Measuring Preferences for Competition

Lina Lozano and Ernesto Reuben

EEA-ESEM 2022 - Experimental Methodology

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جامعة نيويورك أبوظبي
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Motivation

- **Non-cognitive factors** are important determinants of economic behavior (Heckman et al., 2019).

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- One such factor is people's **preferences for competition**, which help explain individual differences in many labor market outcomes:
  - Career choices in secondary (Buser et al., 2014; 2017a; 2017b; Zhang, 2019) and tertiary education (Reuben et al., 2017; Kamas and Preston, 2018)
  - Performance of entrepreneurs (Berge et al., 2015)
  - Salaries, bonuses, and industry choice (Buser et al., 2018; Reuben et al., 2019)
  - And many more (Buser et al., 2020)

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- They are typically measured using **one choice** between two remuneration schemes in a real-effort task (Niederle and Vesterlund, 2007)
  I. Individual performance pay **(piece rate)**
  II. Relative performance pay **(tournament rate)**

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What is it missing?

- Individual measures can be noisy → only one choice (Agranov and Ortoleva, 2017)
- Bias due to noisy control variables (Westfall and Yarkoni, 2016; Gillen, et al. 2019; Van Veldhuizen, 2022)
- Not possible to check consistency - It is not modeled.

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Contribution

- We take a deeper look at **preferences for competition** using a rich dataset of individual-level choices.

1) Provide the first test of whether choices to enter tournaments are **consistent** with GARP.
2) Develop a framework for the **joint treatment** of preferences for competition and risk.
    - We propose **two pathways** by which competition affects utility:
        I. Directly through changes in payoffs (i.e., like/dislike for competition).
        II. Through risk preferences (Weber et al., 2002; Barseghyan et al., 2011; Einav et al., 2012).

Experimental Design

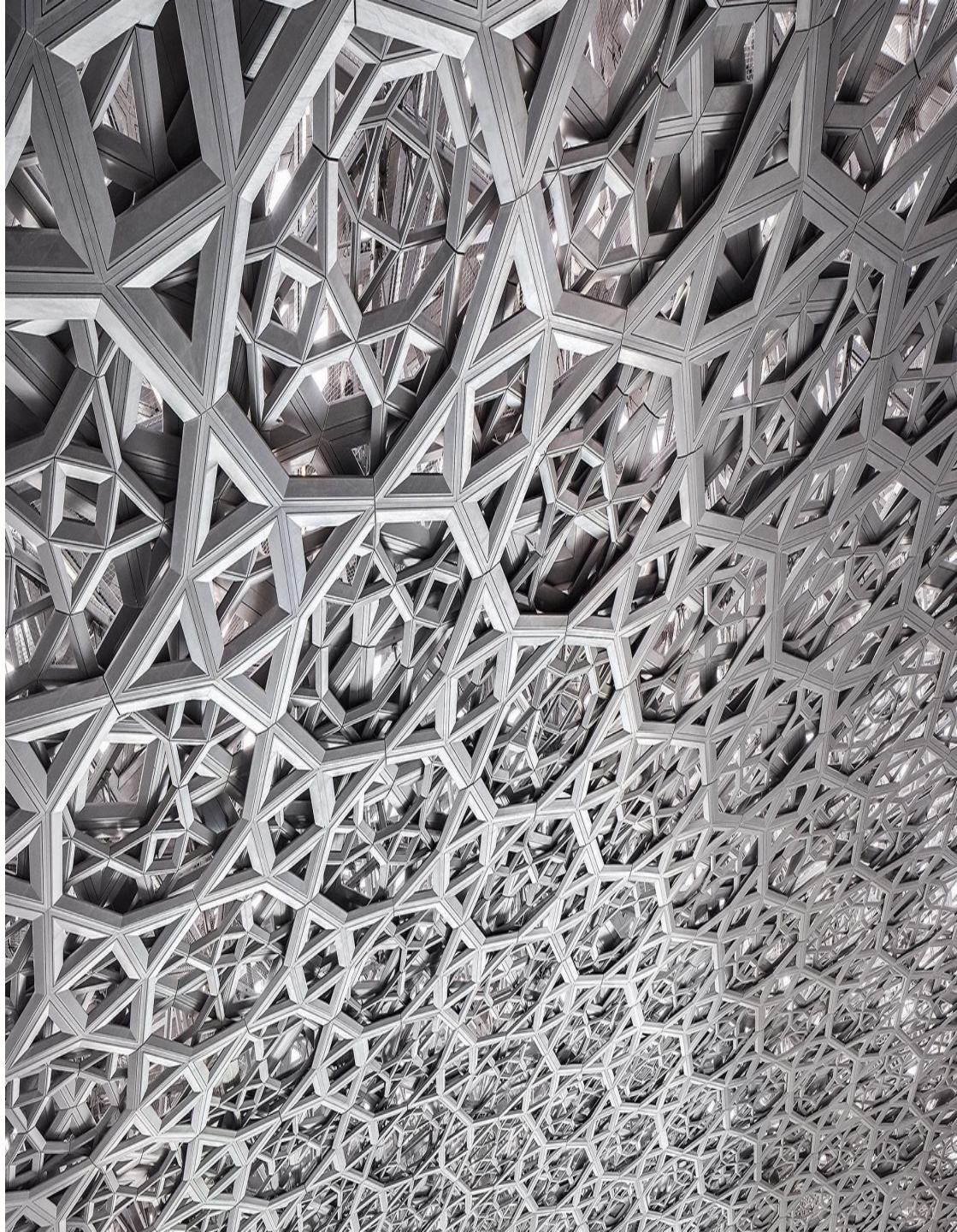
Why Experiments?

- Controlled **randomized** environment where one can derive **causal links** and **identify exact mechanisms**.

I. Real **monetary incentives** for individual choices to encourage participants to make thoughtful and honest decisions.

II. Every information shared with participants is true **no deception**.

I. All decisions take place in an **anonymous** environment.



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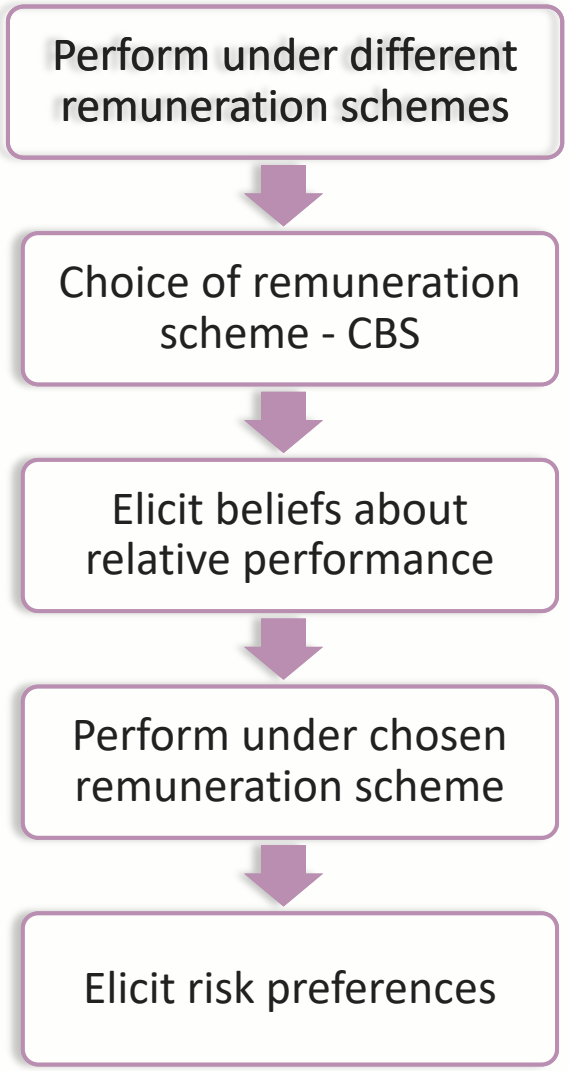

