niederle and Vesterlund (2007) and expand it to a setting of out-group exposure and nationality which, to the author's best knowledge, has never been studied before.

3 Methodology – A laboratory experiment

To assess the impact of competition across nationality as out-group competition, a laboratory experiment was designed, planned and conducted at Nova SBE. The pairing of subjects into competitive groups of two is regarded as the treatment, depending on the matching. Participants who were matched with a competitor from a different nationality are considered to have received the treatment, whereas participants who competed against someone from their own country serve as control group for the effect of cross-nationality exposure. The experiment is an alteration of an experiment conducted in Niederle and Vesterlund (2007). Participants conducted a real effort task by adding a series of two-digit numbers. This task has familiarity, comparable to everyday tasks such as adding prices during grocery shopping. It cannot be said that the task is too difficult or unfamiliar which has been found to influence overconfidence (see Moore and Healy, (2008)). Nevertheless, it takes some mental effort to add the numbers and thus performing is not costless such as in experiments where a given endowment must be allocated. The experiment was conducted in a pen-and-paper style, and all sheets were handed out and collected individually, resulting in around 900 pages of material.

3.1 Participants

Three experimental sessions of about one hour each were conducted at Nova SBE with a total of 71 students participating in the experiment, 47.9% of which were female. Students were recruited through a public invitation to the experiment on the social media platform "Facebook". For each Masters programme, an individual group exists on this platform within which the invitation was published. Therefore, every Master student at Nova SBE was targeted to participate. Table 1 below reports the distribution of participants by age, gender, and nationality. Participants' age was between 20 and 26, except for one outlier at 35 years of age, with a median age of 22.8 years. Excluding the one outlier, normality in the age distribution failed to be rejected at 10%. Out of all participating students, only one pursued a Bachelor's degree whereas all others pursued a Master's degree. Due to the nature of the undertaking, a large number of participants pursued a degree in Economics, representing about 50% of participants. The distribution of nationalities is wide, with a peak in Portuguese and German participation. Close to 50% of participants were Portuguese, 25% German and 8.5% Italian with the rest diversely distributed.

	Age	Total	AT	BE	BR	CA	DK	DE	GW	IT	NO	PL	PT	CH	TN	US
Female		34	1			1		5		5	3	1	18			
	20-22	16				1				3		1	11			
	23-25	18	1					5		2	3		7			
Male		37	1	1	1		1	12	1	1			16	1	1	1
	20-22	14						1		1			11		1	
	23-25	21	1	1	1		1	10					5	1		1
	26+	2						1	1							
Total		71	**2**	**1**	**1**	**1**	**1**	**17**	**1**	**6**	**3**	**1**	**34**	**1**	**1**	**1**

Note: AT= Austria, BE=Belgium, BR=Brazil, CA=Canada, DK= Denmark, DE=Germany, GW=Guinea-Bissau, IT=Italy, NO=Norway, PT=Portugal, CH=Switzerland, TN=Tunisia, US=United States

3.2 Experimental design

Participants were asked to add five two-digit numbers and could add as many out of 30 additions as they achieved during a 5 minutes periods. Participants received a sheet of paper with the numbers they must add. This procedure was performed four times whereas three of these four rounds differed by payment scheme. In round 1 and 2, payment schemes were given whereas round 3a) and 3b) allowed participants to choose the payment scheme. The payment schemes will be discussed in detail in section 3.4.

Round 1 and 2 are for controls on participants behaviour, whereas round 3a) and 3b) evaluate the treatment. In round 1, participants did not compete against one another. For round 2 – 3b), subjects were randomly allocated into groups of two in which they competed in a 1v1 fashion. Rounds 3a) and 3b) are repetitions of one another, as the task faced by participants remained the same and the repetition was done to permit multiple matches with different nationalities. A difference in matching existed between 3a) and 3b) due to the limitations the experimenter faced regarding the scope of the experiment and the number of participants, which are discussed in section 3.6.

3.3 Payment

Students received chocolate as a show-up fee and were rewarded with Experimental Currency Units (ECUs) depending on their performances. ECUs worked as lottery tickets. Each ECU was a ticket that could be drawn. The pool of the lottery was the sum of all ECUs earned by all participants. The chance of winning money from the lottery was strictly increasing in one's own ECUs. In total, 100€ were allocated to tranches of 5 times 20€ which were then raffled among ECUs. The experimenter made participants aware of how this payment scheme functions and asked whether they understood it before the experiment. Students were told that one out of four rounds would be randomly chosen for payment. Expected payoffs for students are:

$$E(X) = \frac{\Sigma\, ECU_{individual}}{\Sigma\, ECU_{allparticipants}} * 100€ \quad (1)$$

3.4 The rounds

Round 1 was performed under a flat-wage scheme. Participants received a sheet with two-digit number additions which contained brief instructions and had 5 minutes to perform the additions task. For each correct addition, they received 1 ECU. In round 2, Participants received a new sheet with additions to perform. They had 5 minutes to perform the additions task. Round 2 was performed under a tournament scheme. Students were randomly matched with one other player. The participant amongst the two with the highest number of correctly solved additions received 2 ECU per correctly solved addition, the other none (in case of ties the winner was chosen randomly). Participants were forced to perform under a competitive tournament scheme and had no information against whom they performed.

Round 3a) and 3b) were performed alike, but the matching between the two differed. Students received a sheet with information about their competitor, as explained in section 3.5. After receiving this and before performing the round, they had to make a choice on how to be remunerated in the next round: they could choose a flat wage and be paid as in round 1 or a tournament scheme and be paid as in round 2. Choosing the tournament scheme was considered as entry into the tournament, whereas the flat wage was considered as the choice to not enter the tournament. After this choice was made, the corresponding sheets were collected and only then was the task distributed to students so that they could not alter their choice ex-post.

As suggested by Niederle and Vesterlund (2007), in rounds 3a) and 3b) participants did not perform against their competitor's performance in the same round, but against their competitor's performance in round 2, to exclude the possibility that participants make their choice partly on the belief whether the competitor enters. Round 2 has already been played, beliefs about the behaviour of others are irrelevant as it is known that Round 2 was played under the tournament scheme. The same procedure was repeated for round 3b), but participants were rematched.

Table 2

			Round			
			1	2	3	
					3a)	3b)
Task			Number adding	Number adding	Number adding	Number adding
Payment			Flat-wage	Tournament	Choice	Choice
Matching	PT	Half A	None	Random	Random within	Random
		Half B			Random	Random within
	DE				Random within	Random
	Others				Random	Random
Treatment			No	No	Yes	Yes

3.5 Treatment

The treatment occurred through giving students pieces of information on their competitor, thus creating knowledge on the opponent. Whereas no information was provided to students ahead of rounds 1 and 2, in round 3a) and 3b) they were silently given information about their competitor for the following round (See Appendix, Section 9.3). Participants received a sheet of paper which stated their competitor's age, degree level they pursued, favourite colour and nationality. Only the latter was the treatment which is hypothesized to alter participants behaviour. The former three were given in addition to not elicit participants awareness of the variable of interest. This additional information was chosen as it is considered to not have any economically meaningful impact on behaviour. This was confirmed in robustness checks ex-post. Regressed on tournament entry, none of these additional pieces of information was found to have any statistically significant effect. Assessing the effect of giving students information on their competitor's nationality, making them aware of in-group or out-group competition, on tournament entry decision and overconfident entry is the principal motivation for this thesis.

