Gamification & Influencers in Finance: An Experiment

MH Broihanne - AMF Scientific committee - June, 21st, 2023

Background and literature review

- New financial platforms and apps => 2 main new important devices: **gamification** and **copy trading**
- Common issue for regulators: **excessive risk taking**

- Gamification is described as ***"the integration of video game elements into non-gaming contexts"*** (Deterding *et al.*, 2011).
  - Has the potential to:
    - Democratize investing by broadening access to more individuals (e.g. *Gamestop and Robinhood*, Barber *et al.*, 2022)
    - Divert investors' attention from rational decision-making towards emotional aspects and social responses (Seasholes & Wu, 2007)
    - Accentuate behavioral biases & misinterpret chance (Anagol *et al.*, 2021; Glaze, 2022)
    - …

- This presentation: **laboratory experiment*** that aims to achieve two objectives:
  - to examine the **impact of gamification** on financial decision-making and to identify **who** is more susceptible to be influenced by gamification stimuli
  - to investigate the **individual determinants of copying influencers**

**no specific context, no self-selection of subjects -> minimize endogeneity issues by controlling exogenous stimuli*

Experimental procedures & hypotheses

- 7 treatments:
  - 1 **Baseline** treatment
  - 5 **Gamified** treatments, various gamification stimuli:
    - Hedonic: falling confetti + encouragement messages
    - Achievement badges: (private or social) X (risky asset or safe asset)
  - 1 **Copy influencer** treatment

- Each experimental treatment consists in two parts:
  - 1/ A variation of the **experimental portfolio choice offered by Langer and Weber (2008) and based on the original framework by Gneezy and Potters (1997)**
  - 2/ Questionnaire (socio-demographics, Financial literacy_6 questions, risk aversion, gaming & investment experience, CRT, attitudes towards competition, imitation…)

- Instructions are the same in all treatments, including the baseline one
- -> subjects do not know they could earn achievement badges, see encouragement messages and falling confetti, or copy the influencer
- **Related study:** Chapowski *et al.* (2021)_ online experiment

The Experimental Portfolio Choice

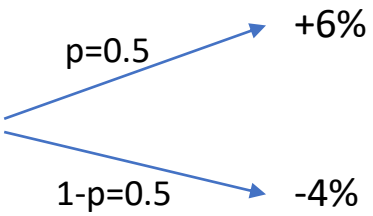
- Adapted from **Langer & Weber (2008)**_inspired by Gneezy & Potters (1997)
  - Initial endowment of €***Y***
  - Subjects select ***α(t)***, the proportion of endowment invested in the **risky asset** in period *t* ($0 \leq \alpha(t) \leq 1$) [the proportion ***1- α(t)*** is kept as a **safe option**].
  - The risky asset yields a return ***r(t)*** in period *t*, the safe asset yields a return of ***0***
  - Multiplicative adaptation of the Gneezy-Potters framework (**compounded returns** over **T** periods), a subject final wealth FW' writes:

$$FW' = Y \prod_{t=1}^{T} \{\alpha(t)[1 + r(t)] + [1 - \alpha(t)]\}$$

Our experimental treatments:

BASELINE

- Initial endowment *Y* = ***€22***
- *T*= **16** decision periods
- Choice of $\alpha(t)$ is made by dragging a slider between 0 and 100.
- Return of the risky asset is shown in the lottery:



$E(r)$=1%

$\sigma(r)$=5%

Zero-skewness distribution -> no specific effect on risk taking is expected over time (Hinck et al., 2022)

Decision screen example (all treatments)

Accumulated wealth over the last rounds

econ play — Bienvenue lees_1 — Se déconnecter

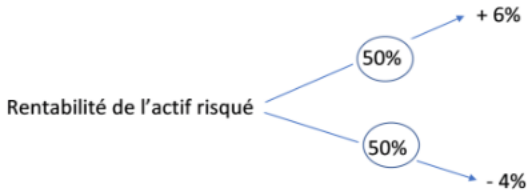
Vous êtes le participant n° 1 — **Période n° : 4 / 16**

Montant de votre dotation initiale pour la période : 23,539 €

Quel pourcentage de votre dotation initiale souhaitez-vous placer dans le compte investissement ?

Gains potentiels suivant la rentabilité du compte investissement

Choice of α
Potential gains are computed accordingly



***Si rentabilité* = +6%** *(50% de chance)*	***Si rentabilité* = -4%** *(50% de chance)*
*Gain potentiel = 24,443 € = 23,539 * 0,64 * 1,06 + 23,539 * 0,36*	*Gain potentiel = 22,936 € = 23,539 * 0,64 * 0,96 + 23,539 * 0,36*

% de votre dotation dans le compte investissement :

