

Student Performance and Loss Aversion

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 - either negative points for wrong answers
 - or points for unanswered questions
- This can disadvantage less risk tolerant students
- Women are often found to be less risk tolerant
- Hence women could be disadvantaged in multiple choice exams with penalties

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 - field experiment in **second-year micro exam**
 - women do generally better
 - women guess less with punishment than men, but benefit from this
- Iriberry and Rey-Biel (2019)
 - field experiment; **regional math contest** with primary school, secondary school and high school students
 - with penalty women answer fewer questions
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- Key results
 - more loss-averse students **guess less** in exam
 - more loss-averse students **perform worse**
 - loss aversion explains **part of gender gap** in guessing and performance
 - risk aversion has little explanatory power

Design

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 - class taught in three sessions
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- Experiment taken early in term so that topics such as expected utility theory have not yet been discussed
- Conducted in Autumn 2013 at University of Mannheim

Class Room Experiment

- Loss task
 - decide whether to play 50/50 lotteries
(eliminating the impact of probability weighting; Koeberling and Wakker, 2005)
 - winning yields 4 Euro gain
 - losing yields loss $-0.60, -1.20, -1.80, -2.40, -3.00, -4.00$
 - indicate for each possible loss whether lottery played

Exam

- Multiple-choice exam with 30 questions
 - 4 answer options per question (only one option is correct):
 - 3 points for correct answer
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 - 1 point for unanswered question
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 - first exam about two months after class room experiment
- 646 observations with both (consistent and complete) experiment and first-exam data

Loss Aversion and Behavior in Multiple-Choice Exams

Formalization of Loss Aversion

- Power utility representation (Kahneman and Tversky 1992):

$$u_i(z) = \begin{cases} z^\beta & \text{if } z \geq 0; \\ -\lambda(-z)^\beta & \text{if } z < 0; \end{cases} \quad (1)$$

- $\beta \in (0, 1)$ represents diminishing sensitivity, i.e., risk aversion in gains and risk love in losses (and vice versa for $\beta > 1$)
- $\lambda > 1$ indicates loss aversion

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- $u_i(z_k)$ describes student i 's utility from question k ,
 - where $z_k = x_k - r_k$,
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 - The same predictions hold with an expectation-based reference point (Koszegi and Rabin 2006, 2007)

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 - A risk- and loss-neutral student answers question k if her success probability p_k exceeds $1/3$
 - Assume that students are risk neutral $\beta = 1$:
 - Student with loss aversion λ is indifferent between answering and not answering iff $p_k \cdot (3 - 1) + (1 - p_k) \cdot \lambda(0 - 1) = 1 - 1$

$$p^*(\lambda) \equiv \frac{\lambda}{\lambda + 2} \in (1/3, 1] \text{ and } p^*(\lambda) \text{ is increasing}$$

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Students are less likely to answer a question the more loss-averse they are.

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Hypothesis 3:

Conditional on answering, students are more likely to give the correct answer the more loss-averse they are.

Loss Aversion Measure and Estimate of Gambling

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 - Risk aversion $\beta_i < 1$ cannot plausibly explain choice behavior in small-stake lotteries without implying absurd degrees of risk aversion in high-stake gambles
- λ_i derived from switch point R_i in loss task, i.e.
 $0 = 1/2 \cdot 4 + 1/2 \cdot (-\lambda_i |R_i|)$, where the reference point is zero

$$\lambda_i = \frac{4}{|R_i|}.$$

Estimate of Gambling

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- For number of incorrectly guessed questions n , number of guessed questions is thus at least $3n/2$
- Let m be number of unanswered questions
- Gambling rate is then taken as

$$\frac{\frac{3}{2}n}{\frac{3}{2}n + m}$$

Results: Descriptives

Classroom Experiment

Individual Measure of Loss Aversion

- Categorization of the measured degree of loss aversion:
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$$\lambda_i^c = \begin{cases} 1 \text{ "loss-neutral or weakly loss-averse",} & \text{if } \lambda_i \leq 1.67; \\ 2 \text{ "loss-averse",} & \text{if } \lambda_i \in (1.67, 3.33]; \\ 3 \text{ "strongly loss-averse",} & \text{if } \lambda_i > 3.33. \end{cases}$$

<i>R</i>	λ^c		
	“loss-neutral or weakly loss-averse” 1	“loss-averse” 2	“strongly loss-averse” 3
-4	60	0	0
-3	53	0	0
-2.4	57	0	0
-1.8	0	199	0
-1.2	0	119	0
-0.6	0	0	77
0	0	0	81
Total	170	318	158

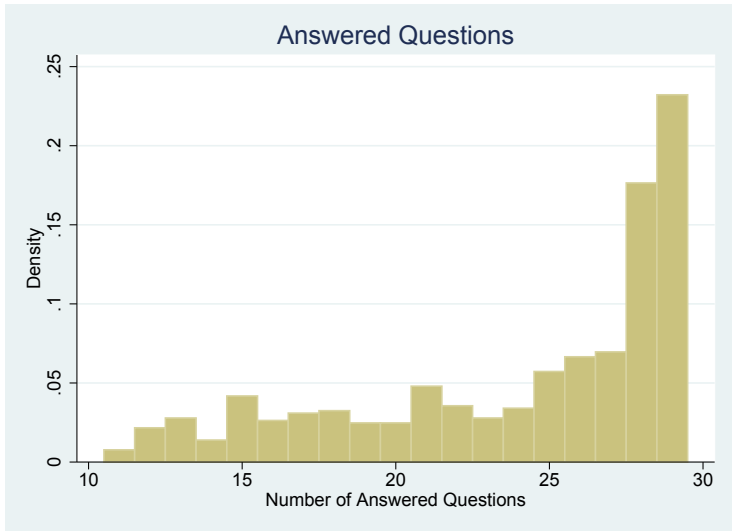
Correlation between Loss Aversion and Other Explanatory Variables