3.6 Matching

Participants were matched randomly. However, some restrictions were made to allow for the proper functioning of the treatment allocation and due to the limitation of the subject pool. In round 2, students were randomly matched without restrictions. In round 3a) and 3b), students were divided into subgroups. All Portuguese participants were equally divided into two subgroups. Participants in one of the subgroups were randomly matched with other Portuguese participants, those in the other group were randomly matched with all remaining non-Portuguese participants. This process was reversed in round 3b). Therefore, a Portuguese who was matched with a Portuguese in round 3a) was matched with a foreigner in round 3b) and vice versa. This was to ensure that each Portuguese student would face a Portuguese once as a control. Some of the 14 nationalities were unique and therefore could not match with anyone from the same nationality and would always receive the treatment. A difference in matching between 3a) and 3b) was done for Germans. All Germans were randomly allocated amongst each other in round 3a) and randomly matched against a non-German in round 3b)[1] . This potentially induced round-effects which can be controlled for. All other students were randomly matched. In section 6.2.3, this difference in matching is explored to assess whether it affected the results.

3.7 Beliefs elicitation and other information

After each round, participants were asked how many correct additions they think they solved. For round 3a) and 3b), this was also asked about their competitor's performance. If correct, students would receive an additional ECU. After playing all rounds of the game, participants were also asked about their guess on the average performance in the tournament[2], their belief on their relative rank amongst ten randomly chosen participants and to do a risk-aversion test based on Holt and Laury (2002).

3.8 Tournament entry: predicted behaviour

Participant i has the choice between a risk-free flat wage scheme that remunerates him/her with 1 ECU per correctly solved addition c_i or enter a tournament against their matched competitor j. Under the tournament scheme, the participant receives 2 ECU for each correct addition if he/she "wins" against his/her competitor, that is, makes more correct additions than his/her competitor and nothing if he/she makes less. In case of a tie, the winner is randomly chosen. The participant thus faces the issue to choose between $E(X_f) = 1 * c_i$ (flat wage) and $E(X_t) = \rho * 2 * c_i$ (tournament scheme) with ρ the probability that $c_i \geq c_j$. That is, receiving 1 per correct answer with certainty or 2 with the probability of winning.

A risk-neutral individual with perfect expectations would enter the tournament if and only if his/her expected pay-offs were higher than under the risk-free flat-wage scheme, which is $E(X_t) > E(X_f)$ or $\rho * 2 * c_i > 1 * c_i$ which only holds if ρ>0.5. Therefore, a risk-neutral individual with perfect expectations would only strictly enter the tournament if the probabilities of winning are at least 50% - or simply more than chance. On average, in a pair of risk-neutral individuals with perfect expectations, only one participant would join the tournament whereas

[1]There were not enough German participants to perform the matching the way it was done for the Portuguese participants, as it requires 4 Germans per session to create two subgroups of two participants each.

[2]Question was incentivised.

the second player maximizes his/her expected payoff by choosing the flat wage. Consequently, with risk-neutral individuals with perfect expectations one would expect exactly 50% of participants to join the tournament in aggregate, and even lower numbers for risk-averse decision makers. The following paragraph shows that this is not the case.

4 Experimental results: behaviour and summary statistics

The following paragraphs describes participants' behaviour regarding entrance, performance, and beliefs to illustrate how participants performed. Table 3 below provides summary statistics of tournament entry and performance (number of additions) regarding gender, rounds of the experiment (those with treatment), and nationality, divided into Portuguese, Germans, and Others, due to the low number of nationalities.

4.1 Tournament entry decision

Regarding entry, data shows that participants do not enter in the fashion predicted above for risk neutral, rational decision makers in aggregate. 60% of the time, participants choose to compete, effectively forgoing the chance to gain real money through ECUs. This pattern is consistent and identical over the two repeated rounds, 3a) and 3b) (Mann-Whitney p = 0.731). There can be several explanations for higher than expected entry.

First, participants were not risk-neutral, but instead risk-loving. To control for this, students performed a Holt-Laury test of risk aversion (Holt and Laury, 2002). Using this measure, only 4.84% of participants exhibited risk-loving behaviour, 25.81% exhibited risk-neutral behaviour, and the remaining 69.35% exhibited risk-aversion (See Table A-1). One would expect that, if risk aversion played a role, on average, even less than 50% of participants joined. Second, participants show what Niederle and Vesterlund (2007) describe as *taste for competition*. Niederle and Vesterlund define *taste for competition* as the error term of their regression analysis on tournament entry. This explanation cannot be straightforwardly rejected from the experimental data directly. Instead, if the introduced treatment is valid in contributing to explain over-entry by itself, it is not only robust to taste for competition but also allows to explain further what

Niederle and Vesterlund attributed to the residual of their model. Third and most importantly, data showed that participants exhibited overconfidence. Their perception of the probability of winning the tournament was incorrect resulting in inefficient over-entry. Observations of entry and reported beliefs strongly suggest that it is overconfidence that drives over-entry.

Table 3

	Gender			Round				Nationality		
	Male	Female		Total	3a	3b		PT	DE	Other
			p-value*				p-value*			
Not entered	32%	49%	0.046	40%	39%	41%	0.73	46%	19%	48%
Entered	68%	51%		60%	61%	59%		54%	81%	53%
Performance	11.03	8.60	0.00	10.69	10.20	11.19	0.14	9.29	11.02	9.88
Belief on own performance	11.97	9.72	0.00	12	11.57	12.42	0.17	10.49	12.33	10.38

*p-value for the null hypothesis that enter and not enter are equal across column values
Numbers subject to rounding

4.2 Observations on performance

As predicted by theory on incentives and repeatedly shown in the literature (e.g., Niederle and Vesterlund, 2007), performance differs with payment scheme. Comparing round 1, played under a flat wage, to round 2, played under a tournament scheme, participants perform better under the tournament scheme. Performance also significantly differs from round 1 to when the choice of enumeration scheme is left to the participants as in round 3a) ($p<1\%$) and 3b) ($p<1\%$). There is no statistically significant difference between round 2 and 3a) or round 3a) and 3b). However, performance in round 3b) is different (and better) than in round 2 and the difference is statistically significant at 5%. The average number of correctly solved additions increases with every round, suggesting that participants perform better with experience and show some effect of learning (See Figure A-1 in the Appenidx). Contrary to Niederle and Vesterlund (2007), the author finds a consistent and significant difference in performance between men and women, both for a flat wage and a tournament payment scheme (See Figure A-2). The difference in performance across gender was driven by a strongly male-dominated 10th decile, including two exceptionally high performers who happen to be male.

4.3 Beliefs on own performance

Participants were asked incentivized questions about their beliefs on performance. Comparing this belief to their actual performance allows shedding light on how accurate beliefs are and the presence of overconfidence in the form of overestimation. Participants were not accurate in guessing their performance correctly with "misses" both up- and downwards, even though the upward biases were much more present and persistent. Table 4 reports some summary statistics on belief accuracy, providing further evidence that overconfidence is present in the sample. Within a band of ± 1 around the actual value (a not too small band, given that the average correct number is 9.8) around half of the participants expressed a belief on their performance that is inaccurate, with a wide range around it. The average "miss" is 1.03 away from the actual performance. However, the standard deviation is considerably larger at 2.4 with participants overestimating their performance by up to 14 additions. Using a Wilcoxon signed-rank test, the null hypothesis that the actual number of correctly solved additions and the belief on the number of solved additions are equal can be rejected at 1% and show an upward bias, that is, beliefs are consistently and significantly above the actual value. Participants were not naively overestimating themselves as in the sense that the number of additions they attempted was equal to their belief on how many they solved. They acknowledged that they can make mistakes and the reported belief is significantly (at 1%) below the number of attempted additions. Participants updated their beliefs downward. However, they did not do this sufficiently.