64 %

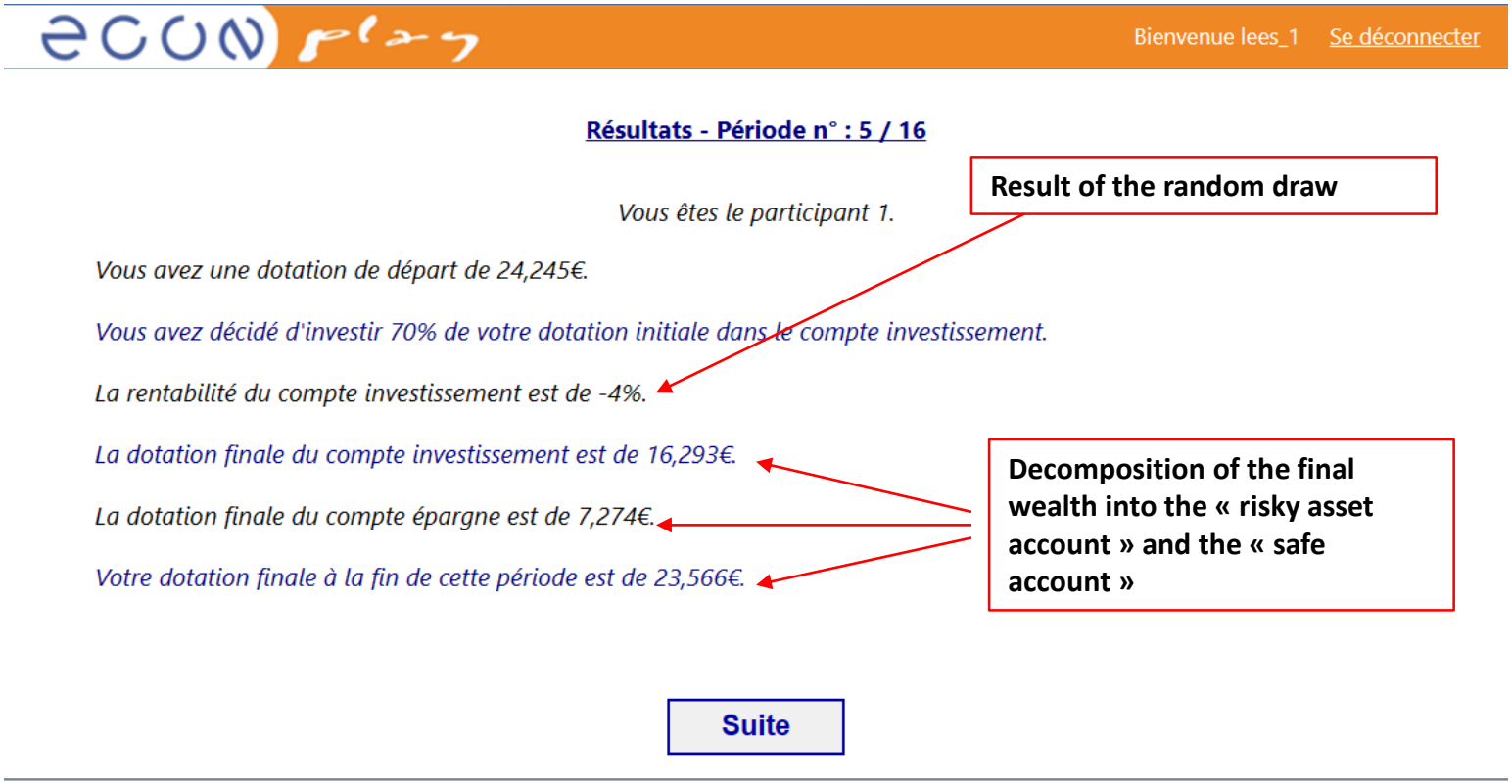
0 10 20 30 40 50 60 70 80 90 100

0 — 100

Veuillez choisir le % de votre dotation que vous souhaitez investir dans le compte invetissement en déplaçant le curseur ci-dessus, le reste sera automatiquement affecté dans le compte épargne.

Valider

End of round example (***BASELINE***)



The **5 Gamified** treatments

*Stimuli are initially introduced starting from the end of period 4 (next, at the end of each block of four rounds, i.e. end of round 8, 12, and 16) -> **comparability on non-gamified periods** + **comparability of subjects' trajectories**.*

- ***PUREGAME**:* hedonic elements (falling confetti during the random drawing, encouragement messages)

PUREGAME end of round example

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- ***PUREGAME**:* hedonic elements (falling confetti during the random drawing, encouragement messages)

- *Gamified with achievement badges:*

2X2 design -> (private or social) X (risky asset or safe asset achievements)

***PRIVBADGE**^{RISK}*, ***PRIVBADGE**^{SAFE}*, ***SOCBADGE**^{RISK}*, and ***SOCBADGE**^{SAFE}*

PRIVBADGE^{RISK} end of round example

econ play — Bienvenue lees_3 — Se déconnecter

Résultats - Période n° : 12 / 16

Vous êtes le participant 1.

Vous avez une dotation de départ de 22,736€.

Vous avez décidé d'investir 70% de votre dotation initiale dans le compte investissement.

La rentabilité du compte investissement est de 6%.

La dotation finale du compte investissement est de 16,87€.

La dotation finale du compte épargne est de 6,821€.

Votre dotation finale à la fin de cette période est de 23,691€.