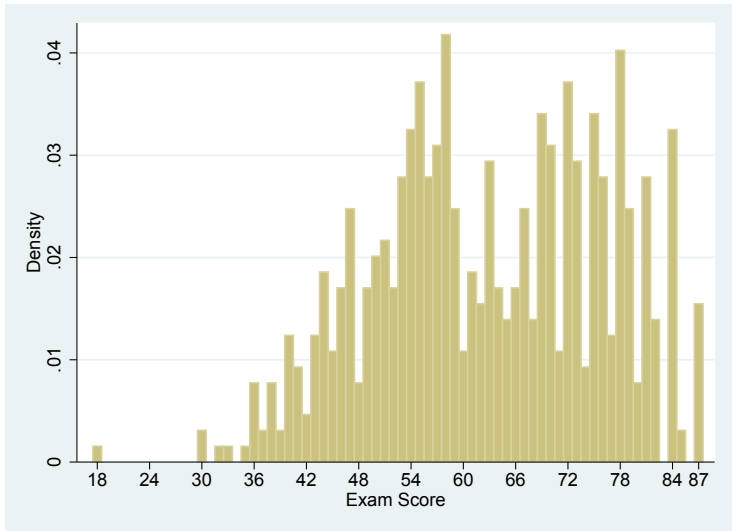
	Loss Av'n	Confidence	Cognitive Refl'n	Gender (F.)
Loss Aversion	1			
Confidence	-0.180***	1		
Cognitive Refl'n	-0.207***	0.176***	1	
Gender (F.)	0.343***	-0.364***	-0.307***	1

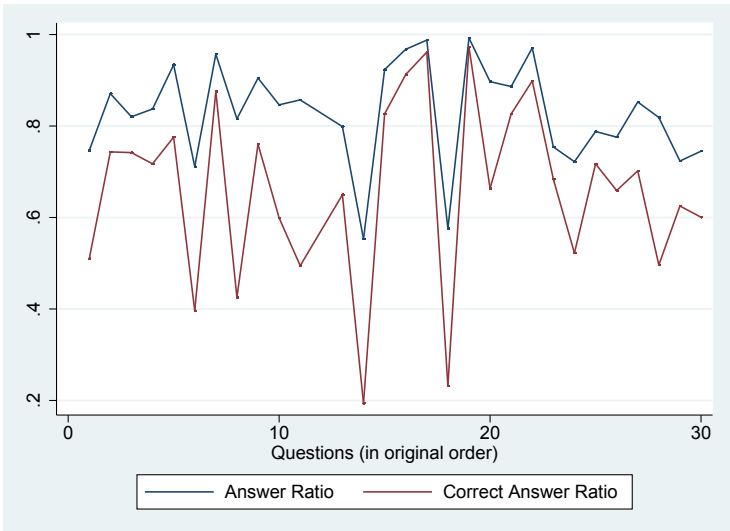
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

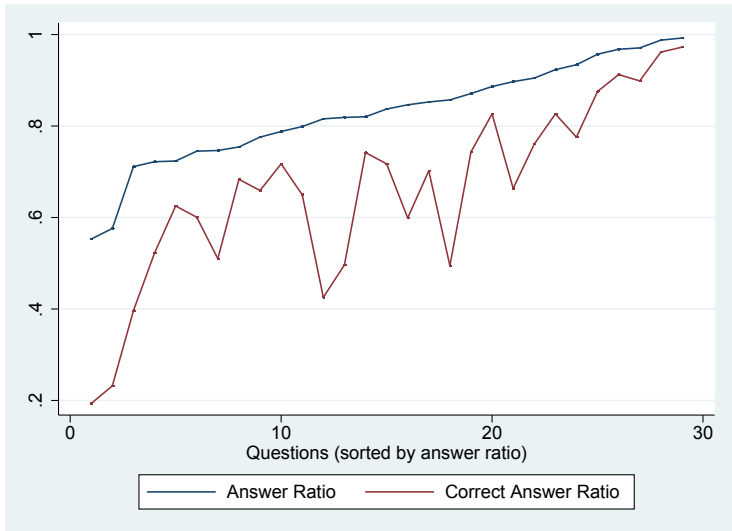
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Exam









Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Answered Questions	646	23.9954	5.3095	11	29
Correct Answers	646	19.2740	5.7239	5	29
Exam Score	646	62.8266	13.0478	18	87
Propensity to Gamble	646	0.6981	0.2736	0.0811	1
Loss Aversion, λ^c	646	1.9814	0.7129	1	3
Confidence	645	-0.5189	1.7614	-7	5
Cognitive Reflection	646	1.7665	1.076	0	3
Age	646	19.4593	2.1767	16	37

Descriptive Statistics: Female Students

Variable	Obs	Mean	Std. Dev.	Min	Max
Answered Questions	279	22.2151	5.6035	11	29
Correct Answers	279	17.2760	5.6992	6	29
Exam Score	279	58.6129	12.6889	30	87
Propensity to Gamble	279	0.6249	0.2716	0.0968	1
Loss Aversion, λ^c	279	2.2616	0.6567	1	3
Confidence	279	-1.2518	1.6501	-7	3
Cognitive Reflection	279	1.3901	1.0690	0	3
Age	279	19.5248	1.7252	17	27