Table 4

	Accuracy of beliefs on own performance			Accuracy of beliefs on competitor's performance		
	Correct	Correct ±1	Δ from true value	Correct	Correct ±1	Δ from true value
Share of accurate beliefs	0.23	0.54	1.03	0.06	0.19	-0.49
SD	0.42	0.50	2.40	0.24	0.40	4.95

Note: Table 4 reports accuracy of participants beliefs on their own performance and on performance of competitors. *Correct* reports the share of participants whose belief coincide with the actual value, *Correct ±1* reports the share of participants whose belief coincide within a band of ±1 around the actual value. *Δ from true value* is the difference between belief and actual value.

5 Tournament entry – model selection

This section prepares the analysis of the treatment effect on tournament entry. To do so, a probit model to describe tournament entry choices using established factors net of the treatment variable is discussed first. In section 6, an analysis including the treatment variable is performed. This way, it is highlighted how the treatment can add value above established tournament entry factors and whether it influences the degree of overconfidence participants exhibit.

The dependent variable, tournament entry, is binary. It can take only values of either 0 (not enter) or 1 (enter). Using a maximum-likelihood probit estimation, all specification will be estimated along the lines of the below model:

$$Pr(Y=1|X) = \gamma_0 + \beta_i * I + \beta_C * C + \theta_i L \tag{2}$$

Where X is the set of all explanatory variables $X = \{I, C, L\}$. I is a set of explanatory variables that affect tournament entry net of the new treatment which have been discussed in the literature and can be retrieved from the experimental data. These mostly refer to performance measures. Their appropriateness for model specification is discussed below. C is the treatment dummy; facing a competitor with a different nationality. L is a set of control variables. The information given to the participants about their competitors beyond the treatment are not included in the displayed estimations results for two reasons. First, it was given only to not make participants aware that the opponent's nationality is the variable of interest and considered economically meaningless. Second, several model specifications were ran including all of the additional pieces of information and, as expected, none of them were found to be significant or meaningful. Models are estimated using clustered standard errors on individuals over both rounds to account for the fact that every individual played twice and a person's choice in round 3a) is not independent of that in round 3b).

5.1 Set of control variables

Using a Mann-Whitney test, there were no significant differences on tournament entry over experimental sessions detected. There is some evidence that the age of participants influences entry decisions, where entry increased with age. This justifies the usage of age as a control variable in probit estimation models. The number of observations for each age is not very high and results comparing age need to be considered with care. Additionally, round fixed-effects are included to control for differences across the pooled round 3a) and 3b). As established in the literature, there are significant differences in tournament entry across gender. Less than 50% of women in the sample entered the competition, whereas nearly 70% of men entered (Mann-Whitney p = 0.046). A female dummy is included to capture potential effects. Lastly, dummy variables on risk aversion retrieved from a Holt-Laury test on risk aversion are included.

5.2 Independent variables net of treatment

Whether a participant wins in the tournament or not depends crucially on his/her performance in the setting. Therefore, subjects' decision on entry should be strongly influenced by their expectations of their future performance. It is crucial to include an approximation of these expectations to a model of entry decision to which the treatment shall bring additional insight. However, this internal information is not observable ex-ante. Two variables are tested as an approximation for the expectations on future performance that influence participants in their decisions: actual future performance, as suggested in Niederle and Vesterlund (2005), and belief on past performance.

If participants had perfect expectations, then future performance would be perfectly anticipated and entry decision should be perfectly predictable for risk neutral agents based on this performance which can be observed ex-post. However, one observed inefficient over-entry, with participants effectively forgoing real monetary reward. This strongly suggests that participants did not have perfect expectations when making their entry decision but were overconfident in their expectations of winning. The 5% of risk-loving participants alone cannot explain this excess entry. If perfect expectations do not hold, the most relevant information to build expectations on performance in the upcoming competitions are past experiences, unless participants expect a sudden and significant increase in performance and thus their ability. During the experiments, subjects never received feedback on their actual performance. As the actual performance was not known to participants, it could not be part of their decision process. It is therefore argued that ex-ante, belief on past performance is the most reliable performance measure to predict entry. Participants' belief on their performance most closely reflected what they (inaccurately) assessed as their performance, measured after they performed.

As future performance and reported beliefs on past performance are correlated (Spearman's $\rho = 0.6938$) they are expected to work similarly well as performance measures of tournament entry decision. However, it is argued ex-ante that belief on past performance would be the most accurate measure: past performance was unknown and so was future performance unless participants had very accurate expectations. Their belief on how they performed before should, therefore, be closest to how they expected to perform next.

5.2.1 Belief on past performance vs. future performance

Estimating a probit model with the controls mentioned above, the result shows that, as expected, participants belief is a valid predictor of entrance probability and statistically significant at 5%, with a positive coefficient. All control variables, except a participants age, are highly insignificant. An increase in the belief on past performance has a positive effect on tournament entry, that is, it increases the probability of entrance.

If participants had perfect expectations then future performance, as perfectly expected, would be the strongest indicator of entering the tournament scheme, though both the aggregate tournament entry and the inaccuracy of belief speak against perfect expectations. Running the estimation, indeed, yields similar results compared to past beliefs. Higher future performance increases the probability of entering the tournament at 1% significance level. Both belief on past performance and future performance are valid means to capture the impact of participants' expectations of their future performance on entry decisions. Both regressors are used in the model assessing the cross-nationality exposure treatment.

5.2.2 Past entry-decision

Past entry decision can help assess future decisions through two channels. On the one hand, people could be repetitive in their choices, either through perceiving their past behaviour as a heuristic "default" or a consistent expression of individual characteristics, such as risk appetite or degree of overconfidence. On the other hand, individuals could reverse their choices to "insure" themselves against ambiguity and therefore play each option once. A simple model of tournament entry decision using past entry and the common control variables was estimated indicating that choosing tournament in the previous round had a significant positive effect on the probability of choosing to enter the tournament in the current round. This suggests that participants rather did not play an insurance pattern, but that entry decisions show some consistency. Table 5 below highlights this: 63% of participants who did not enter in round 3a) did not enter in round 3b), 37% altered their choice. Similarly, 72% of participants who entered in round 3a) did so in round 3b). To capture this degree of consistency, a robustness check using past entry decision will be included in a specification of the probit model to assess the impact of the treatment in section 6.2.

Table 5

Choice in round 3b)	Choice in round 3a)				
	Not enter		enter		Total
Not enter	17	**63%**	12	28%	29
Enter	10	37%	31	**72%**	41
Total	27		43		70

Note: One incomplete observation reduced observations in Round 3a and 3b

6 The effect of cross-nationality exposure treatment on tournament entry and overconfidence

6.1 Main findings

In this section, the impact of the novel treatment of cross-nationality exposure is discussed. Table 6 below shows tournament entry by treatment groups. It is observable that entry and the degree of over-entry were higher in the non-treated group than the treated one. Entry in the treated group was closer to the pay-off maximizing 50%. A probit model is used as discussed above to assess the effect of the cross-nationality exposure treatment to figure out whether it had a non-trivial impact on tournament entry decision and overconfidence as hypothesized in the motivation part.