Trophées de l'investisseur déjà obtenus : 

Félicitations! Suite à vos choix d'investissement sur les 4 dernières périodes vous avez obtenu le trophée d'or de l'investisseur.

Suite

Reminder of badges obtained over previous rounds

Achievement badge obtained for the current round (on the RISKY asset)

SOCBADGE^{SAFE} end of round example

econ play Bienvenue lees_6 Se déconnecter

Résultats - Période n° : 12 / 16

Vous êtes le participant 1.

Vous avez une dotation de départ de 27,101€.

Vous avez décidé d'investir 30% de votre dotation initiale dans le compte investissement.

La rentabilité du compte investissement est de -4%.

La dotation finale du compte investissement est de 7,805€.

La dotation finale du compte épargne est de 18,971€.

Votre dotation finale à la fin de cette période est de 26,776€.

Trophée de l'épargnant déjà obtenu :

Reminder of badges obtained <u>by the subject</u> over previous rounds

Félicitations! Suite à vos choix d'épargne sur les 4 dernières périodes vous avez obtenu le trophée d'or de l'épargnant.

Achievement badge obtained <u>by the subject</u> for the current round (on the SAFE asset)

Le nombre total de trophées de l'épargnant distribués à l'issue des choix de tous les participants sur les 4 dernières périodes est de :

0 trophée(s) de bronze de l'épargnant.

1 trophée(s) d'argent de l'épargnant.

10 trophée(s) d'or de l'épargnant.

Distribution of badges among all the subjects for the current round (on the SAFE asset)

Suite

The **5 Gamified** treatments

*Stimuli are initially introduced starting from the end of period 4 (next, at the end of each block of four rounds, i.e. end of round 8, 12, and 16) -> **comparability on non-gamified periods** + **comparability of subjects' trajectories**.*

- ***PUREGAME**:* hedonic elements (falling confetti during the random drawing, encouragement messages)

- *Gamified with achievement badges:*

2X2 design -> (private or social) X (risky asset or safe asset achievements)

***PRIVBADGE**^{RISK}*, ***PRIVBADGE**^{SAFE}*, ***SOCBADGE**^{RISK}*, and ***SOCBADGE**^{SAFE}*

- *Related literature*:
- **Influence of attention on investors' behaviors** (Barber and Odean, 2008; Sicherman *et al.*, 2016; Gargano and Rossi, 2018; Barber *et al.*, 2022) -> **excessive risk-taking behaviors** (Arnold *et al.*, 2022; Kalda *et al.*, 2021)
- **Nudging effects** (Thaler & Sunstein, 2009)
- **Social comparisons, competition and peer effects** (Dijk *et al.*, 2014; Kirchler *et al.*, 2018, 2020; Sutter, 2009; Bougheas *et al.*, 2013)

- Remarks:
  - Badges yield no pecuniary advantage and are thus "symbolic" rewards -> NUDGING
  - Badges are awarded based on pre-programmed threshold values for getting bronze, silver, gold, and platinum

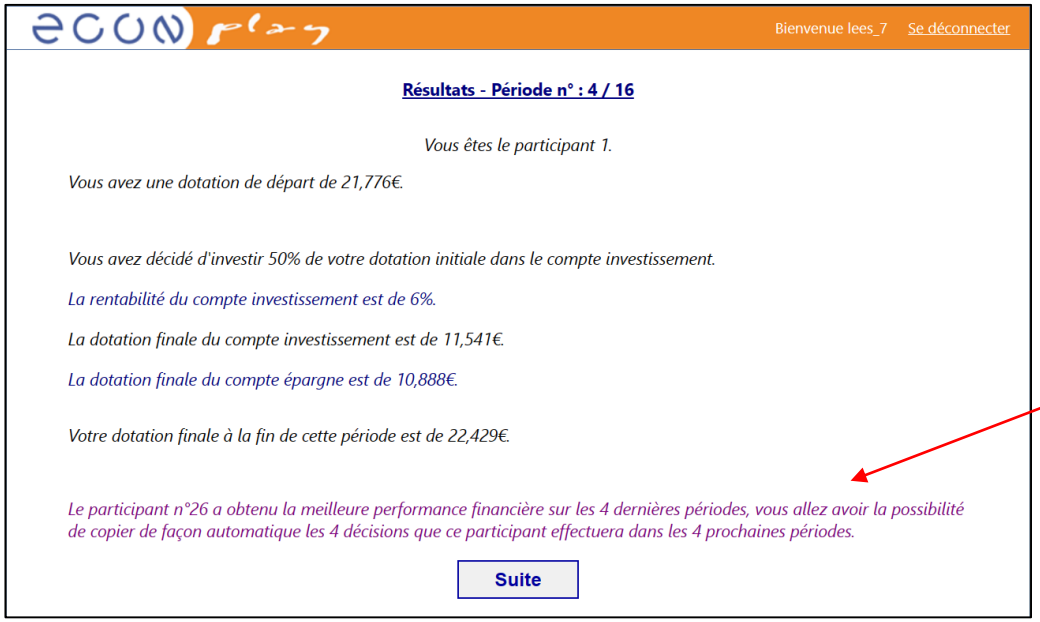
The **Copy influencer** treatment

*Stimuli are initially introduced starting from the end of period 4 (next, at the end of each block of four rounds, i.e. end of round 8, 12, and 16) -> **comparability on non-gamified periods** + **comparability of subjects' trajectories**.*

- ***COPYINFL:*** subjects receive information on the identity of the participant who has accumulated the highest performance (i.e., the **influencer**) over the last 4 previous decisions.
- They have the possibility to copy this participant's strategy automatically during the next 4 periods or to continue to make their decision alone.