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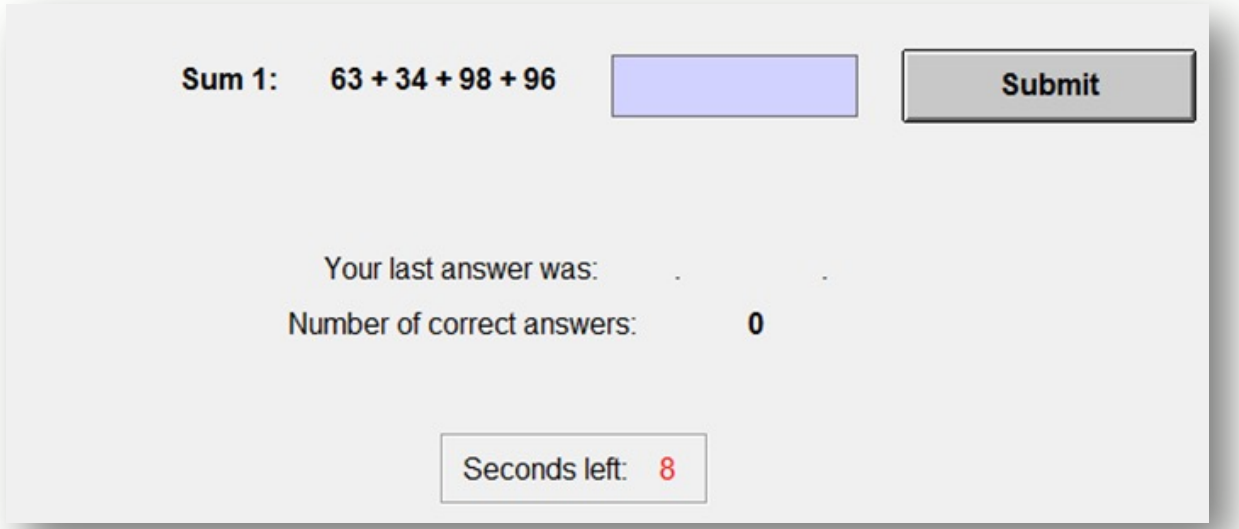
Perform under different remuneration schemes

Choice of remuneration scheme - CBS

Elicit beliefs about relative performance

Perform under chosen remuneration scheme

Elicit risk preferences



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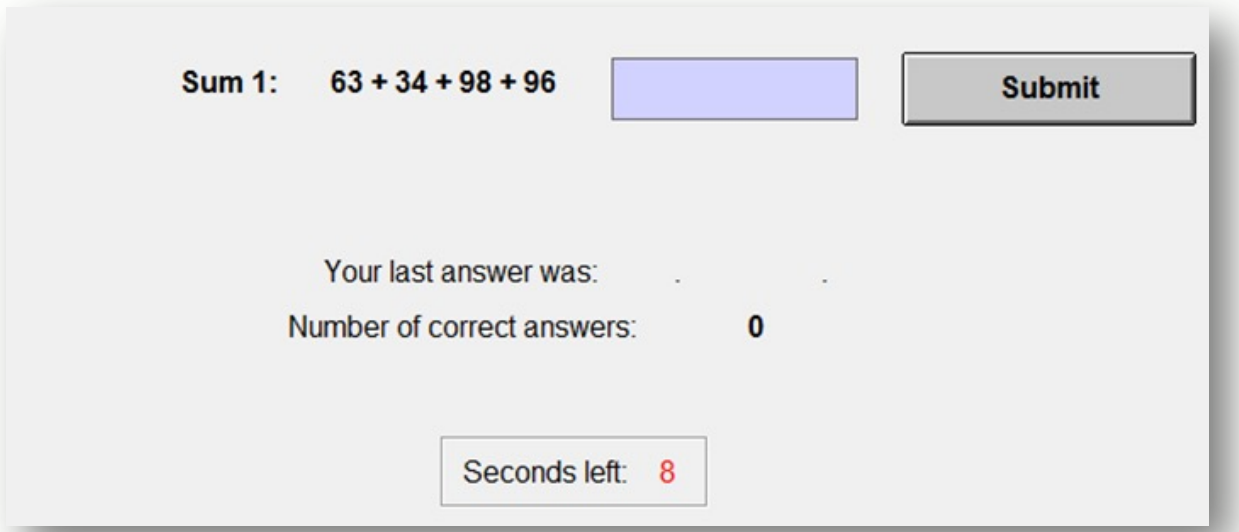

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  - 100 tokens per correct sum.

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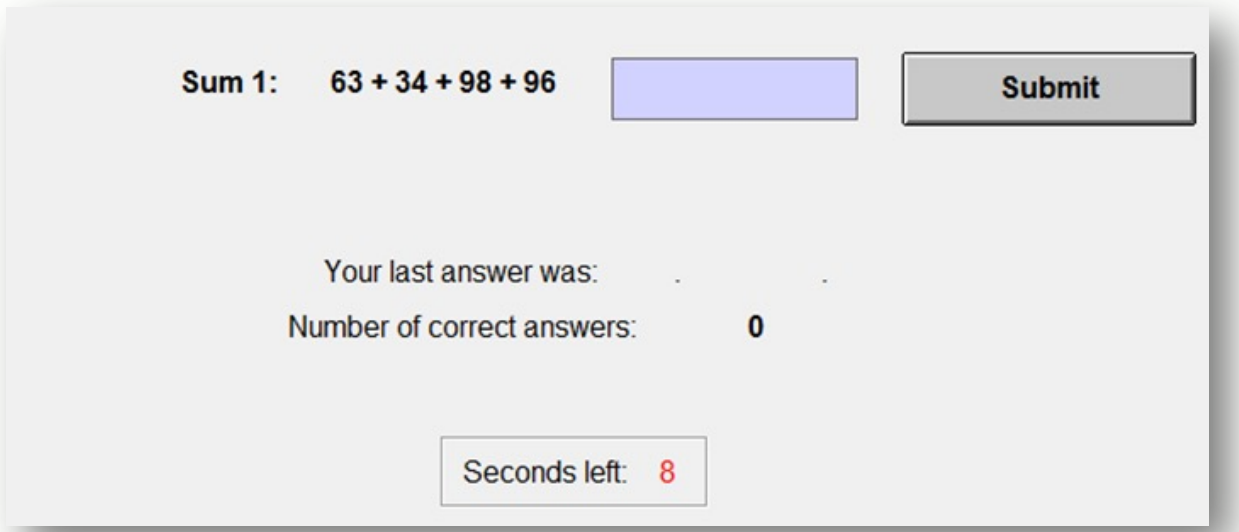

- Perform for 4 minutes under **individual rate**.
  - 100 tokens per correct sum.
- Perform for 4 minutes under **tournament rate**.
  - Winner in group of 5 gets 550 tokens per correct sum, otherwise 0 tokens.

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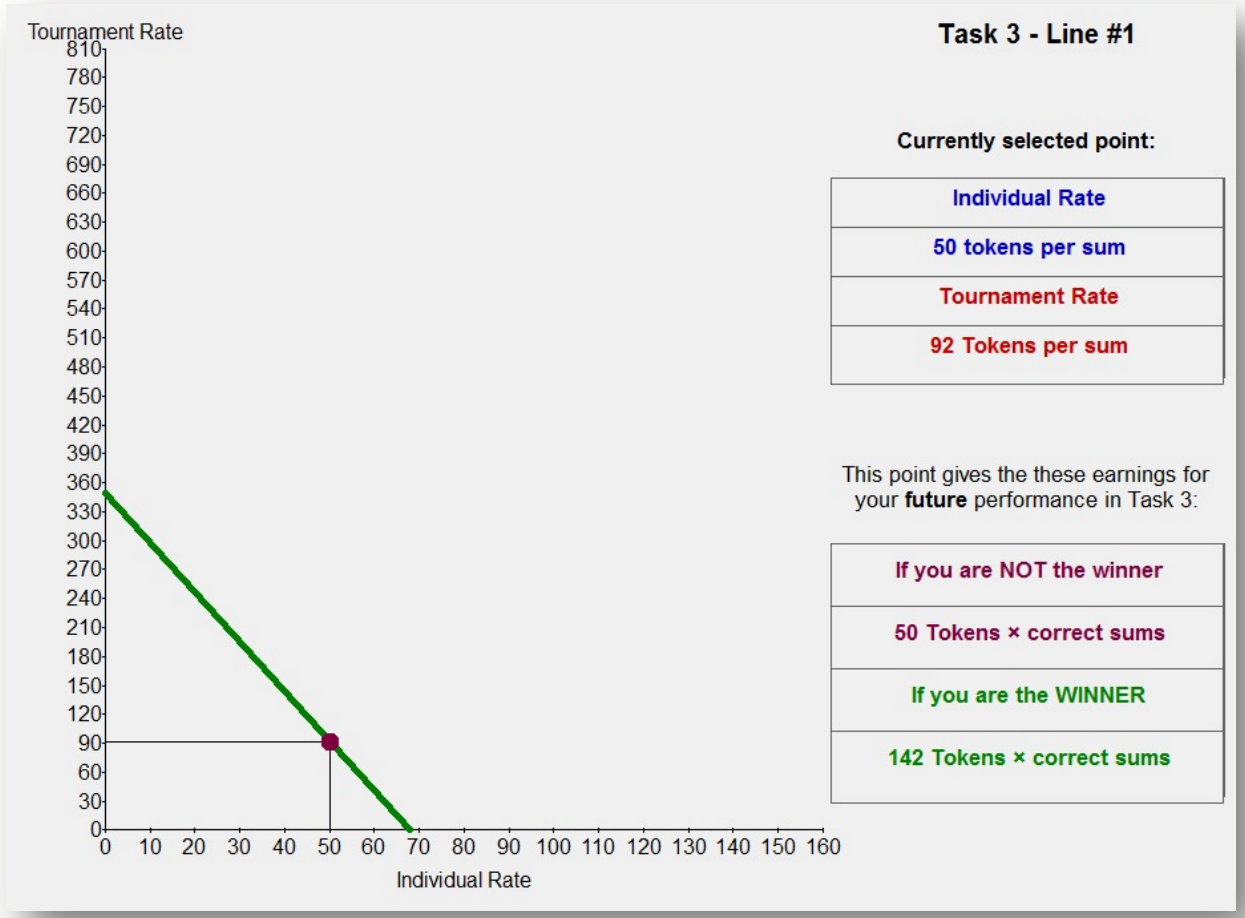