Table 6

Entry choice	Cross-nationality treatment: Non-treated Frequency	Non-treated Percentage	Treated Frequency	Treated Percentage	Total
Not enter	19	33%	37	45%	56
Enter	39	67%	45	55%	84
Total	**58**		**82**		

	Non-treated PT	Non-treated DE	Non-treated OTHER	Treated PT	Treated DE	Treated OTHER	
Not enter	14	5		17	1	19	
Enter	20	19		17	7	21	
Total	**34**	**24**		**34**	**8**	**40**	

Table 7 reports marginal effects of probit regressions on the dependent variable tournament entry, where 1 is entry. Marginal effects are reported at means. The regressions include a set of control variables and different explanatory variables, as discussed in section 5. For robustness and to interpret interaction terms, all specifications are also represented as linear OLS estimations.

For all specifications, the point estimate of the female dummy has the direction predicted by the literature (e.g., Niederle and Vesterlund, 2007) but remains insignificant. As suggested above, a participant's age has a positive effect on the probability of tournament entry across most specifications. Older participants are more likely to enter, ceteris paribus. The dummy terms for risk appetites have the expected sign but are statistically insignificant across all specifications. Nine participants (18 observations) were excluded as their Holt-Laury test was inconsistent (mostly alternating A-B pattern). No round effects can be detected.

As can be seen from models (1) and (2) to (4), future performance of participants is a functioning predictor of tournament entry, suggesting that the realization of performance scores that ex-ante can only be anticipated influence tournament entry, with a higher ex-post score increasing participation in the tournament. Contrary to the author's ex-ante expectations above, future performance (1) is a stronger predictor than reported beliefs (2) and has proven so in different specifications. Consequently, future performance is used as independent variable for models (3) and (4). Similar observations hold for OLS regressions with subscript "-a".

Regressions (1) and (2) introduce the treatment, whereas (3) and (4) include controls and interaction terms on the treatment. These are used to assess the importance and direction of the

Table 7

	Regression on tournament entry							
	Marginal effect estimation of probit models at mean				OLS estimations			
VARIABLES	(1)	(2)	(3)	(4)	(1-a)	(2-a)	(3-a)	(4-a)
Future performance	0.0403***		0.0438***	0.0435***	0.0320***		0.0330***	0.0326***
	(0.0129)		(0.0130)	(0.0132)	(0.00896)		(0.00908)	(0.00934)
Belief on past performance		0.0206				0.0188*		
		(0.0136)				(0.0108)		
Cross-nationality exposure treatment	**-0.189****	**-0.140***	**-0.0831**		**-0.160****	**-0.132***	**-0.0796**	
	(0.0857)	(0.0851)	(0.103)		(0.0734)	(0.0773)	(0.0883)	
DE*treatment				0.0148				-0.0231
				(0.227)				(0.146)
PT*treatment				-0.105				-0.0980
				(0.117)				(0.109)
OTHER*treatment				-0.296*				-0.230*
				(0.160)				(0.132)
Participant Portuguese			0.225*	0.0223			0.176	0.0349
			(0.133)	(0.172)			(0.115)	(0.143)
Participant German			0.232	omitted			0.163	omitted
			(0.191)				(0.155)	
Participant Other				omitted				omitted
Risk-lover dummy	0.184	0.218	0.184	0.178	0.174	0.175	0.176	0.172
	(0.268)	(0.268)	(0.263)	(0.265)	(0.186)	(0.185)	(0.185)	(0.186)
Risk-averse dummy	-0.178	-0.163	-0.168	-0.165	-0.162	-0.154	-0.152	-0.150
	(0.116)	(0.113)	(0.122)	(0.123)	(0.0989)	(0.100)	(0.102)	(0.103)
Female	-0.0863	-0.136	-0.0677	-0.0691	-0.0786	-0.124	-0.0660	-0.0670
	(0.104)	(0.104)	(0.105)	(0.105)	(0.0950)	(0.0969)	(0.0941)	(0.0945)
Age	0.0689*	0.0733**	0.0825**	0.0821**	0.0607*	0.0653**	0.0724**	0.0726**
	(0.0358)	(0.0370)	(0.0403)	(0.0403)	(0.0310)	(0.0322)	(0.0339)	(0.0344)
Round	-0.0247	-0.0119	-0.0453	-0.0514	-0.0220	-0.00786	-0.0364	-0.0417
	(0.0892)	(0.0877)	(0.0916)	(0.0941)	(0.0761)	(0.0781)	(0.0772)	(0.0818)
Constant					-0.840	-0.861	-1.248	-1.083
					(0.734)	(0.779)	(0.814)	(0.868)
Observations	120	120	120	120	120	120	120	120
R-squared					0.217	0.170	0.233	0.233

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

treatment on tournament entry and whether it is suitable to reduce overconfident over-entry.

Introducing cross-nationality exposure as independent variable next to performance measures in (1) and (2) support the hypothesized effect. Participants facing someone from a different nationality are estimated to be less likely to enter the tournament, compared to those who faced a compatriot. The coefficient estimates in (1) and (2) are significant at 5% and 10%, respetively. Point estimates suggest that the treatment reduces entry probability by 19% to 14%, at means. Moreover, the treatment is also significant at 5% and 10%, respectively, in the OLS specification (1-a) and (2-a). These simple regression estimates suggest that controlling for performance measure, risk appetite, and some individual characteristics, the treatment effect has the potential to reduce entry and lower efficiency-decreasing over-entry. Regression (3) and (4) allow controlling and elaborating on these findings.

Estimation (3) is extended by dummy variables for the nationality of the participants. For most nationalities, only one participant was present; these were grouped into "Others" and serve as a baseline against facing a Portuguese or German competitor. Adding these nationality dummies for competitors can be interpreted as controlling for tournament entry decision patterns that would be specific and inherent to a participant's nationality – one could imagine a specific effect by nationality group for several reasons. For example, "Others" and Germans studying at NOVA made the explicit choice to study abroad in a foreign environment and could generally be more competitive or overconfident by self-selection. Contrary, given the reputation of the selectiveness of the Bachelor's programme, Portuguese who studied at NOVA before the Master's degree could have a strong self-perception. These stories show that a nationality specific effect is not all implausible.

Virtually no statistically significant effect can be detected for participant's nationality dummies, as visible from Table 7. Only the probit marginal effect dummy for Portuguese participant is significant at 10% in (3), but not in the OLS specification 3-a. However, this specification renders the treatment effect insignificant. It might be that in regressions (1) and (2) the treatment effect merely picked up variations in the difference in tournament entry across nationalities of participants which were wrongly interpreted as a treatment effect. This observation also holds for the Ordinary Least Squares (OLS) specifications reported on the right-hand side of the table. Including dummies for participants' and competitors' nationalities in a linear regression on a binary variable, the treatment effect shows no significant effect.

Regression (4) is used to investigate this claim and suggests rejecting it. The final estimation presented introduces interaction terms with respective nationalities of participants, again divided into German, Portuguese and "Other" due to the size of the dataset. These specifications ought to allow the treatment effect to differ across nationalities and detect whether introducing mere nationality dummies picked up some of this effect or whether the treatment effect was driven by one group. Regression (4) also allows a direct assessment of whether the treatment effect merely picked up nationality level effects as (3) could suggest. The interaction term for both the “Other” group and Portuguese is negative and points towards the hypothesized direction. Of those two, only the “Other” term is significant at 10%. The treatment effect for Germans is not significantly different from 0, suggesting that treatment effects that have been interpreted in (1) and (2) are driven by non-Germans. While only one interaction term is significant at 10%, given the number of observations, the estimates for Portuguese and “Others” are still suggestive that the treatment has an effect and invite for an expanded analysis. For all regressions (1) to (4) and all interaction terms, the point estimate always has the hypothesized sign.