Descriptive Statistics: Male Students

Variable	Obs	Mean	Std. Dev.	Min	Max
Answered Questions	367	25.3488	4.6452	11	29
Correct Answers	367	20.7929	5.2641	5	29
Exam Score	367	66.0300	12.4058	18	87
Propensity to Gamble	367	0.7541	0.2623	0.0811	1
Loss Aversion, λ^c	367	1.7684	0.6802	1	3
Confidence	366	0.03989	1.6360	-4.6	5
Cognitive Reflection	367	2.054	0.9903	0	3
Age	367	19.4092	2.4678	16	37

Descriptive Statistics: Students per Field

Field	Obs	Freq.	% Female
Business Administration	249	38.54	37.35
Business Law	136	21.05	42.65
Business Education	107	16.56	68.22
Economics	99	15.33	31.31
Others	55	8.51	43.64
Total	646	100.00	43.19

Correlation between Main Variables and Field of Study

Field	Cognitive R.	Loss A.	Risk A.	Confidence	Gender (F.)
Business Adm'n	0.1549*** (0.000)	-0.0776** (0.049)	0.0787** (0.045)	-0.0246 (0.533)	-0.0934** (0.018)
Business Law	-0.0728* (0.065)	0.0081 (0.837)	-0.0538 (0.172)	0.0010 (0.980)	-0.0056 (0.886)
Business Educ'n	-0.3068*** (0.000)	0.0584 (0.138)	-0.0718* (0.068)	-0.0907** (0.021)	0.2252*** (0.000)
Economics	0.1830*** (0.000)	0.0111 (0.778)	0.0147 (0.710)	0.0591 (0.134)	-0.1020** (0.010)
Others	0.0087 (0.826)	0.0313 (0.427)	0.0180 (0.648)	0.0856** (0.030)	0.0028 (0.944)

Results: Cross-Sectional Regressions

OLS with robust s.e.

Number of Answered Questions (Hypothesis 1)

	(1)	(2)	(3)	(4)
Cognitive Reflection	0.561*** (0.171)	0.486*** (0.166)	0.504*** (0.170)	0.438*** (0.167)
Loss Aversion		-1.649*** (0.382)		-1.574*** (0.383)
Strong Loss Aversion		-1.998*** (0.475)		-1.889*** (0.474)
Confidence			0.340*** (0.102)	0.314*** (0.102)
Gender (F.)	-2.026*** (0.375)	-1.544*** (0.380)	-1.600*** (0.375)	-1.177*** (0.378)
Age	0.057 (0.094)	0.054 (0.094)	0.042 (0.090)	0.039 (0.090)
Constant	21.916*** (2.101)	23.263*** (2.113)	25.738*** (1.807)	27.119*** (1.847)
Field Fixed Effects	Yes	Yes	Yes	Yes
N. Obs.	646	646	645	645
R square	0.3855	0.4051	0.3970	0.4145

Propensity to Gamble (std), $\sigma = 0.262$

	(1)	(2)	(3)	(4)
Cognitive Reflection	0.098*** (0.035)	0.084** (0.034)	0.087** (0.035)	0.076** (0.035)
Loss Aversion		-0.386*** (0.080)		-0.373*** (0.080)
Strong Loss Aversion		-0.390*** (0.095)		-0.370*** (0.096)
Confidence			0.064*** (0.021)	0.059*** (0.021)
Gender (F.)	-0.304*** (0.075)	-0.208*** (0.077)	-0.224*** (0.077)	-0.139* (0.078)
Age	0.013 (0.018)	0.012 (0.019)	0.010 (0.018)	0.009 (0.018)
Constant	-0.407 (0.410)	-0.106 (0.416)	0.231 (0.360)	0.549 (0.372)
Field Fixed Effects	Yes	Yes	Yes	Yes
N. Obs.	646	646	645	645
R square	0.2939	0.3200	0.3050	0.3291

Exam Score

	(1)	(2)	(3)	(4)
Cognitive Reflection	1.583*** (0.414)	1.443*** (0.415)	1.466*** (0.417)	1.341*** (0.418)
Loss Aversion		-1.029 (1.055)		-0.860 (1.055)
Strong Loss Aversion		-3.022** (1.262)		-2.800** (1.261)
Confidence			0.590** (0.263)	0.557** (0.264)
Gender (F.)	-4.154*** (0.876)	-3.483*** (0.913)	-3.391*** (0.918)	-2.816*** (0.952)
Age	-0.002 (0.172)	0.007 (0.168)	-0.023 (0.173)	-0.013 (0.169)
Constant	58.697*** (4.131)	59.843*** (4.197)	67.337*** (3.627)	68.297*** (3.743)
Field Fixed Effects	Yes	Yes	Yes	Yes
N. Obs.	646	646	645	645
R square	0.3682	0.3744	0.3749	0.3803

Exam Score including Propensity to Gamble (std)