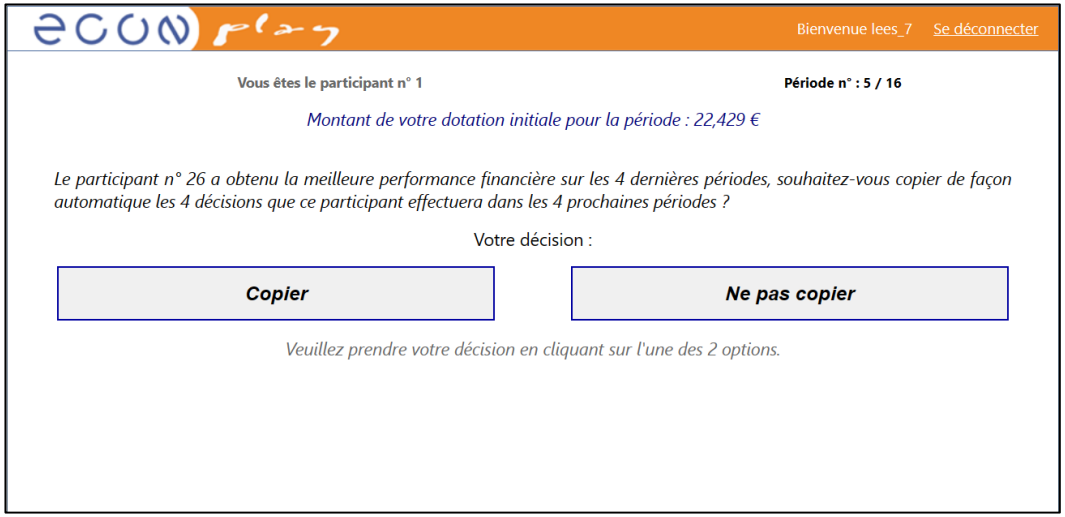
    - *Related literature*: copy trading (Apesteguia *et al.*, 2020), behavior of leaders (Pelster and Hofmann, 2018)

COPYINFL end of round example



SCREEN 1: Information on the identity of the influencer

SCREEN 2: Decision to copy (or not) the influencer choices over the next 4 rounds



Hypotheses

- $\alpha(t)$ = % of endowment invested in the risky asset in period t
- Let's denote: α' the average percentage invested over the **4 first rounds,** α'' the average percentage invested over the **remaining 12 rounds**
- Subscripts **B**, **PG**, **PBR**, **PBS**, **SBR**, **SBS** and **C** denote the average percentage invested in each treatment.

- *H0 (Comparabiliy in non-gamified periods):* $\alpha'_B = \alpha'_{PG} = \alpha'_{PBR} = \alpha'_{PBS} = \alpha'_{SBR} = \alpha'_{SBS}$
- *H1 (Gamification impact between treatments):*

$\alpha''_{PG} > \alpha''_B$; $\alpha''_{PBR} > \alpha''_B$; $\alpha''_{SBR} > \alpha''_B$

$\alpha''_{PBS} < \alpha''_B$; $\alpha''_{SBS} < \alpha''_B$

- *H2 & H3 (Social badges effect is higher than private badges effect):*

H2: $\alpha''_{PBR} < \alpha''_{SBR}$ *H3:* $\alpha''_{SBS} < \alpha''_{PBS}$

- *H4 (Gamification impact within treatments):*

$\alpha''_{PG} - \alpha'_{PG} > 0$; $\alpha''_{PBR} - \alpha'_{PBR} > 0$; $\alpha''_{SBR} - \alpha'_{SBR} > 0$

$\alpha''_{PBS} - \alpha'_{PBS} < 0$; $\alpha''_{SBS} - \alpha'_{SBS} < 0$

- *(Copy influencer) H5:* $\alpha'_B = \alpha'_C$ *and, H6:* $\alpha''_C > \alpha''_B$

Results

The experiment was carried out face-to-face at the **Strasbourg Experimental Economics Laboratory (LEES)** on **May 25-26th** and **June 7-8th 2023**.
Subjects are seated in front of a computer in individual cubicles

2 sessions per treatment

366 participants = students from various disciplines at the University of Strasbourg.