The OLS estimation for models (1-a) to (4-a) broadly support these findings. As in probit marginal effects specification, the treatment has a negative effect on entrance at 10% significance. However, it is not robust to estimating (3-a) or (4-a) under OLS specification, only the interaction term for “Others” is significant at 10% as in (4). Under consideration of the sample size, in (4-a), the point estimate again is suggestive that the treatment has a negative effect on tournament entry.

To conclude, the estimation results presented are suggestive that the treatment of cross-national exposure reduces the probability of tournament entry and thus has the potential to reduce overconfident, efficiency-reducing over-entry. It has been shown that the treatment is not robust to the mere introduction of dummy variables by participant’s nationality. However, it was argued that more precise specification (4), including interaction terms between treatment and nationalities, shows that the treatment could have the hypothesized effect, driven by non-Germans. A larger sample pool could shed light on this. The remainder of this section will discuss whether the treatment is robust to past entry decisions and potential issues arising from the matching procedure.

6.2 Robustness checks

The following section will discuss the robustness of the treatment effect to different specifications.

6.2.1 Past entry decision and cross-nationality exposure

Information on past tournament entry can potentially be a useful predictor of current tournament entry to allow for a pattern in behaviour – consistency, insurance play, or a mix. This information is only observable for round 3b), reducing the number of observations to 60. The difference in matching between round 3a) and 3b) could potentially raise questions about the validity, which will be discussed below. The models used in paragraph 6.1 were enhanced by a dummy variable for past tournament entry, and the estimation results are presented in Appendix Table A-3 (with added subscript "-c"). Surprisingly, adding past entry decision on itself adds only little explanatory power, with the added coefficient only statistically different from zero in an expansion of regression (2). The point effect of the treatment variables remains the same as for the estimations in table 7 and significant for expansions of the models (1) to (4), except (3) as before. The proposed treatment is robust in its evaluation above to the inclusion of past entry decision and does not lose validity. Thus, facing a competitor from a different nationality is suggestive to reduce a participant's probability of joining the tournament and thus reduces over-entry, compared to those facing a competitor from their own country when controlling for participants past entry decisions.

6.2.2 Conditional past entry decision

Further refining of the sample supports the viability of the treatment. Regression (1) to (4) were performed on the subset of round 3b) participants who have entered the tournament in round 3a) (See Appendix Table A-4 with added subscript "-d"). It thus includes all participants who proofed willingness to enter a tournament. These regressions include a maximum 35 observations and thus have only limited statistical power. The cross-nationality exposure treatment remains significant with the correct sign for (1), (2) and (4), as before.

6.2.3 Robustness checks on matching

Due to limitations faced by the experimenter on the scale of the experiment and the number of participants, round 3a) and 3b) were not fully identical. A difference existed in the matching process. The matching procedure for Germans was fixed and differed over rounds. Therefore, it would seem reasonable to investigate whether there were differences stemming from the change of matching of the German participants. To assess whether the treatment is robust to this alteration in matching procedure, estimation model (1) to (4) were reran excluding all German participants and all participants who faced a German – thus, the data are treated as if no German were present in the first place. Results can be found in the Appendix (Table A-5). Necessarily, both the level dummy and treatment interaction term for German participants were removed. The pattern observed before still holds. The treatment effect on tournament entry probability is negative and significant for one interaction term under the fully specified model (4), but not for a specification (3) with only nationality level dummies, similar to the findings before. This suggests that it is unlikely to be the differences in the matching process of Germans that drove the results.

7 Conclusion

This thesis presented a behavioural economic laboratory experiment on overconfident over-entry into tournaments conducted with 71 students at Nova SBE. Using an experimental design based on Niederle and Vesterlund (2007), a novel information-based treatment was introduced. Before making decisions on entry, students were provided additional information on their competitor. All information except for a competitor's nationality was considered economically meaningless and introduced to not prime participants on the topic. Information on the competitor's nationality was fundamental and exposure to a competitor from a different nationality regarded as the treatment of cross-nationality exposure.

Treating nationality as an in-group defining characteristic, the goal was to assess the hypothesis that competition across groups and thus exposure to a competitor from a different nationality affected tournament entry decision. Consequently, it was shown that cross-nationality exposure is a valid mean to reduce overconfident over-entry and increase efficient entry decision making.

In line with the literature, it has been shown that overconfidence in entry was present within the sample. The effect of the treatment was found to be pointing towards the hypothesized direction and significant for some specifications, yet not in all circumstances. However, results are suggestive that the treatment has the hypothesized effect and could be a valid mechanism to reduce inefficiently high numbers of entry when overconfident over-entry is present. Whereas results are suggestive, it remains important to note that like in all laboratory experiments, issues of external validity might remain if students at Nova SBE are a specifically non-representative sample. Contrary, Nova SBE has an international student population and may, in fact, be an appropriate environment to study such effects. This leaves scope for further research to investigate the proposed treatment with a higher number of participants allowing for improved matching, observation, and statistical power.

If the proposed effect holds, that is, cross-nationality exposure is found to be a valid means to reduce overconfident over-entry, it could be an important mechanism to reduce overconfidence in applied settings. It could encourage to increase the exposure of agents to individuals from different nationalities to reduce overconfident actions. This finding suggests that promoting a multicultural workplace can be beneficial to improve efficient decision making in all kind of entities and principal-agent relations such as companies, corporations, NGOs or public bodies.

8 References

Arkes, Hal R., Christensen, Caryn, Lai, Cheryl, and Catherine Blumer. 1987. "Two methods of reducing overconfidence." *Organizational Behavior and Human Decision Processes*, 39(1): 133-144.

Barber, Brad M., and Terrance Odean. 2001. "Boys will be boys: Gender, overconfidence, and common stock investment." *The quarterly journal of economics*, 116(1): 261-292.

Barberis, Nicholas, and Richard Thaler,. 2003. "A survey of behavioral finance." In *Handbook of the Economics of Finance*, Edited by George M. Constantinides, Milton Harris and Rene M. Stulz, 1053-1128.

Brenner, Lyle A., Koehler, Derek J., Liberman, Varda., and Amos Tversky. 1996. "Overconfidence in probability and frequency judgments: A critical examination." *Organizational Behavior and Human Decision Processes*, 65(3): 212-219.

Buehler, Roger, Griffin, Dale, and Michael Ross. 1994. "Exploring the "planning fallacy": Why people underestimate their task completion times." *Journal of personality and social psychology*, 67(3): 366.

Camerer, Colin, and Dan Lovallo. 1999. "Overconfidence and excess entry: An experimental approach." *The American Economic Review*, 89(1): 306-318.

Charness, Gary., and Aldo Rustichini. 2011. "Gender differences in cooperation with group membership." *Games and Economic Behavior*, 72(1): 77-85.

Charness, Gary., Rigotti, Luca, and Aldo Rustichini. 2007. "Individual behavior and group membership." *American Economic Review*, 97(4): 1340-1352.

Chen, Yan, and Sherry X. Li. 2009. "Group identity and social preferences." *The American Economic Review*, 99(1): 431-457.

Clayson, Dennis E., and Debra. A. Haley. 2005. "Marketing models in education: Students as customers, products, or partners." *Marketing Education Review*, 15(1): 1-10.