	(1)	(2)	(3)	(4)
Cognitive Reflection	1.267*** (0.406)	1.173*** (0.409)	1.194*** (0.409)	1.106*** (0.412)
Propensity to Gamble (std)	3.231*** (0.506)	3.196*** (0.516)	3.118*** (0.516)	3.097*** (0.526)
Loss Aversion		0.205 (1.043)		0.294 (1.043)
Strong Loss Aversion		-1.776 (1.233)		-1.654 (1.233)
Confidence			0.391 (0.262)	0.375 (0.262)
Gender (F.)	-3.171*** (0.848)	-2.820*** (0.894)	-2.692*** (0.896)	-2.384** (0.937)
Age	-0.045 (0.164)	-0.032 (0.161)	-0.055 (0.167)	-0.041 (0.164)
Constant	60.013*** (3.937)	60.181*** (4.008)	66.616*** (3.472)	66.595*** (3.601)
Field Fixed Effects	Yes	Yes	Yes	Yes
N. Obs.	646	646	645	645
R square	0.4115	0.4152	0.4146	0.4181

Number of Correct Answers Unconditionally (Hypothesis 2)

	(1)	(2)	(3)	(4)
Cognitive Reflection	0.715*** (0.175)	0.643*** (0.174)	0.657*** (0.175)	0.593*** (0.174)
Loss Aversion		-0.893** (0.431)		-0.811* (0.431)
Strong Loss Aversion		-1.673*** (0.522)		-1.563*** (0.521)
Confidence			0.310*** (0.109)	0.291*** (0.109)
Gender (F.)	-2.060*** (0.376)	-1.676*** (0.387)	-1.664*** (0.385)	-1.331*** (0.397)
Age	0.018 (0.078)	0.020 (0.077)	0.006 (0.077)	0.009 (0.076)
Constant	17.204*** (1.856)	18.035*** (1.864)	21.358*** (1.602)	22.139*** (1.637)
Field Fixed Effects	Yes	Yes	Yes	Yes
N. Obs.	646	646	645	645
R square	0.4217	0.4311	0.4306	0.4388

Number of Correct Answers/ Questions Answered (Hypothesis 3)

	(1)	(2)	(3)	(4)
Cognitive Reflection	0.013** (0.005)	0.013** (0.005)	0.013** (0.005)	0.012** (0.005)
Loss Aversion		0.020 (0.012)		0.021* (0.012)
Strong Loss Aversion		-0.004 (0.015)		-0.003 (0.015)
Confidence			0.003 (0.003)	0.003 (0.003)
Gender (F.)	-0.021** (0.010)	-0.021* (0.011)	-0.018 (0.011)	-0.018 (0.012)
Age	-0.001 (0.002)	-0.000 (0.002)	-0.001 (0.002)	-0.000 (0.002)
Constant	0.766*** (0.051)	0.754*** (0.053)	0.810*** (0.045)	0.795*** (0.047)
Field Fixed Effects	Yes	Yes	Yes	Yes
N. Obs.	646	646	645	645
R square	0.1329	0.1399	0.1344	0.1416

Results: Panel Data Estimations

Random Effects Logit with clustered s.e. on the
Student Level

Answer a Question (Hypoth's 1)

	(1)	(2)	(3)	(4)
Cognitive Reflection	0.286*** (0.058)	0.255*** (0.057)	0.267*** (0.057)	0.240*** (0.057)
Loss Aversion		-0.590*** (0.147)		-0.565*** (0.147)
Strong Loss Aversion		-0.684*** (0.164)		-0.645*** (0.164)
Confidence			0.106*** (0.034)	0.097*** (0.034)
Gender (F.)	-0.667*** (0.120)	-0.518*** (0.118)	-0.532*** (0.122)	-0.404*** (0.119)
Time Micro	-0.704*** (0.098)	-0.703*** (0.098)	-0.702*** (0.098)	-0.702*** (0.098)
Time Macro	-1.350*** (0.093)	-1.350*** (0.093)	-1.347*** (0.093)	-1.348*** (0.093)
Cognitive Reflection \times Micro	-0.132*** (0.027)	-0.132*** (0.027)	-0.132*** (0.028)	-0.132*** (0.028)
Constant	2.115*** (0.268)	2.610*** (0.284)	2.102*** (0.269)	2.571*** (0.287)
N. Obs.	18,734	18,734	18,705	18,705

Unconditionally Correct Answer (Hypoth's 2)

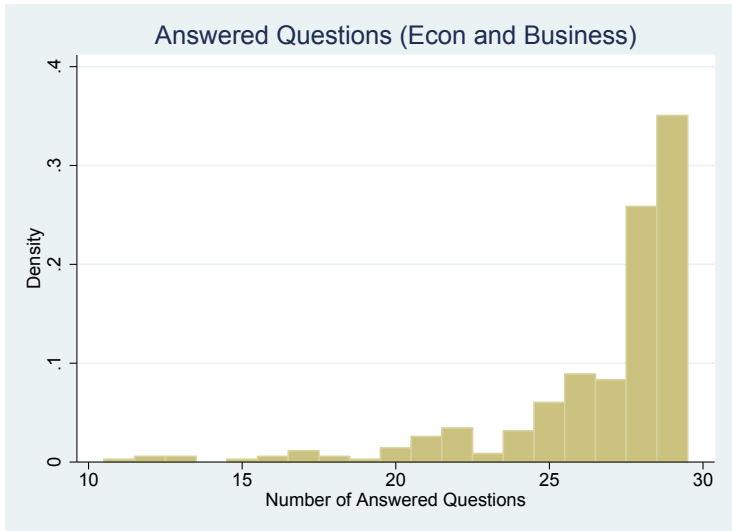
	(1)	(2)	(3)	(4)
Cognitive Reflection	0.199*** (0.033)	0.184*** (0.033)	0.189*** (0.033)	0.176*** (0.033)
Loss Aversion		-0.171** (0.084)		-0.157* (0.083)
Strong Loss Aversion		-0.311*** (0.096)		-0.291*** (0.096)
Confidence			0.054*** (0.020)	0.050** (0.020)
Gender (F.)	-0.369*** (0.069)	-0.299*** (0.069)	-0.299*** (0.070)	-0.239*** (0.071)
Time Micro	-1.013*** (0.069)	-1.013*** (0.069)	-1.017*** (0.069)	-1.017*** (0.069)
Time Macro	-1.063*** (0.076)	-1.063*** (0.076)	-1.064*** (0.076)	-1.064*** (0.076)
Cognitive Reflection \times Micro	-0.134*** (0.020)	-0.133*** (0.020)	-0.133*** (0.020)	-0.133*** (0.020)
Constant	0.911*** (0.166)	1.092*** (0.176)	0.910*** (0.168)	1.077*** (0.178)
N. Obs.	18,734	18,734	18,705	18,705