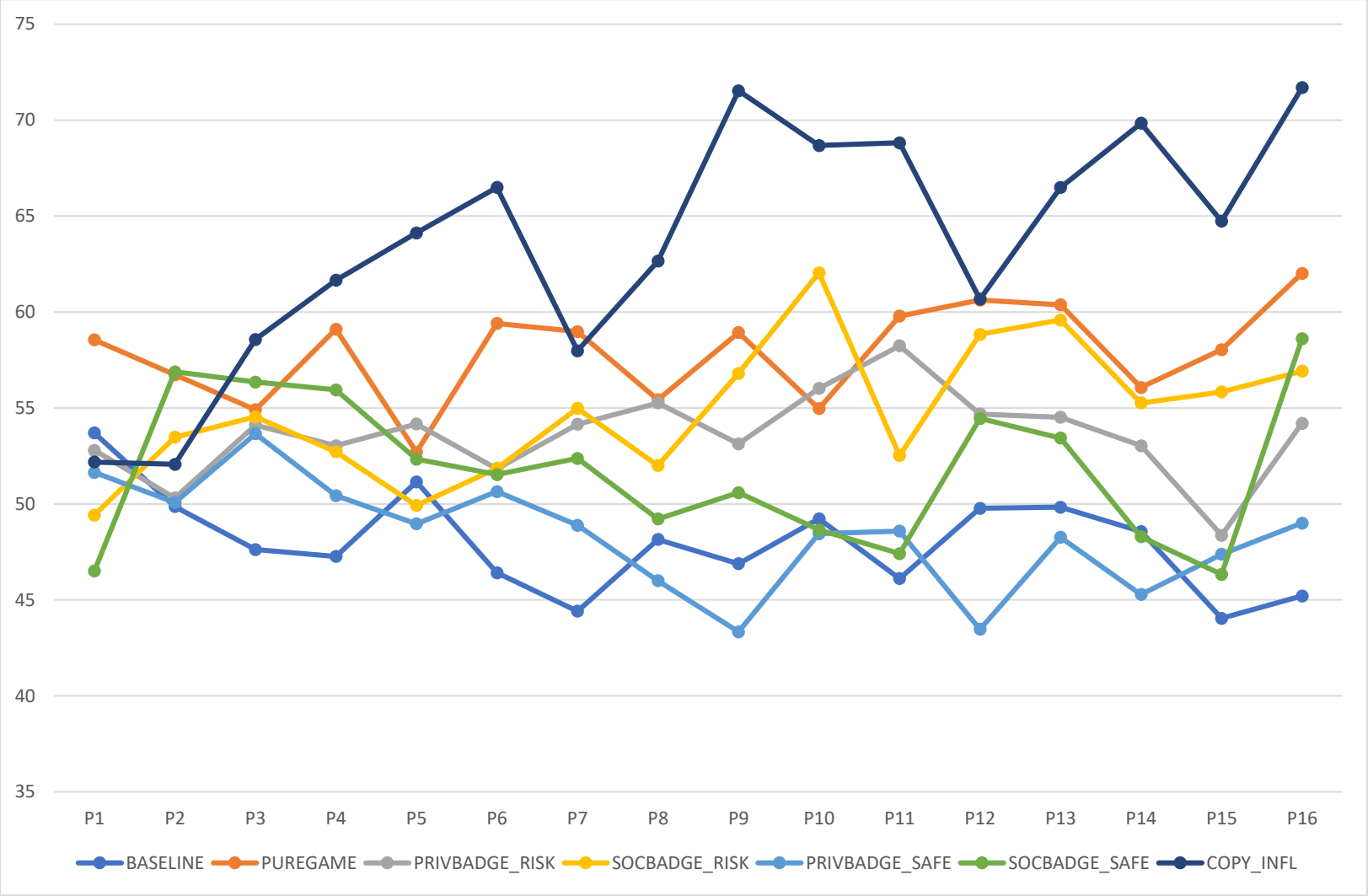
Remuneration (end of the experiment) = final wealth + 0,10€ per correct answer to some questions (financial literacy and CRT) of the second part.