- Choose a combination of ***individual rate*** and ***tournament rate*** in 40 randomly-generated budget lines (Choi et al., 2007).

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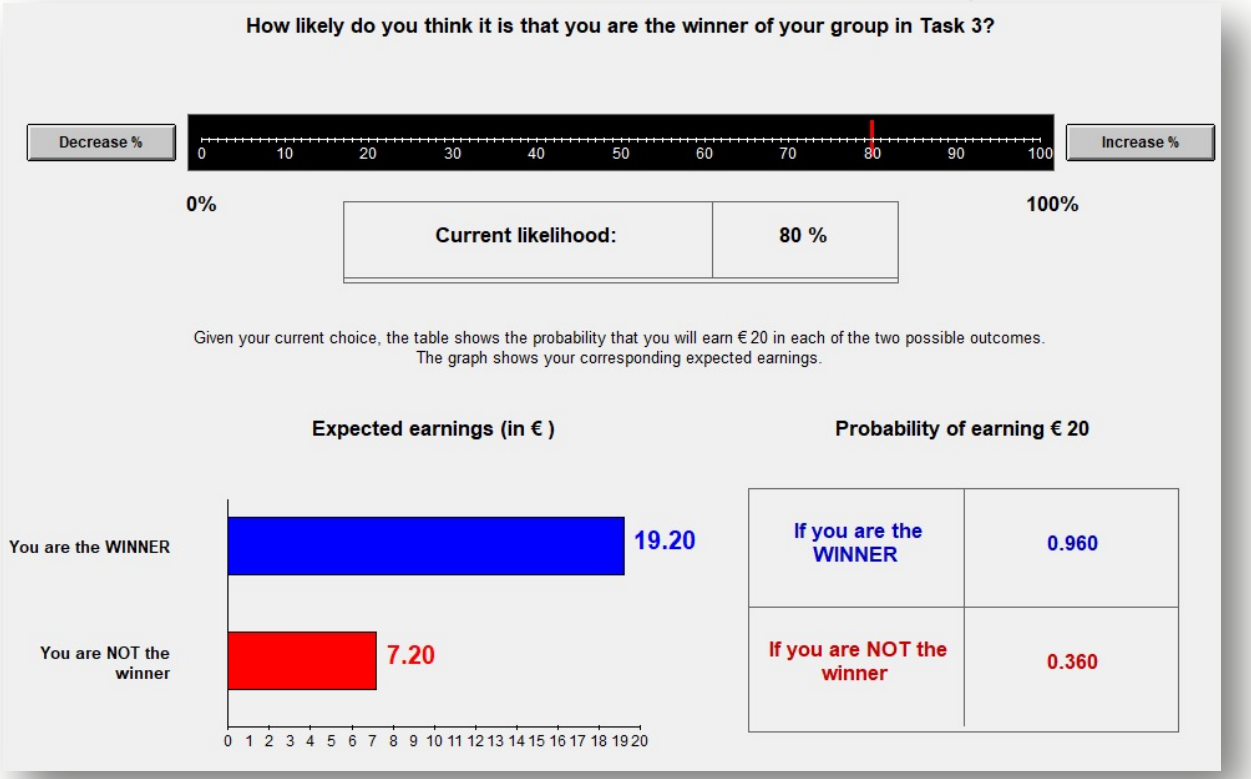
Elicit risk preferences

- Inform subjects which budget line will be used.
- Elicit subjects' **belief of winning the tournament:**
  - Incentivized with a **robust scoring rule** (Karni, E., 2009) and using a rich interface to facilitate understanding.



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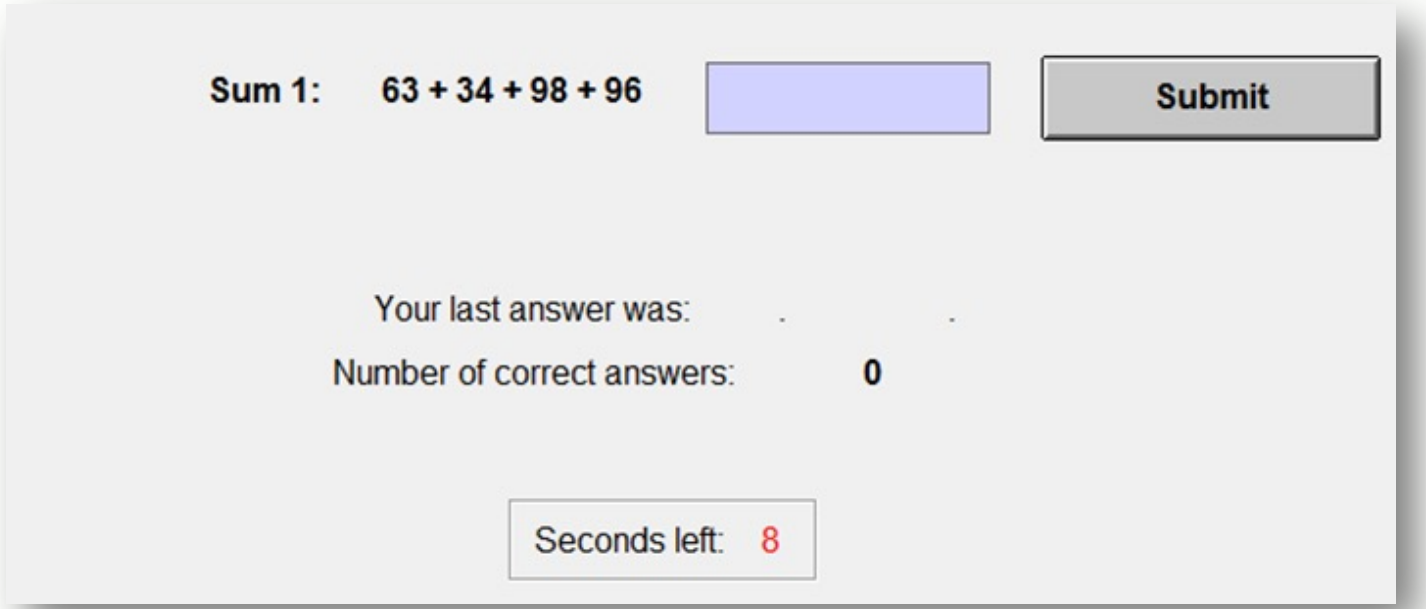