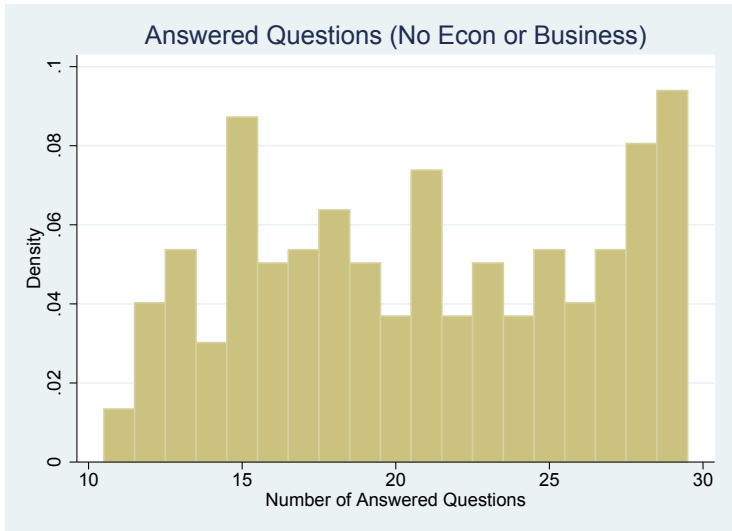
Correct Answer, Conditionally On Answering (Hypoth's 3)

	(1)	(2)	(3)	(4)
Cognitive Reflection	0.142*** (0.035)	0.137*** (0.035)	0.138*** (0.036)	0.133*** (0.036)
Loss Aversion		0.109 (0.084)		0.115 (0.084)
Strong Loss Aversion		-0.049 (0.097)		-0.041 (0.097)
Confidence			0.014 (0.021)	0.014 (0.021)
Gender (F.)	-0.143** (0.069)	-0.138* (0.073)	-0.124* (0.074)	-0.120 (0.076)
Time Micro	-1.081*** (0.084)	-1.081*** (0.084)	-1.089*** (0.084)	-1.089*** (0.084)
Time Macro	-0.632*** (0.101)	-0.631*** (0.101)	-0.637*** (0.101)	-0.636*** (0.101)
Cognitive Reflection \times Micro	-0.095*** (0.024)	-0.095*** (0.024)	-0.094*** (0.024)	-0.094*** (0.024)
Constant	1.575*** (0.170)	1.547*** (0.182)	1.579*** (0.171)	1.547*** (0.182)
N. Obs.	15,501	15,501	15,473	15,473

Correct Answer, Conditionally On Answering (Subsamples)

	Low Sum of Answers:		High Sum of Answers:	
	(1)	(2)	(3)	(4)
Cognitive Reflection	0.137*** (0.047)	0.142*** (0.047)	0.098* (0.056)	0.103* (0.056)
Loss Aversion		0.302** (0.118)		-0.125 (0.108)
Strong Loss Aversion		0.180 (0.130)		-0.342** (0.145)
Gender (F.)	-0.130 (0.094)	-0.157 (0.096)	-0.026 (0.104)	0.079 (0.113)
Time Micro	-1.015*** (0.111)	-1.014*** (0.111)	-1.174*** (0.127)	-1.174*** (0.127)
Time Macro	-0.739*** (0.132)	-0.736*** (0.132)	-0.484*** (0.154)	-0.484*** (0.154)
Cognitive Reflection \times Micro	-0.166*** (0.034)	-0.166*** (0.034)	-0.015 (0.033)	-0.015 (0.033)
Constant	1.544*** (0.200)	1.345*** (0.223)	1.827*** (0.320)	1.847*** (0.334)
N. Obs.	7,959	7,959	7,542	7,542





Correct Answer, Conditionally On Answering (Subsamples)

	Other Fields:		Business Adm'n and Econ:	
	(1)	(2)	(3)	(4)
Cognitive Reflection	0.152*** (0.054)	0.157*** (0.055)	0.137*** (0.047)	0.137*** (0.047)
Loss Aversion		0.251** (0.122)		-0.022 (0.114)
Strong Loss Aversion		0.135 (0.140)		-0.242* (0.135)
Gender (F.)	-0.198* (0.103)	-0.227** (0.106)	-0.097 (0.092)	-0.029 (0.097)
Time Micro	-1.037*** (0.120)	-1.036*** (0.120)	-1.113*** (0.120)	-1.111*** (0.120)
Time Macro	-0.648*** (0.152)	-0.643*** (0.152)	-0.619*** (0.132)	-0.620*** (0.132)
Cognitive Reflection × Micro	-0.132*** (0.038)	-0.131*** (0.038)	-0.071** (0.032)	-0.071** (0.032)
Constant	1.615*** (0.226)	1.453*** (0.256)	1.856*** (0.178)	1.897*** (0.195)
N. Obs.	6,212	6,212	9,289	9,289