Average final wealth was €23.90

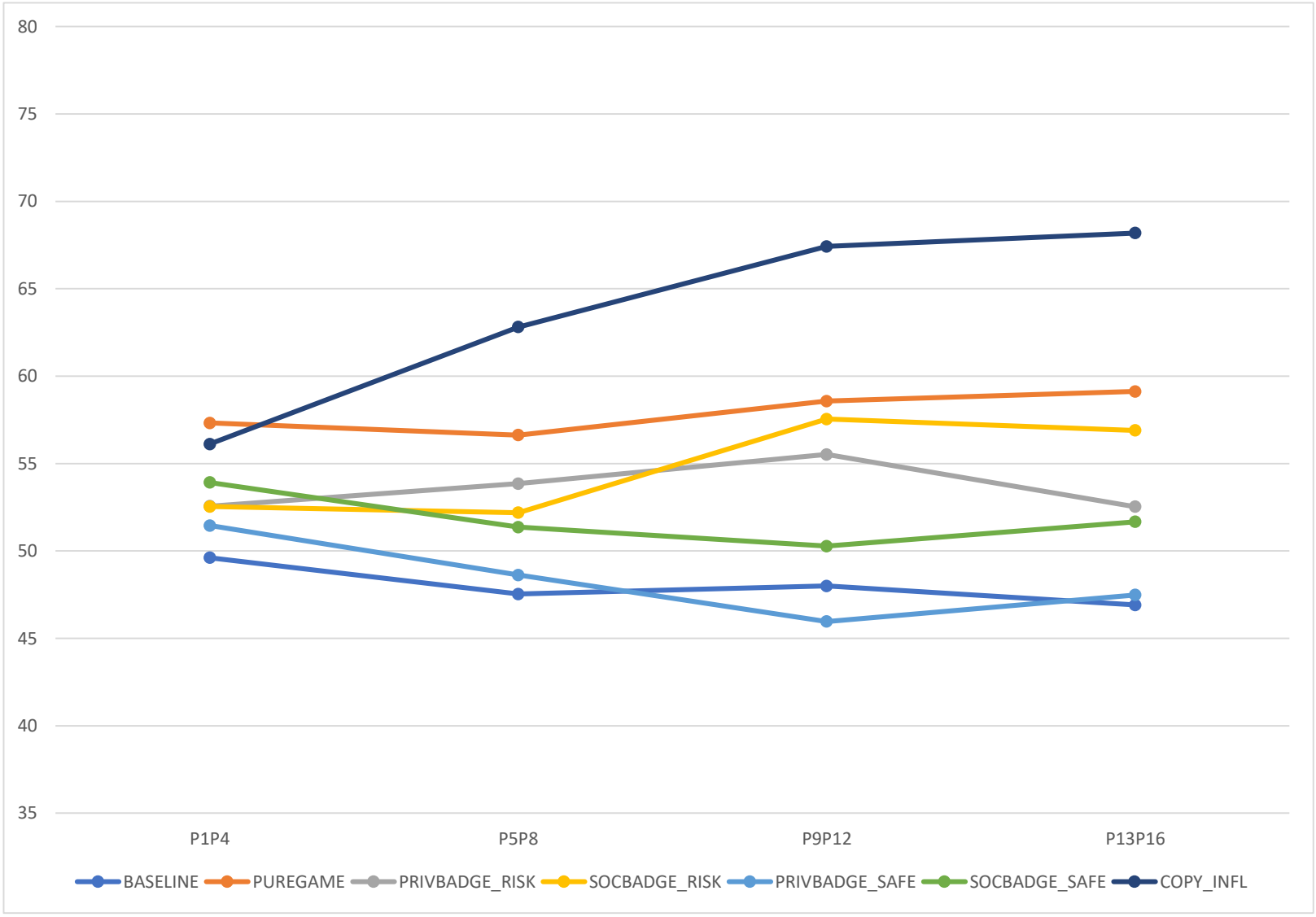
Descriptive stats on subjects (N=366)

Variables	Mean	Std. Dev.	Min	Max
% invested in risky asset	52.221	35.038	0	100
Age	22.404	4.199	17	55
Gender	1.557	.497	1	2
- Male (0)	44.66%			
- Female (1)	55.74%			
Degree Level	2.953	1.416	1	6
Financial Literacy (Obj.)	5.139	1.001	1	6
Financial Literacy (Dnk)	.243	.552	0	3
Financial Literacy (Sbj.)	1.923	.619	1	3
Risk aversion (Bianchi, 2018)	3.123	1.132	1	4
Self-ass. risk tolerance (Dohmen et al., 2011)	4.773	2.006	0	10
Follow influencer/invt	1.932	.253	1	2
- Yes (1)	6.83%			
- No (0)	93.17%			
Imitindex (Apesteguia et al., 2020)	2.5464	0.853	1	5
CRT (Frederick, 2005)	1.254	.912	0	3
Math (Falk et al., 2018)	5.721	2.469	0	10
Competition (Fallucchi et al., 2020)	4.525	1.573	1	7

Average risky allocations over 16 periods



Average risky allocations over 4-periods blocks



Test of H0 (Comparability in non-gamified periods)

Average allocations over the initial four periods

$\alpha'(t)$							
	BASELINE	*PUREGAME*	*PRIVBADGE^{RISK}*	*PRIVBADGE^{SAFE}*	*SOCBADGE^{RISK}*	*SOCBADGE^{SAFE}*	*COPYINFL*
	n=53	n=56	n=54	n=53	n=50	n=51	n=49
Mean	49.61	57.33	52.56	51.45	52.54	53.92	56.12
Median	50	59.5	50	50	50	50	51.5

Mann-Whitney one-tailed: no signif. difference with *BASELINE* **except in *PUREGAME***

Test of H1 (Gamification effect "between")

Average allocations over periods 5 to 16

$\alpha''(t)$							
	BASELINE	*PUREGAME*	*PRIVBADGE^{RISK}*	*PRIVBADGE^{SAFE}*	*SOCBADGE^{RISK}*	*SOCBADGE^{SAFE}*	*COPYINFL*
	n=53	n=56	n=54	n=53	n=50	n=51	n=49
Mean	47.48	58.11	53.97	47.36	55.55	51.10	66.14
Median	42	60	50	45	55.50	50	70

Mann-Whitney one-tailed: signif. differences with *BASELINE* **except in *PRIVBADGE^{SAFE}***