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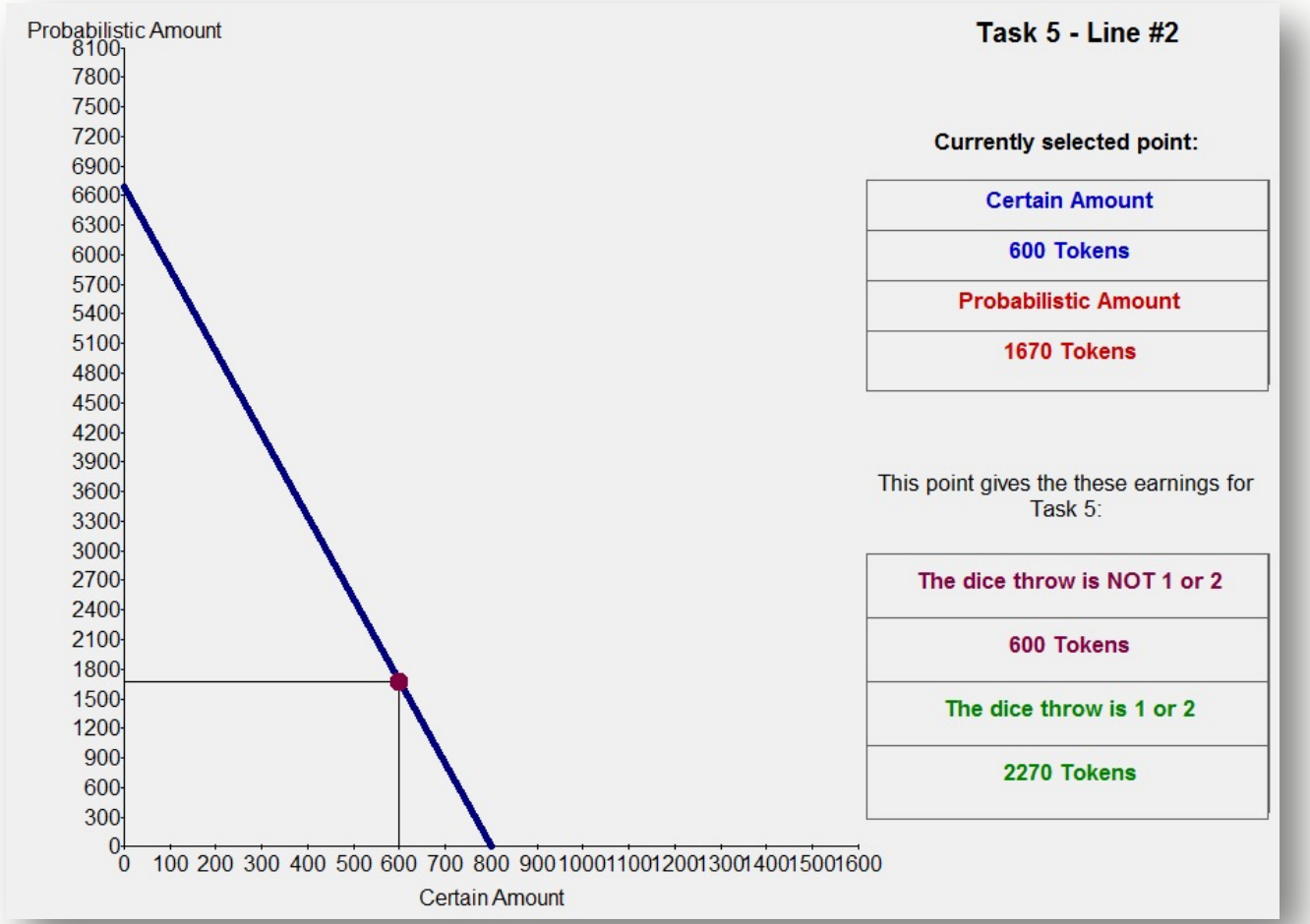
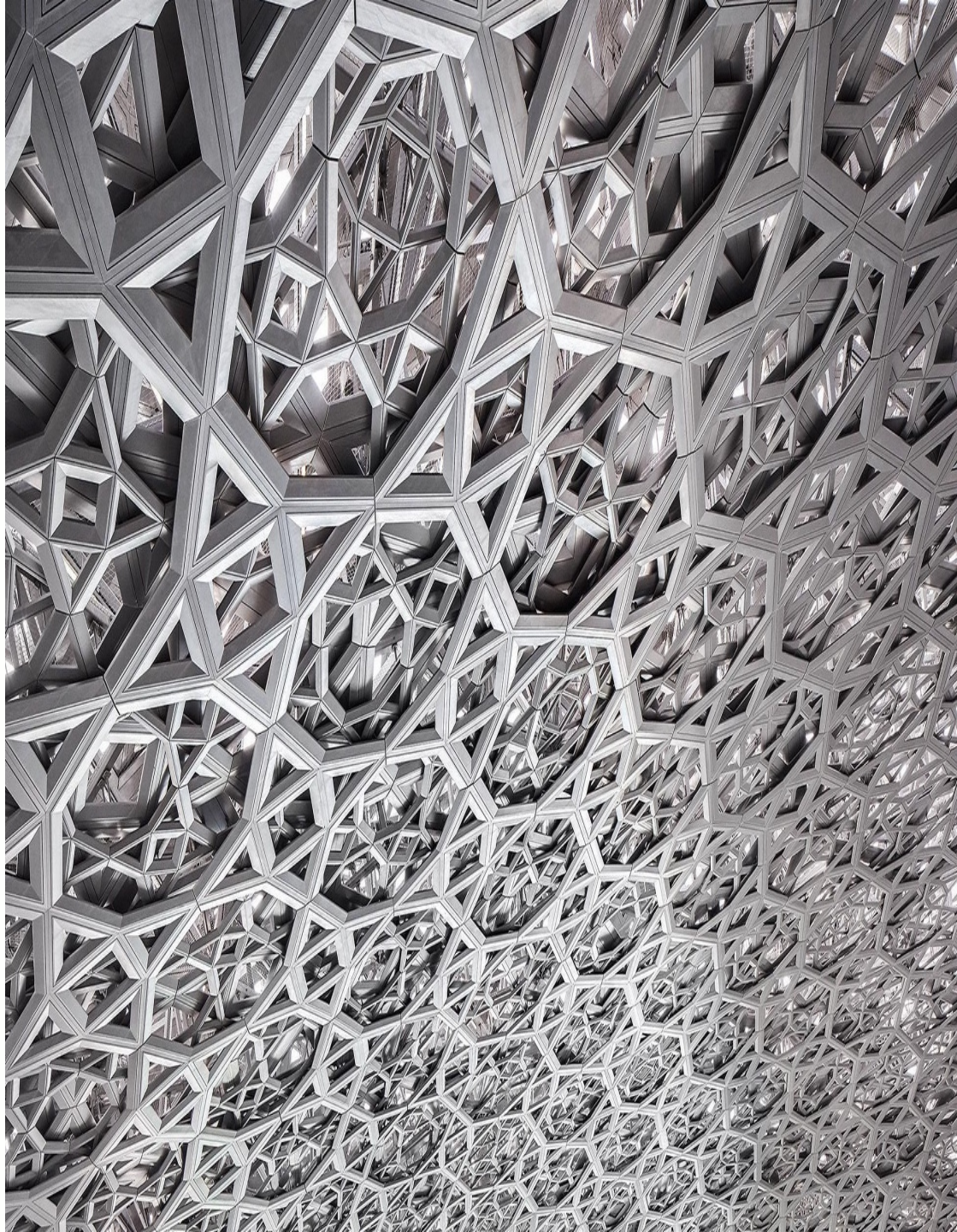


- Allocate money between **certain** and an **uncertain** amounts in 40 randomly-generated budget lines.
- Amounts scaled according to performance to match choice of remuneration scheme.

Sample

- Behavioral and Experimental Economics Laboratory (BEElab) at Maastricht University.
- 140 subjects (77 women and 63 men).
- Payoff in cash: €5 show-up fee + Earnings from one of the 5 tasks.
- Average payment: €25.
- 1 h 45 minutes.
- Programed with zTree (Fischbacher,2007).