Alternative Specification of Risk Preferences

Classroom Experiment

- No loss task
 - choose between fixed amount and 50/50 lottery that yields 4 Euro or 0
 - fixed amount 0.40, 0.80, 1.20, 1.60, 2.00 or 2.40
 - indicate for each possible fixed amount whether lottery played

Alternative Curvature-Adjusted Loss Aversion Measure

- In conflict with Rabin (2000)'s calibration theorem allow for $\beta_i \neq 1$:

Alternative Curvature-Adjusted Loss Aversion Measure

- In conflict with Rabin (2000)'s calibration theorem allow for $\beta_i \neq 1$:
- β_i derived from switch point S_i in no loss task, i.e. $1/2 \cdot 4^{\beta_i} = S_i^{\beta_i}$,

$$\beta_i = \frac{\ln(2)}{\ln(4) - \ln(S_i)}.$$

Alternative Curvature-Adjusted Loss Aversion Measure

- In conflict with Rabin (2000)'s calibration theorem allow for $\beta_i \neq 1$:
- β_i derived from switch point S_i in no loss task, i.e. $1/2 \cdot 4^{\beta_i} = S_i^{\beta_i}$,

$$\beta_i = \frac{\ln(2)}{\ln(4) - \ln(S_i)}.$$

- Given estimate of β_i , $\tilde{\lambda}_i$ derived from switch point R_i in loss task, i.e. $0 = 1/2 \cdot 4^{\beta_i} + 1/2 \cdot (-\tilde{\lambda}_i)(|R_i|)^{\beta_i}$,

$$\tilde{\lambda}_i = \left(\frac{4}{|R_i|} \right)^{\beta_i}$$

Result: Measure of Risk Aversion

- Categorization of the measured degree of risk aversion:
- To avoid that the results depend on outliers

Result: Measure of Risk Aversion

- Categorization of the measured degree of risk aversion:
- To avoid that the results depend on outliers

$$\beta_i^c = \begin{cases} 0.25 \text{ "strongly risk-averse",} & \text{if } \beta_i \leq 0.431; \\ 0.75 \text{ "risk-averse",} & \text{if } \beta_i \in (0.431, 1); \\ 1.25 \text{ "risk-neutral or weakly risk-loving",} & \text{if } \beta_i \geq 1. \end{cases}$$

S	$1 - \beta^c$		
	“risk-neutral or weakly risk-loving” -0.25	“risk-averse” 0.25	“strongly risk-averse” 0.75
0	0	0	29
0.4	0	0	9
0.8	0	0	37
1.2	0	160	0
1.6	0	264	0
2	59	0	0
2.4	88	0	0
Total	147	424	75

Result: Alternative Measure of Loss Aversion

- Categorization of the measured degree of loss aversion:
- To avoid that the results depend on outliers

Result: Alternative Measure of Loss Aversion

- Categorization of the measured degree of loss aversion:
- To avoid that the results depend on outliers

$$\tilde{\lambda}_i^c = \begin{cases} 1 \text{ "loss-neutral or weakly loss-averse",} & \text{if } \tilde{\lambda}_i \leq 1.5; \\ 2 \text{ "weakly loss-averse",} & \text{if } \tilde{\lambda}_i \in (1.5, 2]; \\ 3 \text{ "strongly loss-averse",} & \text{if } \tilde{\lambda}_i > 2. \end{cases}$$

Correlation between Loss Aversion and Other Explanatory Variables

	Loss Av'n	Risk Av'n	Confidence	Cognitive Refl'n	Gender (F.)
Loss Aversion	1				
Risk Aversion	-0.0158	1			
Confidence	-0.119**	-0.145***	1		
Cognitive Refl'n	-0.137***	-0.129**	0.176***	1	
Gender (F.)	0.286***	0.174***	-0.364***	-0.307***	1

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Number of Answered Questions

	(1)	(2)	(3)	(4)
Cognitive Reflection	0.561*** (0.171)	0.499*** (0.167)	0.504*** (0.170)	0.447*** (0.167)
Loss Aversion		-1.290*** (0.408)		-1.246*** (0.406)
Strong Loss Aversion		-1.263*** (0.415)		-1.221*** (0.412)
Risk Aversion		0.358 (0.378)		0.469 (0.375)
Strong Risk Aversion		-1.257* (0.651)		-1.132* (0.648)
Confidence			0.340*** (0.102)	0.335*** (0.106)
Gender (F.)	-2.026*** (0.375)	-1.657*** (0.384)	-1.600*** (0.375)	-1.263*** (0.382)
Age	0.057 (0.094)	0.067 (0.095)	0.042 (0.090)	0.053 (0.091)
Constant	21.916*** (2.101)	22.501*** (2.181)	25.738*** (1.807)	26.352*** (1.911)
Field Fixed Effects	Yes	Yes	Yes	Yes
N. Obs.	646	646	645	645
R square	0.3855	0.4041	0.3970	0.4147