In *COPYINFL*, differences are also significant **for the non-copying subjects**

-> The influencer treatment creates an environment leading to more risk-taking behavior

Test of H2 and H3 (Social vs. Private badges)

Mann-Whitney one-tailed: **no signif. difference** between social and private badges

Test of H4 (Gamification effect "within")

Change in average allocation between first 4 non-gamified rounds to average in remaining 12 gamified rounds

$\alpha''(t) - \alpha'(t)$						
	BASELINE	*PUREGAME*	*PRIVBADGE^{RISK}*	*PRIVBADGE^{SAFE}*	*SOCBADGE^{RISK}*	*SOCBADGE^{SAFE}*
	n=53	n=56	n=54	n=53	n=50	n=51
Mean	-2.132	0.784	1.403	-4.097	3.007	-2.82
Median	0	0	3.917	-1.917	1.125	-4.667
# of subjects with pos. /neg/null trend	25 / 21 / 7	18 / 24 / 14	34 / 16 / 4	20 / 28 / 5	25 / 20 / 5	16 / 30 / 5
Signed rank test (Wilcoxon)	n.s.	p<2%	p<1%	p<1%	p<5%	p<1%

Significant increases in gamified treatments with badges that relate to **risky** asset achievements

Significant decreases in gamified treatments with badges that relate to **safe** asset achievements

-> Achievement badges seem to act as NUDGES

Multivariate analyses

Table R1: Individual determinants of change in risky allocations between P1P4 and P5P16

	1	2	3	4	5
% of lottery successes P1P4	0,140 ***	0,144 ***	0,141 ***	0,141 ***	0,140 ***
	(0.047)	(0.047)	(0.047)	(0.047)	(0.047)
Average risky allocations P1P4	-0,284 ***	-0,283 ***	-0,283 ***	-0,283 ***	-0,284 ***
	(0.033)	(0.033)	(0.033)	(0.033)	(0.033)
Age	-0,012	-0,014	-0,018	-0,007	-0,011
	(0.238)	(0.238)	(0.239)	(0.243)	(0.244)
Female	-5,459 **	-5,434 **	-5,261 *	-5,662 **	-5,496 **
	(2.663)	(2.702)	(2.717)	(2.754)	(2.750)
Financial literacy (Obj.)		1,166	1,022		
		(1.148)	(1.131)		
Financial literacy (Sbj.)				0,203	0,239
				(1.985)	(2.027)
CRT		-0,833		-0,557	
		(1.328)		(1.285)	
Math			-0,008		0,060
			(0.455)		(0.462)
Competition	0,335	0,405	0,392	0,349	0,326
	(0.812)	(0.809)	(0.847)	(0.816)	(0.850)
Follows influencers	-7,546 *	-7,799 *	-7,392 *	-7,826 *	-7,496 *
	(4.266)	(4.285)	(4.215)	(4.315)	(4.228)
Imitindex	0,617	0,687	0,656	0,629	0,603
	(1.273)	(1.273)	(1.281)	(1.273)	(1.281)
Individual controls	X	X	X	X	X
Intercept	5,289	-0,605	-0,408	5,242	4,680
	(11.964)	(13.081)	(13.096)	(13.537)	(13.527)
Adjusted R-squared	0,197	0,196	0,194	0,193	0,192
Observations	366	366	366	366	366

Table R2: Individual determinants of change in risky allocations between P1P4 and P5P16, controlling for Nudges