De Bondt, Werner F., and Thaler, Richard H. (1995). "Financial decision-making in markets and firms: A behavioral perspective." in *Handbooks in operations research and management science*, ed. R. Jarrow et al., 9, 385-410. Amsterdam: Elsevier Science

Gervais, Simon., Heaton, J. B., and Terrance Odean. 2011. "Overconfidence, compensation contracts, and capital budgeting." *The Journal of Finance*, 66(5): 1735-1777

Gneezy, Uri, Leonard, Kenneth. L., and John. A. List. 2009. "Gender differences in competition: Evidence from a matrilineal and a patriarchal society." *Econometrica*, 77(5): 1637-1664.

Healy, Andrew, and Jennifer Pate. 2011. "Can teams help to close the gender competition gap?." *The Economic Journal*, 121(555): 1192-1204.

Holt, Charles. A. and Susan Laury. 2002. "Risk Aversion and Incentive Effects." *Andrew Young School of Policy Studies Research Paper Series* No. 06-12.

Johnson, Dominic. D. 2009. *Overconfidence and war*. Cambridge: Harvard University Press.

Malmendier, Ulrike, and Geoffrey Tate. 2005. "CEO overconfidence and corporate investment." *The journal of Finance*, 60(6), 2661-2700.

Moore, Don. A., and Paul J. Healy. 2008. "The trouble with overconfidence." *Psychological review*, 115(2): 502.

Neale, Margaret. A., and Max H. Bazerman. 1985. "The effects of framing and negotiator overconfidence on bargaining behaviors and outcomes." *Academy of Management Journal*, 28(1), 34-49.

Niederle, Muriel, and Lise Vesterlund. 2005. "Do women shy away from competition? Do men compete too much?" No. w11474. *National Bureau of Economic Research.*

Niederle, Muriel, and Lise Vesterlund. 2007. "Do women shy away from competition? Do men compete too much?." *The Quarterly Journal of Economics*, 122(3): 1067-1101.

Odean, Terrence. 1998. "Volume, volatility, price, and profit when all traders are above average." *The Journal of Finance*, 53(6), 1887-1934.

Plous, Scott. 1993. *The psychology of judgment and decision making*. New York: McGraw-Hill.

Scheinkman, Jose. A., and Wei Xiong. W. 2003. "Overconfidence and speculative bubbles." *Journal of political Economy*, 111(6): 1183-1220.

Svenson, Ola. 1981. "Are we all less risky and more skillful than our fellow drivers?." *Acta psychologica*, 47(2): 143-148.

van Veldhuizen, Roel. 2017. "*Gender differences in tournament choices: Risk preferences, overconfidence or competitiveness?*" No. 14. Discussion Paper.

9 Appendix

9.1 Figures

Figure A-1

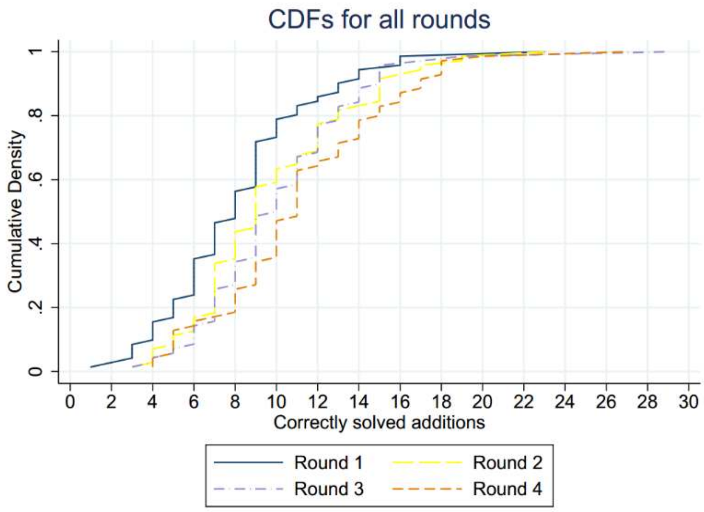
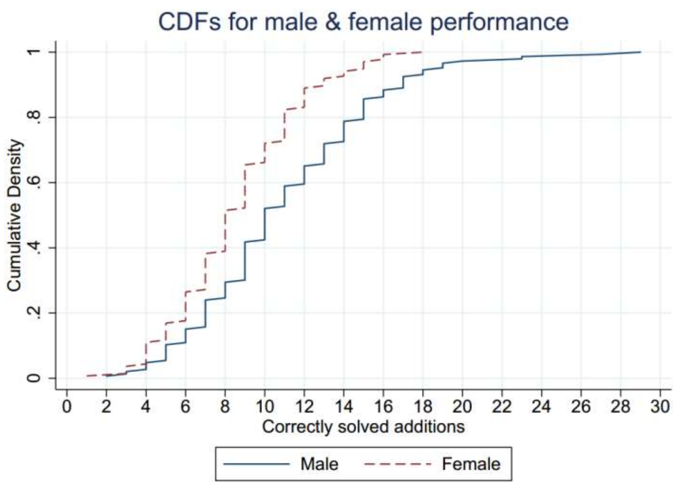


Figure A-2



9.2 Tables

Table A-1

Holt-Laury Risk aversion test

Switching point		Freq.	Percent	Cum.
Risk loving	1	0	0.00%	0.00%
	2	1	1.61 %	1.61 %
	3	2	3.23 %	4.84 %
Risk neutral	4	16	25.81 %	30.65 %
Risk averse	5	16	25.81 %	56.45 %
	6	11	17.74 %	74.19 %
	7	9	14.52 %	88.71 %
	8	2	3.23 %	91.94 %
	9	3	4.84 %	96.77 %
	10	2	3.23 %	100 %
Total		62	100.00	

Table A-2

Participants belief on their relative rank position among 10 randomly chosen participants

Belief on relative rank	Freq.	Percent	Cum.
1	3	4.35 %	4.35 %
2	7	10.14 %	14.49 %
3	12	17.39 %	31.88 %
4	12	17.39 %	49.28 %
5	12	17.39 %	66.67 %
6	10	14.49 %	81.16 %
7	8	11.59 %	92.75 %
8	3	4.35 %	97.10 %
9	1	1.45 %	98.55 %
10	1	1.45 %	100.00 %
Total	69	100.00	

Table A-3

VARIABLES	Marginal effect estimation of Probit estimation on tournament entry, models (1) to (4) including past tournament entry, at means (1-b)	 (2-b)	 (3-b)	 (4-b)
Future performance	0.0309		0.0336*	0.0325
Belief on past performance		-0.00191		
Past tournament entry decision	0.188	0.282*	0.209	0.213
Cross-nationality exposure treatment	-0.361**	-0.299*	-0.249	
DE*treatment				-0.0929
PT*treatment				-0.315
OTHER*treatment				-0.591**
Participant Portuguese			0.0875	-0.217
Participant German			0.421*	omitted
Participant Other				omitted
Risk-lover dummy	0.00747	0.0268	-0.123	-0.139
Risk-averse dummy	-0.112	-0.125	-0.0722	-0.0689
Female	-0.150	-0.227	-0.154	-0.131
Age	0.0390	0.0336	0.00379	0.00441
Observations	60	60	60	60