Propensity to Gamble (std), $\sigma = 0.262$

	(1)	(2)	(3)	(4)
Cognitive Reflection	0.098*** (0.035)	0.088** (0.035)	0.087** (0.035)	0.079** (0.035)
Loss Aversion		-0.311*** (0.085)		-0.304*** (0.085)
Strong Loss Aversion		-0.308*** (0.084)		-0.300*** (0.083)
Risk Aversion		0.105 (0.079)		0.127 (0.078)
Strong Risk Aversion		-0.080 (0.124)		-0.056 (0.123)
Confidence			0.064*** (0.021)	0.064*** (0.021)
Gender (F.)	-0.304*** (0.075)	-0.229*** (0.078)	-0.224*** (0.077)	-0.155* (0.079)
Age	0.013 (0.018)	0.014 (0.019)	0.010 (0.018)	0.011 (0.018)
Constant	-0.407 (0.410)	-0.270 (0.430)	0.231 (0.360)	0.374 (0.383)
Field Fixed Effects	Yes	Yes	Yes	Yes
N. Obs.	646	646	645	645
R square	0.2939	0.3140	0.3050	0.3246

Exam Score

	(1)	(2)	(3)	(4)
Cognitive Reflection	1.583*** (0.414)	1.488*** (0.410)	1.466*** (0.417)	1.383*** (0.413)
Loss Aversion		-1.787 (1.115)		-1.670 (1.115)
Strong Loss Aversion		-1.325 (1.128)		-1.221 (1.128)
Risk Aversion		0.032 (1.021)		0.189 (1.023)
Strong Risk Aversion		-2.933** (1.421)		-2.733* (1.432)
Confidence			0.590** (0.263)	0.568** (0.263)
Gender (F.)	-4.154*** (0.876)	-3.630*** (0.912)	-3.391*** (0.918)	-2.943*** (0.951)
Age	-0.002 (0.172)	0.012 (0.172)	-0.023 (0.173)	-0.005 (0.173)
Constant	58.697*** (4.131)	59.784*** (4.392)	67.337*** (3.627)	68.379*** (3.964)
Field Fixed Effects	Yes	Yes	Yes	Yes
N. Obs.	646	646	645	645
R square	0.3682	0.3762	0.3749	0.3821

Number of Correct Answers Unconditionally (Hypothesis 2)

	(1)	(2)	(3)	(4)
Cognitive Reflection	0.715*** (0.175)	1.488*** (0.410)	0.657*** (0.175)	0.610*** (0.172)
Loss Aversion		-1.787 (1.115)		-0.972** (0.451)
Strong Loss Aversion		-1.325 (1.128)		-0.814* (0.463)
Risk Aversion		0.032 (1.021)		0.219 (0.417)
Strong Risk Aversion		-2.933** (1.421)		-1.289** (0.616)
Confidence			0.310*** (0.109)	0.301*** (0.110)
Gender (F.)	-2.060*** (0.376)	-3.630*** (0.912)	-1.664*** (0.385)	-1.402*** (0.396)
Age	0.018 (0.078)	0.012 (0.172)	0.006 (0.077)	0.016 (0.078)
Constant	17.204*** (1.856)	59.784*** (4.392)	21.358*** (1.602)	21.910*** (1.746)
Field Fixed Effects	Yes	Yes	Yes	Yes
N. Obs.	646	646	645	645
R square	0.4217	0.3762	0.4306	0.4415

Number of Correct Answers/ Questions Answered (H3)

	(1)	(2)	(3)	(4)
Cognitive Reflection	0.013** (0.005)	1.488*** (0.410)	0.013** (0.005)	0.013** (0.005)
Loss Aversion		-1.787 (1.115)		0.005 (0.014)
Strong Loss Aversion		-1.325 (1.128)		0.010 (0.014)
Risk Aversion		0.032 (1.021)		-0.005 (0.012)
Strong Risk Aversion		-2.933** (1.421)		-0.020 (0.018)
Confidence			0.003 (0.003)	0.002 (0.003)
Gender (F.)	-0.021** (0.010)	-3.630*** (0.912)	-0.018 (0.011)	-0.019 (0.012)
Age	-0.001 (0.002)	0.012 (0.172)	-0.001 (0.002)	-0.000 (0.002)
Constant	0.766*** (0.051)	59.784*** (4.392)	0.810*** (0.045)	0.808*** (0.048)
Field Fixed Effects	Yes	Yes	Yes	Yes
N. Obs.	646	646	645	645
R square	0.1329	0.3762	0.1344	0.1371

Answer a Question (Hypoth's 1)

	(1)	(2)	(3)	(4)
Cognitive Reflection	0.286*** (0.058)	0.263*** (0.057)	0.267*** (0.057)	0.247*** (0.057)
Loss Aversion		-0.470*** (0.150)		-0.461*** (0.149)
Strong Loss Aversion		-0.506*** (0.147)		-0.491*** (0.145)
Risk Aversion		0.162 (0.135)		0.208 (0.134)
Strong Risk Aversion		-0.191 (0.189)		-0.138 (0.190)
Confidence			0.106*** (0.034)	0.107*** (0.035)
Gender (F.)	-0.667*** (0.120)	-0.556*** (0.119)	-0.532*** (0.122)	-0.431*** (0.120)
Time Micro	-0.704*** (0.098)	-0.704*** (0.098)	-0.702*** (0.098)	-0.702*** (0.098)
Time Macro	-1.350*** (0.093)	-1.350*** (0.093)	-1.347*** (0.093)	-1.348*** (0.093)
Cognitive Reflection × Micro	-0.132*** (0.027)	-0.132*** (0.027)	-0.132*** (0.028)	-0.132*** (0.027)
Constant	2.115*** (0.268)	2.405*** (0.294)	2.102*** (0.269)	2.346*** (0.295)
N. Obs.	18,734	18,734	18,705	18,705