	1	2	3	4	5	6	7	8	9	10
% of lottery succ. P1P4	0,139 ***	0,142 ***	0,140 ***	0,140 ***	0,138 ***	0,141 ***	0,145 ***	0,142 ***	0,143 ***	0,141 ***
	(0.047)	(0.047)	(0.046)	(0.047)	(0.047)	(0.046)	(0.047)	(0.046)	(0.047)	(0.046)
Average risky allocs P1P4	-0,285 ***	-0,285 ***	-0,285 ***	-0,285 ***	-0,286 ***	-0,283 ***	-0,282 ***	-0,282 ***	-0,282 ***	-0,283 ***
	(0.033)	(0.033)	(0.033)	(0.033)	(0.033)	(0.033)	(0.033)	(0.033)	(0.033)	(0.033)
T_Nudge_Risk						2,000	1,991	1,983	2,002	1,991
						(2.363)	(2.355)	(2.357)	(2.376)	(2.377)
T_Nudge_Safe	-5,174 **	-5,083 **	-5,069 **	-5,195 **	-5,175 **					
	(2.119)	(2.103)	(2.107)	(2.124)	(2.128)					
Age	-0,013	-0,014	-0,019	-0,008	-0,013	-0,025	-0,026	-0,030	-0,020	-0,024
	(0.237)	(0.237)	(0.238)	(0.241)	(0.242)	(0.239)	(0.239)	(0.240)	(0.245)	(0.245)
Female	-5,291 **	-5,301 **	-5,110 *	-5,496 **	-5,312 *	-5,523 **	-5,501 **	-5,327 *	-5,709 **	-5,543 **
	(2.656)	(2.688)	(2.710)	(2.749)	(2.751)	(2.658)	(2.698)	(2.716)	(2.754)	(2.752)
Financial literacy (Obj.)		1,042	0,889				1,160	1,015		
		(1.139)	(1.118)				(1.149)	(1.131)		
Financial literacy (Sbj.)				0,167	0,211				0,142	0,175
				(1.950)	(1.985)				(2.002)	(2.044)
CRT		-0,859		-0,613			-0,839		-0,564	
		(1.324)		(1.279)			(1.327)		(1.285)	
Math			0,011		0,071			-0,010		0,055
			(0.450)		(0.456)			(0.456)		(0.463)
Competition	0,399	0,462	0,442	0,413	0,385	0,352	0,421	0,409	0,363	0,341
	(0.812)	(0.809)	(0.843)	(0.816)	(0.848)	(0.813)	(0.810)	(0.846)	(0.816)	(0.850)
Follows influencers	-7,262 *	-7,552 *	-7,122 *	-7,572 *	-7,205 *	-7,707 *	-7,963 *	-7,554 *	-7,994 *	-7,662 *
	(4.249)	(4.279)	(4.200)	(4.305)	(4.210)	(4.210)	(4.229)	(4.161)	(4.256)	(4.171)
Imitindex	0,490	0,558	0,525	0,505	0,476	0,653	0,723	0,692	0,667	0,642
	(1.263)	(1.261)	(1.272)	(1.261)	(1.272)	(1.277)	(1.276)	(1.285)	(1.276)	(1.286)
Competition	0,399	0,462	0,442	0,413	0,385	0,352	0,421	0,409	0,363	0,341
	(0.812)	(0.809)	(0.843)	(0.816)	(0.848)	(0.813)	(0.810)	(0.846)	(0.816)	(0.850)
Individual controls	X	X	X	X	X	X	X	X	X	X
Intercept	7,063	1,849	2,053	7,146	6,506	3,765	-2,083	-1,879	3,861	3,315
	(12.08)	(13.08)	(13.09)	(13.57)	(13.56)	(11.99)	(12.98)	(13.01)	(13.54)	(13.52)
Adjusted R-squared	0,208	0,206	0,205	0,203	0,203	0,196	0,195	0,194	0,192	0,191

Table R4: Individual determinants of the intensity to copy the influencer

	1	2	3	4	5	6	7	8	9	10
% of lottery succ. P1P4	0,001	0,001	0,001	0,001	0,002	0,002	0,002	0,001	0,001	0,002
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Average risky allocs P1P4	-0,006	-0,005	-0,005	-0,006	-0,005	-0,005	-0,006	-0,005	-0,005	-0,005
	(0.004)	(0.004)	(0.005)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Age		0,038	0,034	0,042	0,040	0,041	0,025	0,038	0,037	0,042
		(0.028)	(0.030)	(0.029)	(0.029)	(0.027)	(0.025)	(0.028)	(0.028)	(0.028)
Female		0,442 **	0,421 **	0,491 **	0,432 **	0,357 *	0,298	0,442 **	0,436 **	0,473 **
		(0.191)	(0.186)	(0.214)	(0.190)	(0.187)	(0.192)	(0.206)	(0.191)	(0.195)
Field of study: Eco/Mgt		-0,153	-0,153	-0,171	-0,137	-0,177	-0,018	-0,153	-0,164	-0,200
		(0.215)	(0.216)	(0.222)	(0.221)	(0.218)	(0.224)	(0.238)	(0.222)	(0.218)
Imitindex			0,070							
			(0.149)							
Competition				0,037						
				(0.076)						
Financial literacy (Obj.)					-0,077					
					(0.135)					
CRT						-0,136				
						(0.108)				
Math							-0,107			
							(0.063)			
Financial literacy (Sbj.)								0,000		
								(0.219)		
FL_dnk									-0,050	
									(0.085)	
Follows influencers										-1,050 ***
										(0.227)
Intercept	0,857 **	-0,208	-0,295	-0,429	0,125	-0,131	0,709	-0,209	-0,153	-0,355
	(0.366)	(0.748)	(0.814)	(0.872)	(0.933)	(0.731)	(0.862)	(0.887)	(0.775)	(0.757)
Adjusted R-squared	0,004	0,076	0,058	0,058	0,061	0,084	0,121	0,053	0,055	0,098
Observations	48	48	48	48	48	48	48	48	48	48

OLS regressions with robust SE, top row=coeff & bottom row=SE; ***/**/*=1/5/10%

Conclusion & Regulatory answers

- Risk-taking increases with:
  - gamification stimuli in the form of achievement badges on risk-taking
  - information on the success of others with the possibility to copy their decisions
- Risk-taking decreases with
  - achievement badges on the safe asset allocations
- Effects are not similar across individuals (gendered effects for achievement badges, other characteristics in the influencer treatment) but much more work has to be done…
- Enhanced due diligence and suitability requirements for gamified platforms
- Nature of nudges:
  - Marketing from platforms (achievement badges on risk-taking)
  - Public policy (achievement badges on safe asset allocations)
- Investment recommendations and disclosures specific to gamification platforms and licensing requirements for social influencers