Robust standard errors
*** p<0.01, ** p<0.05, * p<0.1

Table A-4

VARIABLES	Marginal effect estimation of Probit regression on tournament entry decision in round 3b for participants who entered in round 3a, at means (1-c)	 (2-c)	 (3-c)	 (4-c)
Future performance	0.0314		0.0378	0.0408
Belief on past performance		0.0412**		
Cross-nationality exposure treatment	-0.355**	-0.390**	-0.168	
DE*treatment				omitted
PT*treatment				-0.431*
OTHER*treatment				-0.534*
Participant Portuguese			0.267	0.0907
Participant German			0.456**	omitted
Participant Other				omitted
Risk-lover dummy	-0.0217	-0.0331	-0.167	-0.362
Risk-averse dummy	-0.132	-0.112	-0.157	-0.193
Female	0.0416	0.0378	-0.0204	0.0418
Age	0.0723	0.102*	0.0815	0.107
Observations	35	35	35	30

Robust standard errors
*** p<0.01, ** p<0.05, * p<0.1

Table A-5

	Probit marginal effects estimation on tournament entry, excluding German participants and participants who interacted with those, at means			
VARIABLES	(1-d)	(2-d)	(3-d)	(4-d)
Future performance	0.0497***		0.0544***	0.0544***
Belief on past performance		0.0630***		
Cross-nationality exposure treatment	-0.189	-0.222*	-0.0482	
PT*treatment				-0.0482
OTHER*treatment				-0.352**
Participant Portuguese			0.304*	
Participant Other				omitted
Risk-lover dummy	omitted	omitted	omitted	omitted
Risk-averse dummy	-0.244*	-0.205	-0.224	-0.224
Female	-0.208*	-0.207*	-0.178	-0.178
Age	0.102**	0.139***	0.136***	0.136***
Round	-0.0602	-0.0663	-0.0504	-0.0504
Observations	81	81	81	81

Standard errors
*** p<0.01, ** p<0.05, * p<0.1

9.3 Experiment sheets

Round 3a

Dear student number ___________________ (Student number), your competitor is _________ (age) years old, pursues a ☐ Bachelor's / ☐ Master's degree, _________________________ (nationality) and his/her favourite colour is ____________________ (colour).

Please fill in your 5-digit student ID: _____________

INSTRUCTIONS

Welcome to this experimental session!

During the experiment, it is not allowed to communicate with other participants. If you have a question, please raise your hand and we will approach you in silence. If a question is relevant for other participants, we will answer it aloud for everyone.

Please fill in your 5-digit student ID on the top of EVERY page

You will receive sheets of paper during the course of the experiment. The experiment sheets will contain rows of 2-digit numbers. Each row contains 5 such numbers, followed by an empty cell at the right-side end of each row.

You are asked to add the 2-digit numbers in each row and report the result of your additions in the empty cell at the right-side end of each row. See below for an example exercise.

You cannot use a calculator or phone but you may use blank paper.

EXAMPLE

Below you can see an example on how to perform the exercise. The five 2-digit numbers [Grey background] need to be added up and written in the right-side box labelled "Result", which will be empty. In this example, it is filled with the correct answer [Green background] for illustrative purposes. This will not be the case in your experimental sheets.

Numbers to be added					Result (Box empty)
11	82	29	44	74	240

PAYMENT

In each round, you will be able to earn Experimental Currency Units depending on your performance (ECU).
After the experiment, **one round** (out of 4) will be randomly chosen to determine the ECU allocation.

Each ECU works as an individual lottery ticket. Amongst all ECUs, five will be randomly drawn. Each winning ECU is worth 20€. Thus, for each ECU earned during the game you increase your probability of winning 20€. Winners will be informed after the experiment via mail.

Please fill in your 5-digit student ID: _____________

Round 1: Piece rate

Your sheet contains rows of 2-digit numbers. All rows contain 5 such numbers, followed by an empty cell at the right-side end of each row.

You are asked to add the 2-digit numbers in each row and report the result of your additions in the empty cell at the right-side end of each row. You have 5 minutes to perform as many additions as possible.

You cannot use a calculator or phone but you may use blank paper.

For every correctly solved addition, you will receive 1 ECU.

Numbers to add					Results
21	54	76	56	99	
64	22	28	79	25	
73	88	24	31	71	
57	18	95	53	82	
28	79	46	39	21	
69	27	72	36	32	
86	11	25	17	47	
75	35	55	57	72	
46	41	77	27	45	
36	80	14	73	50	
49	72	86	67	52	
77	80	10	92	39	
28	82	60	76	27	
27	67	16	80	15	
34	71	47	14	37	
98	13	79	99	55	
24	78	33	67	60	
15	89	61	37	70	
63	74	88	69	69	
43	29	26	44	59	
92	85	26	56	27	
29	65	67	37	64	
74	21	79	93	49	
81	53	71	63	61	
66	88	79	44	55	
84	20	43	83	53	
39	73	57	75	30	
68	21	88	76	58	
83	84	27	61	89	
90	91	69	38	67	

Please fill in your 5-digit student ID: _____________

Round 1: Piece rate

Please indicate how many additions you think you solved correctly in round 1 (The round you just played). Report the number in the box below.

If your guess is correct, you will receive an additional **1 ECU** that will be added to your performance.

Please indicate your best guess here:

Please fill in your 5-digit student ID: _____________

Round 2: Tournament

Your sheet contains rows of 2-digit numbers. All rows contain 5 such numbers, followed by an empty cell at the right-side end of each row.

You are asked to add the 2-digit numbers in each row and report the result of your additions in the empty cell at the right-side end of each row. You have 5 minutes time to perform as many additions as possible.

In this round, you will be randomly matched against another participant. If you made more correct additions than your competitor, you will receive 2 ECU per correctly solved answer and none otherwise. In case of a tie, the winner will be randomly chosen.

Numbers to add					Results
38	86	59	36	68	
73	86	14	82	39	
46	49	66	80	89	
65	53	31	44	67	
67	13	21	27	53	
84	71	35	55	75	
65	45	12	35	16	
61	85	23	66	93	
26	70	84	57	83	
22	99	97	87	33	
59	34	58	93	62	
98	74	35	80	94	
63	20	47	41	12	
24	67	14	18	90	
33	46	37	51	56	
91	56	91	81	30	
63	42	13	39	94	
14	43	48	39	47	
75	17	11	18	85	
73	49	96	77	71	
13	53	99	29	79	
69	93	43	18	53	
65	24	36	12	56	
65	40	66	18	49	
50	70	18	92	49	
79	86	48	27	53	
28	54	27	27	12	
87	95	49	20	18	
30	51	46	31	24	
95	34	11	24	57	

Please fill in your 5-digit student ID: _____________

Round 2: Tournament

Please indicate how many additions you think you solved correctly in round 2 (The round you just played). Report the number in the box below.

If your guess is correct, you will receive an additional **1 ECU** that will be added to your performance.

Please indicate your best guess here:

Please fill in your 5-digit student ID: _____________

Round 3a: Choice of compensation

In this round, you will be **randomly matched** against a competitor. You will **receive additional information** about your competitor beforehand and then **choose your compensation scheme** before performing. The tasked performed is the same as before:

Your sheet contains rows of 2-digit numbers. All rows contain 5 such numbers, followed by an empty cell at the right-side end of each row. You are asked to add the 2-digit numbers in each row and report the result of your additions in the empty cell at the right-side end of each row. You have 5 minutes time to perform as many additions as possible.

If you chose the fixed-payment scheme, you will receive 1 ECU for every correctly solved addition

If you chose the tournament payment scheme, you will receive 2 ECU per correctly solved addition if you made more correct additions than your competitor and zero if otherwise. In case of a tie, the winner will be randomly selected. Your performance in round 3a will be evaluated against your competitors **round 2 performances**, which was performed under a tournament scheme.