Results

Results

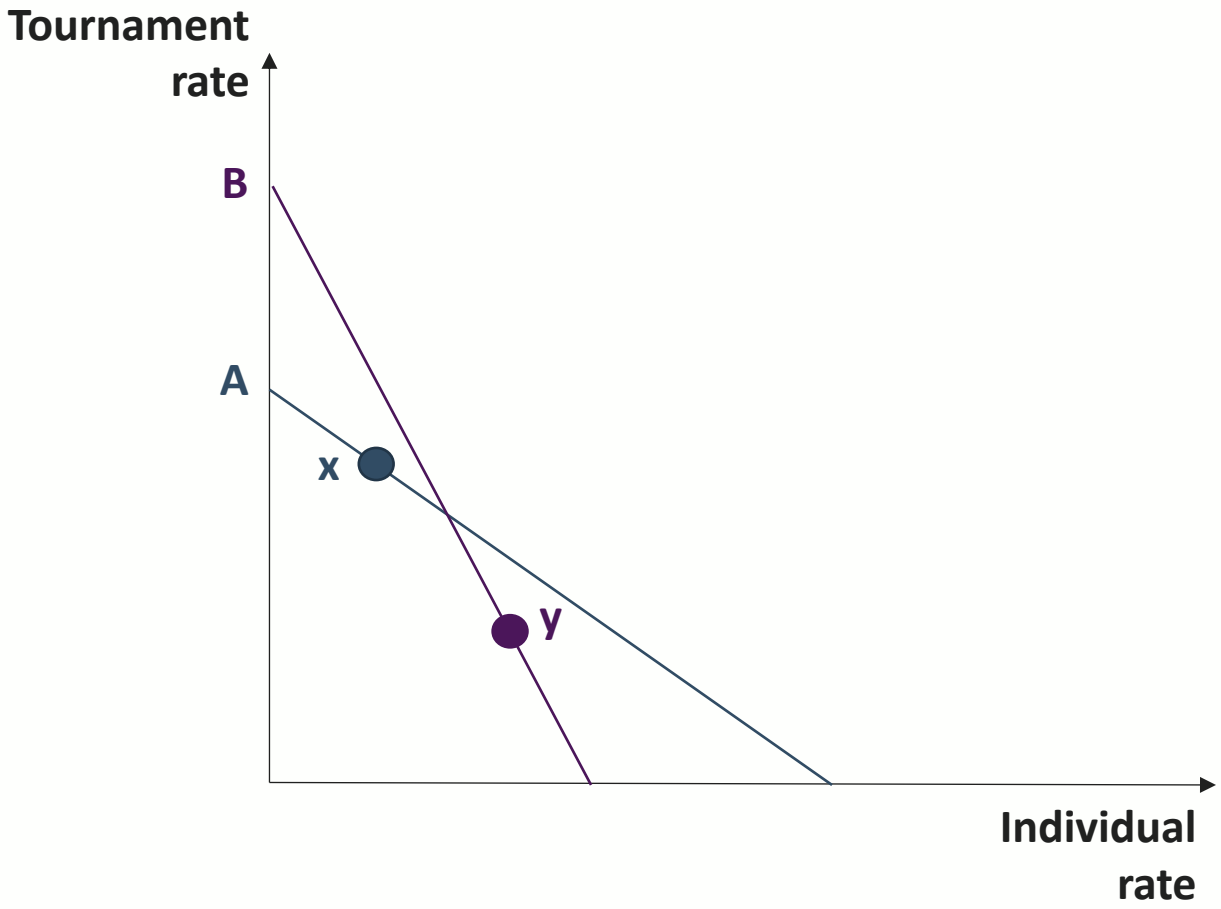
Part I: Consistency

- GARP violations - *Critical Cost Efficiency Index* (CCEI) (Afriat, 1972)

Part II: Structural estimation of preferences for competition

- Parametric estimation of preferences for competition.
- Two interpretations (Bellemare, et al, 2016; Apesteguia, et al 2019; Meissner, et al., 2020).

I. Consistency – GARP violations



Consistency measurement:

- ***Critical Cost Efficiency Index* (CCEI)**
  - How nearly individual choice complies with GARP (Afriat, 1972).

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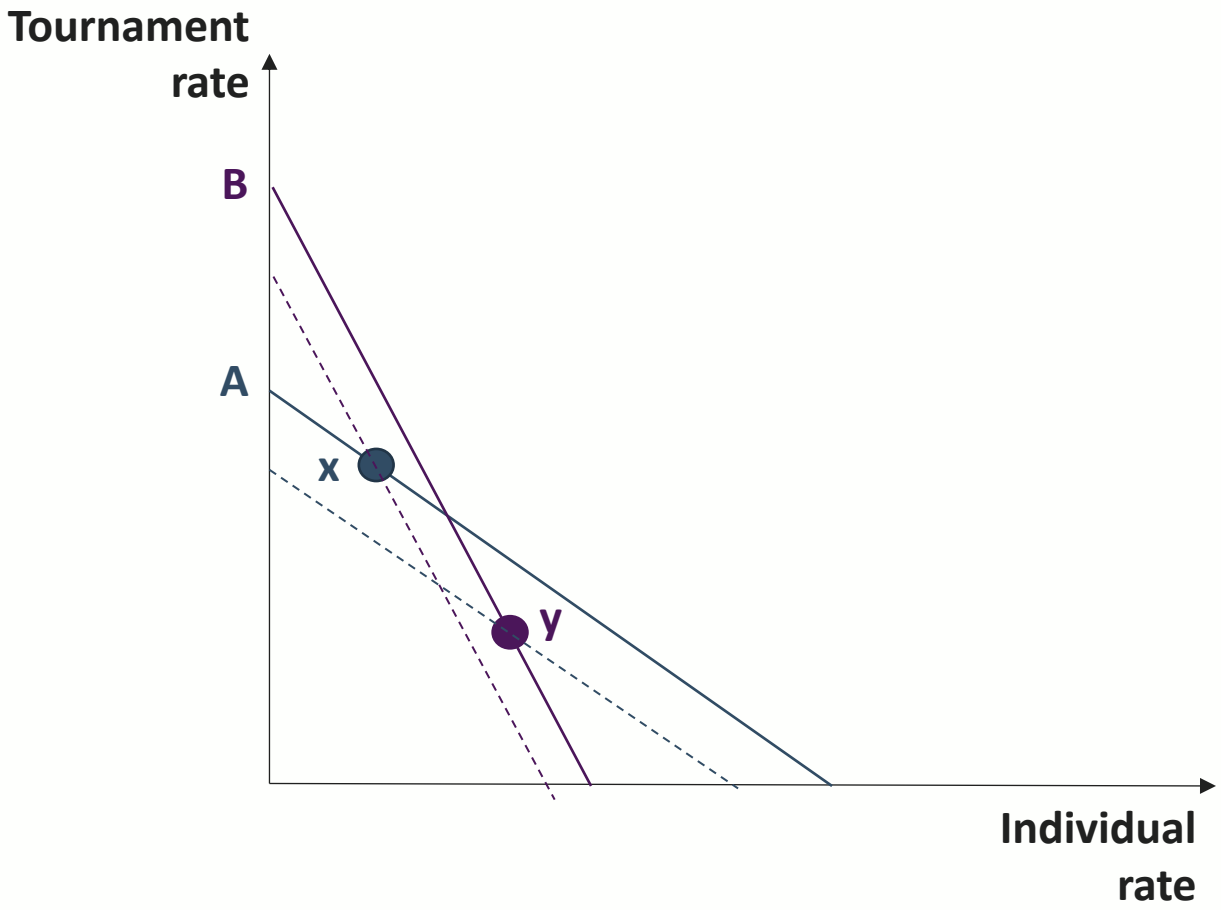
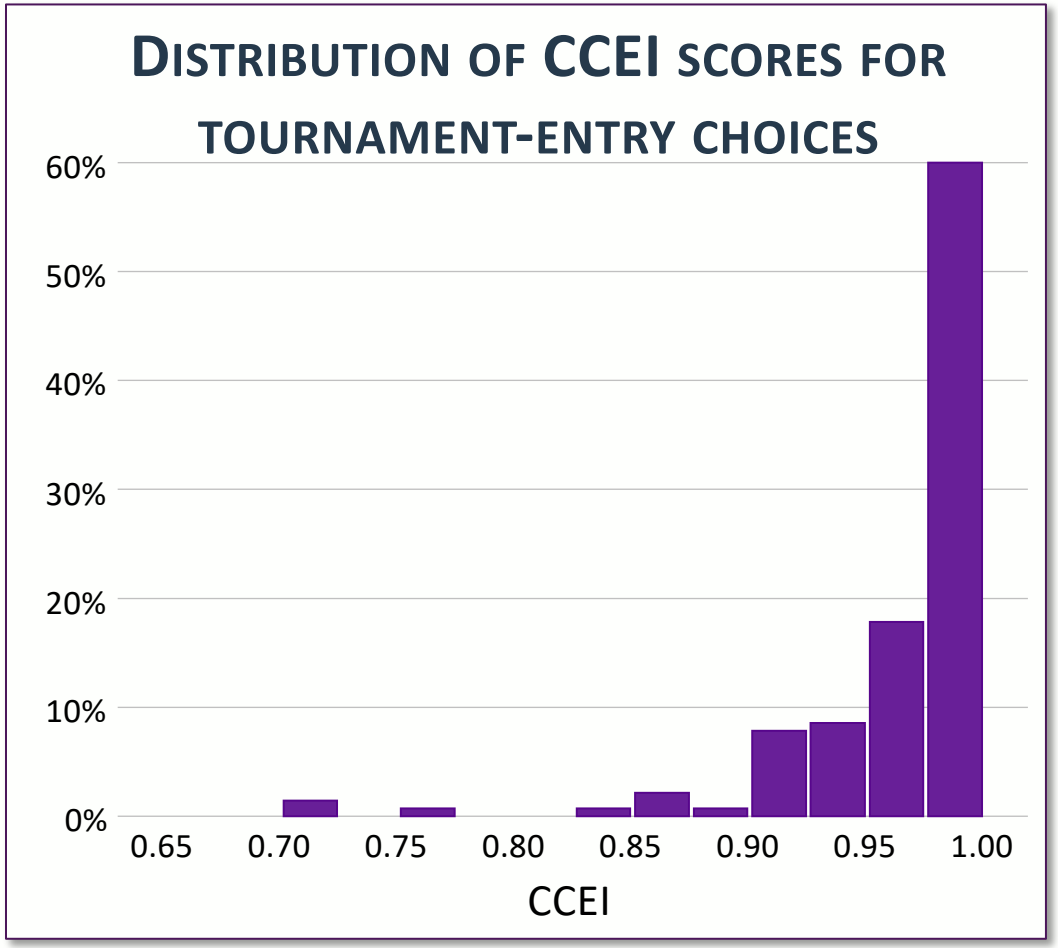


Consistency measurement:

- ***Critical Cost Efficiency Index* (CCEI)**
  - How nearly individual choice complies with GARP (Afriat, 1972).
  - It measures the fraction by which all budget constraints must be shifted to remove all violations of GARP.