Unconditionally Correct Answer (Hypoth's 2)

	(1)	(2)	(3)	(4)
Cognitive Reflection	0.199*** (0.033)	0.189*** (0.033)	0.189*** (0.033)	0.179*** (0.033)
Loss Aversion		-0.205** (0.087)		-0.197** (0.087)
Strong Loss Aversion		-0.185** (0.088)		-0.176** (0.087)
Risk Aversion		0.024 (0.079)		0.043 (0.079)
Strong Risk Aversion		-0.216* (0.110)		-0.193* (0.111)
Confidence			0.054*** (0.020)	0.053*** (0.020)
Gender (F.)	-0.369*** (0.069)	-0.312*** (0.069)	-0.299*** (0.070)	-0.249*** (0.071)
Time Micro	-1.013*** (0.069)	-1.013*** (0.069)	-1.017*** (0.069)	-1.017*** (0.069)
Time Macro	-1.063*** (0.076)	-1.063*** (0.076)	-1.064*** (0.076)	-1.064*** (0.076)
Cognitive Reflection × Micro	-0.134*** (0.020)	-0.133*** (0.020)	-0.133*** (0.020)	-0.133*** (0.020)
Constant	0.911*** (0.166)	1.064*** (0.179)	0.910*** (0.168)	1.042*** (0.182)
N. Obs.	18,734	18,734	18,705	18,705

Correct Answer, Conditionally On Answering (Hypoth's 3)

	(1)	(2)	(3)	(4)
Cognitive Reflection	0.142*** (0.035)	0.139*** (0.035)	0.138*** (0.036)	0.136*** (0.036)
Loss Aversion		-0.007 (0.090)		-0.002 (0.090)
Strong Loss Aversion		0.020 (0.089)		0.024 (0.089)
Risk Aversion		-0.017 (0.083)		-0.014 (0.083)
Strong Risk Aversion		-0.129 (0.116)		-0.124 (0.118)
Confidence			0.014 (0.021)	0.013 (0.021)
Gender (F.)	-0.143** (0.069)	-0.138* (0.073)	-0.124* (0.074)	-0.121 (0.077)
Time Micro	-1.081*** (0.084)	-1.081*** (0.084)	-1.089*** (0.084)	-1.089*** (0.084)
Time Macro	-0.632*** (0.101)	-0.632*** (0.101)	-0.637*** (0.101)	-0.637*** (0.101)
Cognitive Reflection \times Micro	-0.095*** (0.024)	-0.095*** (0.024)	-0.094*** (0.024)	-0.094*** (0.024)
Constant	1.575*** (0.170)	1.598*** (0.189)	1.579*** (0.171)	1.597*** (0.190)
N. Obs.	15,501	15,501	15,473	15,473

Correct Answer, Conditionally On Answering (Subsamples)

	Low Sum of Answers:		High Sum of Answers:	
	(1)	(2)	(3)	(4)
Cognitive Reflection	0.120*** (0.033)	0.115*** (0.033)	0.085 (0.054)	0.102* (0.055)
Loss Aversion		-0.062 (0.085)		-0.261** (0.117)
Strong Loss Aversion		0.003 (0.088)		-0.265** (0.129)
Risk Aversion		-0.099 (0.084)		-0.040 (0.100)
Strong Risk Aversion		-0.263** (0.103)		-0.253 (0.236)
Gender (F.)	-0.240*** (0.067)	-0.219*** (0.069)	-0.023 (0.098)	0.094 (0.114)
Time Micro	-0.983*** (0.083)	-0.983*** (0.083)	-1.121*** (0.124)	-1.174*** (0.127)
Time Macro	-1.297*** (0.089)	-1.297*** (0.089)	-0.369*** (0.141)	-0.484*** (0.154)
Cognitive Reflection × Micro	-0.182*** (0.026)	-0.182*** (0.026)	0.000 (0.031)	-0.015 (0.033)
Constant	0.789*** (0.146)	0.903*** (0.160)	1.768*** (0.316)	1.966*** (0.345)
N. Obs.	11,078	11,078	7,656	7,542

Discussion and Conclusion

Gender Gap without Punishment

- In 2014 punishment points for wrong answers were abolished
- Hence there was no reason not to guess anymore
- Loss aversion should thus not matter anymore for the exam result

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Gender Gap without Punishment

- In 2014 punishment points for wrong answers were abolished
- Hence there was no reason not to guess anymore
- Loss aversion should thus not matter anymore for the exam result
- If difference in loss aversion is partly responsible for the gender gap, we should then also observe a reduced gender gap
- This is indeed what we find
 - 2013 (with punishment): gender gap 7.2
 - 2014 (without punishment): gender gap 4.7
- Note that in this comparison we cannot control for risk or loss preferences and cognitive ability because these were not collected for the 2014 cohort

Conclusion

- Loss-averse students perform worse
- The mechanism appears to be at least partly that they guess less because of risk preferences rather than lower ability
- Loss aversion explains part of the gender gap in performance
- Effects might be different in other exams
 - If there are many answer options that look plausible at first glance but are wrong, guessing may rather be harmful
- In either case, exams with penalties may “test” different things than knowledge and competence

**Thank you
for your attention!**