Please select your scheme of compensation for round 3a below:

☐ **Piece Rate**

☐ **Tournament**

Please fill in your 5-digit student ID: _____________

Round 3a: Choice of Compensation

Your sheet contains rows of 2-digit numbers. All rows contain 5 such numbers, followed by an empty cell at the right-side end of each row.

You are asked to add the 2-digit numbers in each row and report the result of your additions in the empty cell at the right-side end of each row. You have 5 minutes time to perform as many additions as possible.

You will be paid according to the scheme you chose before.

Numbers to add					Results
64	27	63	32	92	
68	34	80	68	54	
46	83	76	52	26	
92	99	89	65	68	
45	61	87	22	70	
33	74	30	65	61	
37	87	99	77	67	
92	95	84	54	29	
22	40	66	84	37	
59	39	35	79	84	
42	71	43	35	17	
21	93	13	92	86	
41	16	90	83	84	
66	20	37	31	26	
20	84	52	80	78	
79	73	75	52	74	
69	56	43	15	32	
48	88	63	60	12	
76	80	86	84	57	
81	10	91	34	86	
43	86	86	51	19	
30	85	29	92	83	
10	88	86	32	41	
53	69	68	80	68	
95	23	25	27	28	
26	63	77	22	20	
42	78	76	28	18	
25	26	54	96	11	
60	21	89	79	94	
70	74	12	14	79	

Please fill in your 5-digit student ID: _____________

Round 3a: Choice of Compensation

Please indicate how many additions you think you solved correctly in round 3a (The round you just played). Please also indicate how many additions you think your competitor solved in **the round you competed against** (his/her Round 2). Report the numbers in the box below.

You will receive an additional **1 ECU** that will be added to your performance for **each correct guess**.

Please indicate your best guess for **your own** performance (number of additions solved correctly) here:	☐
Please indicate your best guess for **your competitor's** performance (number of additions solved correctly) here:	☐

Please fill in your 5-digit student ID: _____________

Round 3b: Choice of compensation

Round 3b is a repetition of Round 3a you just played. However, you will be randomly matched against **a different participant than before.**

In this round, you will **receive additional information** about your competitor beforehand and then **choose your compensation scheme** before performing. The tasked performed is the same as before:

Your sheet contains rows of 2-digit numbers. All rows contain 5 such numbers, followed by an empty cell at the right-side end of each row. You are asked to add the 2-digit numbers in each row and report the result of your additions in the empty cell at the right-side end of each row. You have 5 minutes time to perform as many additions as possible.

If you chose the fixed-payment scheme, you will receive 1 ECU for every correctly solved addition

If you chose the tournament payment scheme, you will receive 2 ECU per correctly solved addition if you made more correct additions than your competitor and zero if otherwise. In case of a tie, the winner will be randomly selected. Your performance in round 3b will be evaluated against your competitors **round 2 performances,** which was performed under a tournament scheme.

Please select your scheme of compensation for round 3b below:

☐ **Piece Rate**

☐ **Tournament**

Please fill in your 5-digit student ID: _____________

Round 3b: Choice of Compensation

Your sheet contains rows of 2-digit numbers. All rows contain 5 such numbers, followed by an empty cell at the right-side end of each row.

You are asked to add the 2-digit numbers in each row and report the result of your additions in the empty cell at the right-side end of each row. You have 5 minutes time to perform as many additions as possible.

You will be paid according to the scheme you chose before.

Numbers to add					Results
93	31	36	25	28	
11	30	79	80	67	
95	17	26	11	48	
98	96	98	47	90	
22	21	99	25	98	
22	37	71	78	14	
68	49	77	21	91	
92	62	43	47	74	
52	67	77	60	71	
10	96	42	12	10	
77	81	29	34	62	
90	97	71	65	22	
45	67	96	46	86	
50	51	63	27	71	
57	10	71	13	78	
15	88	44	99	77	
73	76	47	56	58	
89	14	73	30	91	
39	82	66	71	83	
54	37	36	88	38	
68	48	18	19	99	
42	85	93	80	92	
64	48	83	31	28	
44	11	18	60	70	
24	29	43	26	76	
44	35	13	36	42	
74	90	51	96	71	
12	73	32	57	53	
57	15	35	39	69	
75	29	30	61	98	

Please fill in your 5-digit student ID: _____________

Round 3b: Choice of Compensation

Please indicate how many additions you think you solved correctly in round 3b (The round you just played). Please also indicate how many additions you think your competitor solved **in the round you competed against** (his/her Round 2). Report the numbers in the box below.

You will receive an additional **1 ECU** for that will be added to your performance for **each correct guess**.

Please indicate your best guess for **your own** performance (number of additions solved correctly) here:	☐
Please indicate your best guess for **your competitor's** performance (number of additions solved correctly) here:	☐

Please fill in your 5-digit student ID: _____________

Round 4: Retroactive choice

In this round, you can retroactively change the compensation scheme for your Round 1 performance, which was evaluated under a piece rate payment originally, independent of competitors.

You can choose to have your Round 1 performance be evaluated under a piece rate or a tournament scheme.

If you chose the fixed-payment scheme, you will receive 1 ECU for every correctly solved addition

If you chose the tournament payment scheme, you will be randomly matched against a competitor. You will receive 2 ECU per correctly solved addition if you made more correct additions than your competitor and zero if otherwise. In case of a tie, the winner will be randomly selected. Your performance in round 1 will be evaluated against your competitors round 1 performance.

Please retroactively select your scheme of compensation for round 1 below:

☐ **Piece Rate**

☐ **Tournament**

This is the final round of the experiment. Please fill out the brief questionnaire on the next page.

Thank you very much for your participation.

Please fill in your 5-digit student ID: _____________

Questionnaire

Please indicate, in the box below, your best guess on the **average number** of correctly solved additions across all participants in **Round 2.**

If your guess is correct, 1 ECU will be added to your payment.

Please indicate your best guess here:

If 9 other participants in this room were chosen at random and your **round 2** performance compared to their **round 2** performance, what would be your rank among these 10 participants (9 others+you) from 1 (best) to 10 (worst)?

Please indicate, in the box below, your best guess on your rank in a randomly chosen set of 10 participants.

Please indicate your best guess here:

Below is a table of 10 hypothetical paired lotteries. Please indicate for each pair of lotteries which one you prefer e.g. choose between lottery A or lottery B for each pair. Please write your choice for each lottery on the right-hand side, e.g. write either the letter **A** or the letter **B.** The fractions ahead of pay-offs represent **probabilities.**

Lottery A	Lottery B	Choice
1/10 of 20€, 9/10 of 16€	1/10 of 38.5€, 9/10 of 1€	
2/10 of 20€, 8/10 of 16€	2/10 of 38.5€, 8/10 of 1€	
3/10 of 20€, 7/10 of 16€	3/10 of 38.5€, 7/10 of 1€	
4/10 of 20€, 6/10 of 16€	4/10 of 38.5€, 6/10 of 1€	
5/10 of 20€, 5/10 of 16€	5/10 of 38.5€, 5/10 of 1€	
6/10 of 20€, 4/10 of 16€	6/10 of 38.5€, 4/10 of 1€	
7/10 of 20€, 3/10 of 16€	7/10 of 38.5€, 3/10 of 1€	
8/10 of 20€, 2/10 of 16€	8/10 of 38.5€, 2/10 of 1€	
9/10 of 20€, 1/10 of 16€	9/10 of 38.5€, 1/10 of 1€	
10/10 of 20€, 0/10 of 16€	10/10 of 38.5€, 0/10 of 1€	

This is the end of the Questionnaire and the experimental session. Thank you very much for your participation!