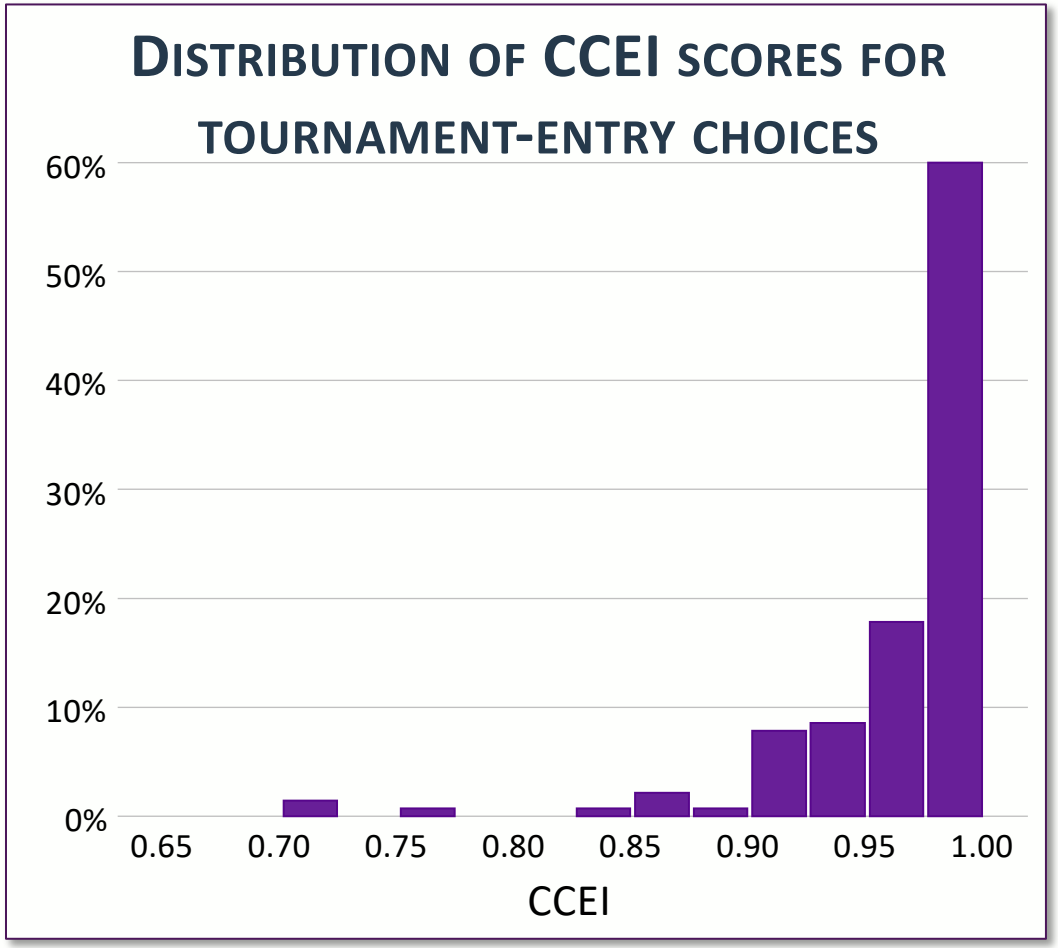
I. Consistency – GARP violations



I. Consistency – GARP violations

Fraction of subjects with a CCEI above …

	Tournament		Risk	
CCEI threshold	0.90	0.95	0.90	0.95
All subjects	94%	79%	94%	84%



I. Consistency – GARP violations

- Most subjects have high CCEI scores (avg. = 0.97).
- No differences between tournament-entry and risky choices (p = 0.22) , or between gender (p = 0.30).

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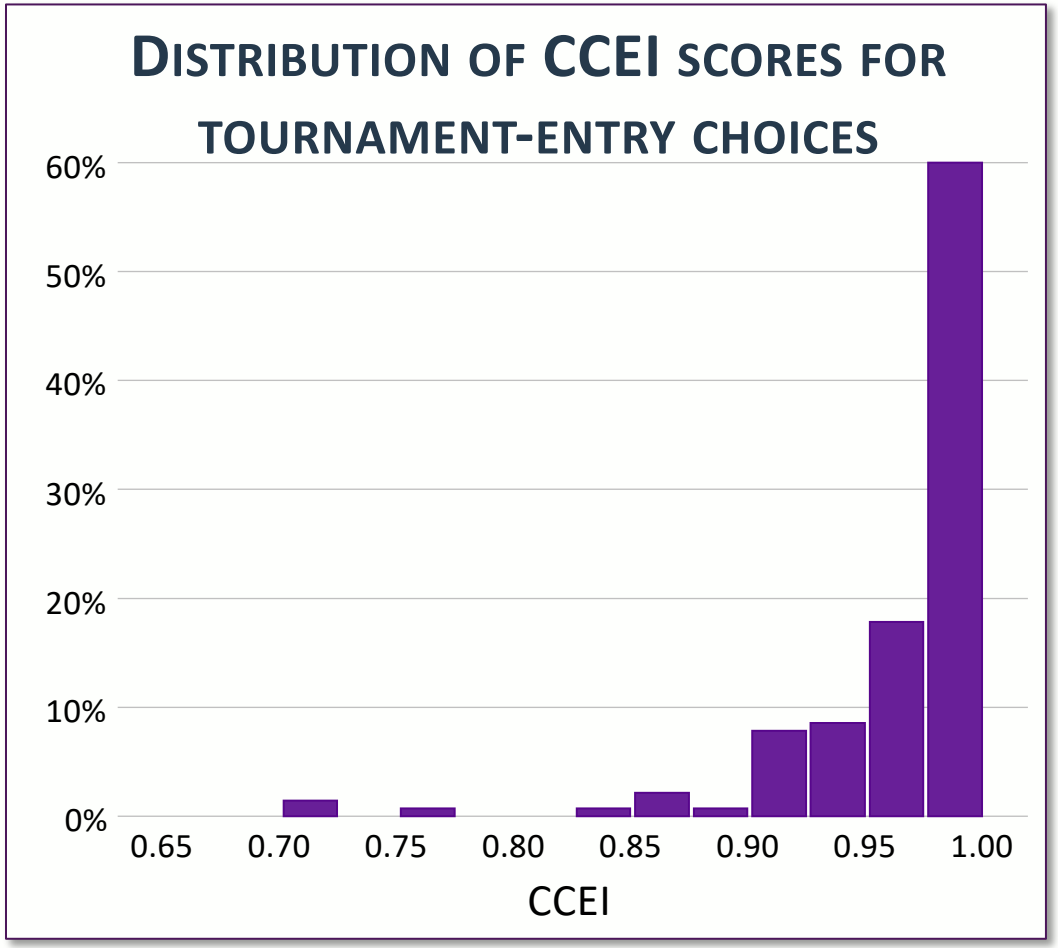

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  1. Without competition:

$$U(x) = \frac{x^{1-\alpha}}{1-\alpha}$$

- α_i is i's coefficient of CRRA when there is no competition.

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- Assume CRRA specification to model the utility of income:

  I. Without competition:

$$U(x) = \frac{x^{1-\alpha}}{1-\alpha}$$

  II. With competition:

$$U(x) = \frac{x^{1-\alpha-\delta}}{1-\alpha-\delta} + \theta$$

- $\boldsymbol{\alpha_i}$ is i's coefficient of CRRA when there is no competition.
- $\boldsymbol{\delta_i}$ is the impact of competition on i's coefficient of CRRA (equals 0 if no competition).
- $\boldsymbol{\theta_i}$ is i's added utility/disutility of being in a competitive environment (equals 0 if no competition).

II. Structural estimation

- Discretize choices from budget lines as sets of binary choices over lotteries and use a random-utility framework to estimate preference parameters (Bellemare et al., 2016; Apesteguia et al., 2019; Meissner et al., 2020).

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- Discretize choices from budget lines as sets of binary choices over lotteries and use a random-utility framework to estimate preference parameters (Bellemare et al., 2016; Apesteguia et al., 2019; Meissner et al., 2020).
- Estimate the expected utility of each lottery:

$$EU_i = b_i \frac{x^{1-\alpha_i-\delta_i}}{1-\alpha_i-\delta_i} + (1-b_i)\frac{(x+y)^{1-\alpha_i-\delta_i}}{1-\alpha_i-\delta_i} + \theta_i\left(\frac{x}{x+y}\right)$$

- x are i's non-competitive/certain earnings
- y are i's competitive/uncertain earnings if she wins the tournament/prize
- b_i is i's belief/probability of losing the tournament/prize.

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- **Two different models**:
  - **i. Model I [$\delta_i = 0$]**
    - Risk preferences (α_i)
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- **Two different models**:

  i. **Model I [$\delta_i = 0$]**
     - Risk preferences (α_i)
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  ii. **Model 2**
     - Risk preferences (α_i)
     - **Additive** preferences for competition (θ_i)
     - The effect of competition on risk preferences (δ_i)

Results
Structural estimation

Summary statistics of estimated risk and competitive preferences at individual level

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	Model 1			
	Median	Mean	sd	p-value
α_i	0.342***	0.282	0.197	0.000
θ_i	-1.703***	-2.385	4.078	0.000
δ_i				
# Subjects		132		
# Obs. per subjects		1600		
Log-Likelihood		-932.291		

Notes: *$p < 0.10$, **$p < 0.05$, ***$p < 0.01$ resulting from a signed-ranks test. Maximum-likelihood estimates of the median, means and the standard deviation of the distributions of risk and competitive preferences.

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- α_i: Individuals are risk averse
- θ_i : Individuals dislike competition

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	Model 1				Model 2			
	Median	Mean	sd	p-value	Median	Mean	sd	p-value
α_i	0.342***	0.282	0.197	0.000	0.370***	0.333	0.352	0.000
θ_i	-1.703***	-2.385	4.078	0.000	-1.560***	-1.919	2.091	0.000
δ_i					-0.046***	-0.111	0.353	0.000
# Subjects		132			131			
# Obs. per subjects		1600			1600			
Log-Likelihood		-932.291			-926.395			

Notes: *$p < 0.10$, **$p < 0.05$, ***$p < 0.01$ resulting from a signed-ranks test. Maximum-likelihood estimates of the median, means and the standard deviation of the distributions of risk and competitive preferences.

- α_i: Individuals are risk averse
- θ_i : Individuals dislike competition
- δ_i : Individuals are **less risk averse in competitive environments**

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Structural estimation

PDFs of estimated risk and competitive preferences at the individual level – Model 2

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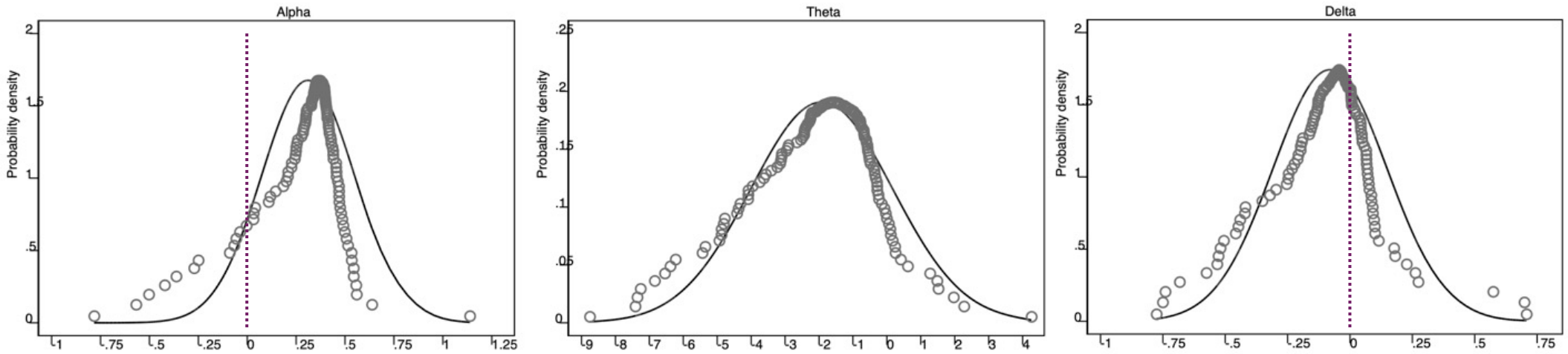

Risk preferences with competition (δ_i): the distribution of individual choices is shifted towards the left in comparison to the one of α_i, with the mode of the distribution close to -0.25 (before 0.5).

Results
Structural estimation – By Gender

Summary statistics of estimated risk and competitive preferences

	Women		Men	
	Model 1	Model 2	Model 1	Model 2
α_i	0.376***		0.285***	
	[0.117]		[0.239]	
θ_i	–2.047***		-1.373***	
	[5.099]		[1.888]	
δ_i				
# Subjects	75	74	57	57
# Obs. per subjects	1600	1600	1600	1600
Log-Likehood	-938.809	-941.360	-923.714	-906.967

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- θ_i and α_i: Gender differences in risk preferences ($p < 0.001$) and in the additive component of preferences for competition ($p < 0.05$).

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	[5.099]	[2.253]	[1.888]	[1.753]
δ_i		-0.040**		-0.058**
		[0.200]		[0.486]
# Subjects	75	74	57	57
# Obs. per subjects	1600	1600	1600	1600
Log-Likehood	-938.809	-941.360	-923.714	-906.967

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- δ_i: No gender differences in the impact of competition on risk preferences ($p = 0.911$) .

Conclusions

- The decisions to compete of most individuals are highly consistent:
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  - Risk preferences differ between an environment with and without competition.
    - People become more tolerant to risk when there is competition.

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  - Risk preferences differ between an environment with and without competition.
    - People become more tolerant to risk when there is competition.

- In line with previous findings, women are more risk-averse and competition averse than men.
- No gender differences in the effect that competition has on individual risk preferences.

Thank you!

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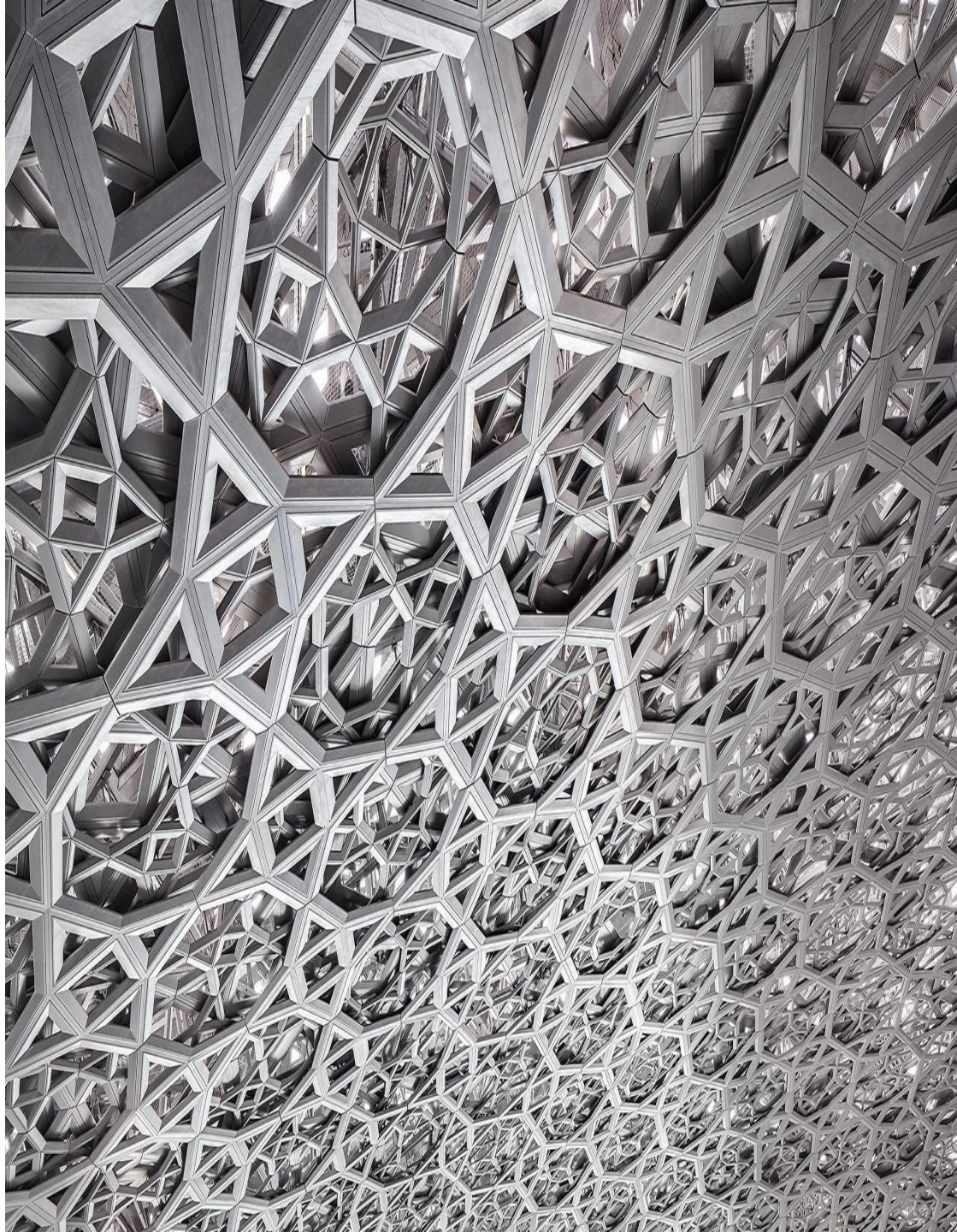

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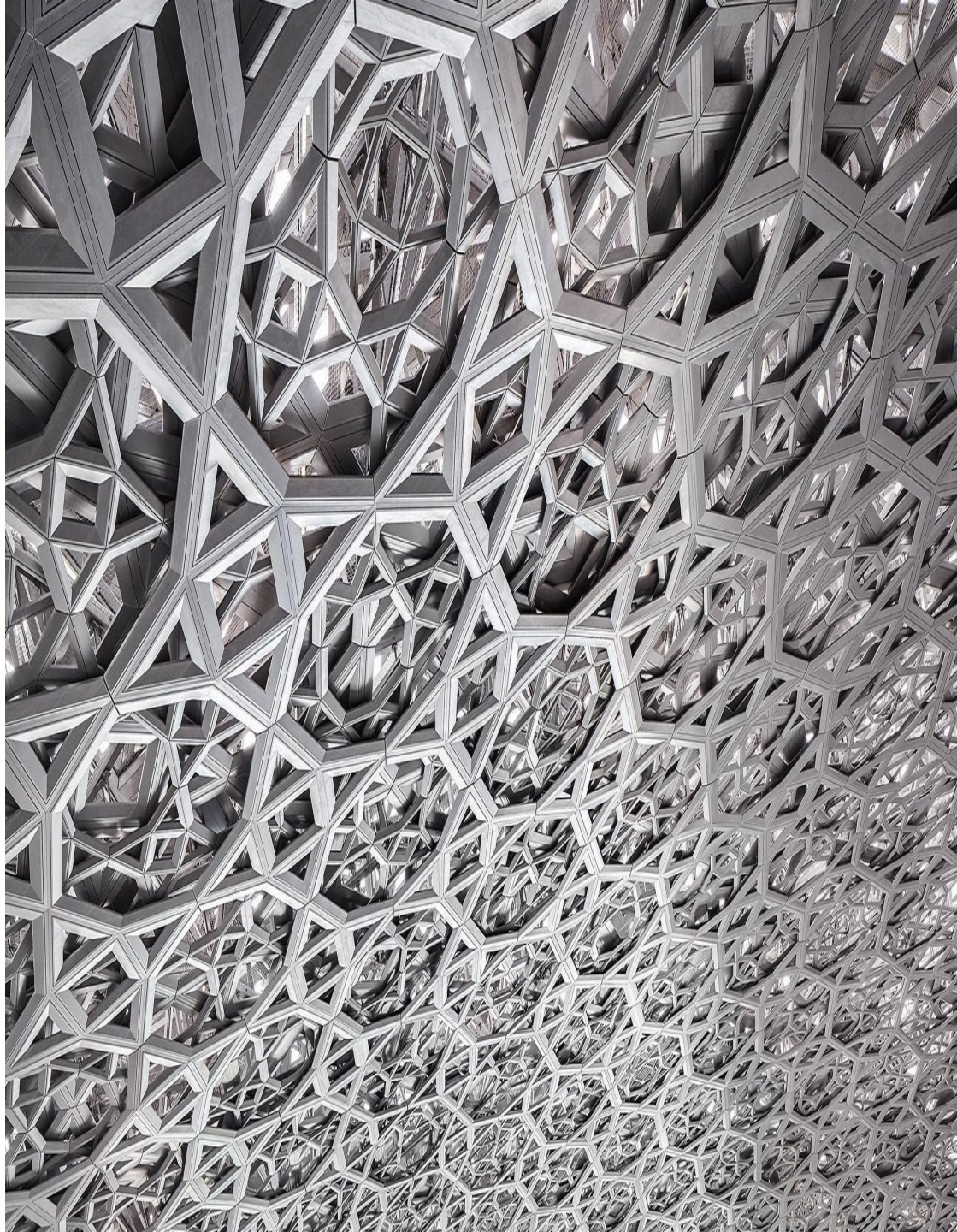
Sample

- Behavioral and Experimental Economics Laboratory (BEElab) at Maastricht University.
- 140 subjects (77 women and 63 men) in 8 sessions.
- Payoff in cash: €5 show-up fee + Earnings from one of the 5 tasks.
- Average payment: €25.
- 1 h 45 minutes.
- Programed with zTree (Fischbacher,2007).



Sample
Competitive behavior and GARP

	Total	Women	Men
Performance Summation Task			
under Indv. Rate (sums)	11	10.4	11.61
under Tourn. Rate (sums)	12	11.44	12.61
Choice remuneration scheme			
Performance (sums)	13.1	12.2	13.9
Tokens allocated to Tourn. Rate	207.1	169.7	244.4
Tokens allocated to Indv. Rate	63.8	69.2	58.5
Risk preferences			
Tokens allocated to Prob. amount	1,883.10	1,352.80	2,413.30
Tokens allocated to Cert. amount	881.5	903.3	859.7
Reported belief			
Prob. of being the group's winner	52.4%	50.1%	54.7%
n	**140**	**77**	**63**

Part 3 - Competition Task					
	Obs	Mean	Std. Dev.	Min	Max
x intercept	5,600	1193.608	580.900	108	3725
y intercept	5,600	6590.499	3095.262	626	19900
# corner choices	5,600	11.557	14.929	0	40
Part 5 - Risk Task					
	Obs	Mean	Std. Dev.	Min	Max
x intercept	5,600	1196.165	587.788	102	3675
y intercept	5,600	6572.185	3051.579	616	19950
# corner choices	5,600	9.936	13.448	0	40

Note: the 5600 observations are the result of 40 choices for each of the 140 participants. Also, for the risk task, the x and y intercepts are adjusted by the number of sums to be comparable to the competition task.

Table 9: Relationships between individual characteristics and risk aversion α_i, additive preferences for competition θ_i and competition aversion δ_i.

	Model 1		Model 2		
	α	θ	α	θ	δ
Gender	0.231***	-0.979***	0.157**	-0.886***	0.054
	(3.31)	(-4.08)	(3.05)	(-4.14)	(1.09)
Age	-0.012*	0.024	-0.025**	0.041	-0.009
	(-1.99)	(1.76)	(-2.74)	(1.77)	(-1.08)
Economics	-0.043	0.216	-0.132	0.881	0.044
	(-1.01)	(1.44)	(-1.53)	(1.68)	(0.93)
Nationality EU	-0.016	-0.059	-0.208	0.021	-0.191
	(-0.31)	(-0.21)	(-1.80)	(0.02)	(-1.51)
# Sisters	-0.015	-0.026	-0.035	-0.054	-0.023
	(-0.77)	(-0.45)	(-1.34)	(-0.68)	(-0.77)
# Brothers	0.050	-0.197**	0.015	-0.257*	-0.021
	(1.73)	(-2.68)	(0.46)	(-2.41)	(-0.69)
Constant	0.267***	-0.385	0.662***	-2.148	-0.280
	(9.65)	(-1.42)	(3.91)	(-1.48)	(2.44)
# Obs.	112000		# Obs.	112000	
Log-Likelihood	-69136.903		Log-Likelihood	-68689.782	

Standard errors (clustered at the individual level) are shown in parentheses.
*p<0.10, **p<0.05, ***p<0.01