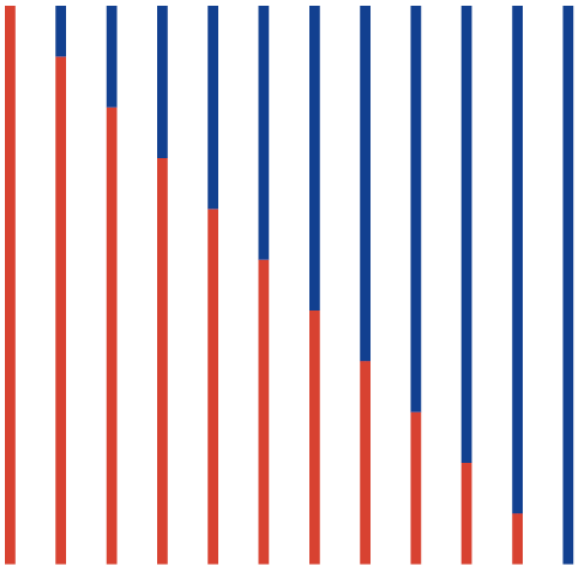

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GAMIFICATION AND COPY TRADING IN FINANCE: AN EXPERIMENT[1]

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Abstract

In recent years, gamification techniques have increasingly been adopted by online trading platforms to engage and motivate individual investors and attract new customers. While gamification can be an effective educational tool for inexperienced and financially underinformed investors, it has the potential to shift their focus away from rational financial decision-making towards emotional and social factors. This paper presents a laboratory experiment that aims to achieve two objectives: first, to examine the impact of gamification on financial decision-making, and second, to investigate the individual determinants of copy trading. The experimental task involves a standard portfolio allocation task, which is adapted from the multiplicative investment game proposed by Langer and Weber (2008) and based on the original framework by Gneezy and Potters (1997). We find that gamification stimuli increase the risk taking by subjects only when these stimuli are achievement badges on risk taking, no effect being observed for hedonic stimuli such as confetti. On the contrary, risk-taking decreases when gamification is achieved through achievement badges on the safe asset allocations. These findings highlight the nudging power of achievement badges. We also find that the copy trading setting creates an environment leading to more risk-taking behavior. Besides, being a female has a strong and positive effect on the intensity to copy.

1. INTRODUCTION

In the past few years, there has been an increasing trend within the financial industry to incorporate gamification techniques into trading platforms and investment applications. Gamification is described as "the integration of video game elements into non-gaming contexts" (Deterding *et al.*, 2011). Gamification is one of the consequences stemming from the rise of a digital landscape populated by easily accessible applications with visually appealing (hedonic) designs. Within the realm of trading, gamification techniques are employed to enhance the accessibility, engagement, and user-friendliness of investment processes for individual investors.

The gamification of trading activities presents both benefits and drawbacks. On the one hand, it has the potential to democratize investing by broadening access to more individuals, particularly young investors, who may feel more at ease with digital platforms and mobile applications. Additionally, gamification may serve as an effective educational tool for investors, helping them gain a better understanding of financial concepts and cultivate sound investing habits.

On the other hand, the adoption of gamification techniques also raises concerns regarding the potential for encouraging excessive risk-taking behaviors. The inclusion of game-like features may inadvertently shift investors' focus towards short-term gains while neglecting crucial aspects such as long-term investment strategies and diversification. Furthermore, gamification can attract a new wave of inexperienced and financially underinformed investors, particularly young individuals, to digital trading platforms. These vulnerable individuals may lack the necessary knowledge and experience, making them more susceptible to potential risks.

The development of such activities has attracted the attention of regulators and academics in various financial markets, particularly in light of the GameStop and Robinhood scandals (Barber *et al.*, 2022). Gamification techniques have been shown to serve as a powerful tool for enhancing participant engagement, improving financial literacy, and guiding individuals towards positive financial decisions, such as saving and retirement preparation. For example, Baptista and Oliveira (2017) showed that the hedonic aspects of certain bank account management applications and digital games significantly contribute to improving financial literacy or increasing savings, as seen

in initiatives like SavingsQuest by the U.S. Federal Reserve Bank of Boston. Similarly, Kwon *et al.* (2015) highlight increased user engagement among platform participants who earn achievement badges.

While some positive effects of gamification for investors can be associated with nudges (Thaler and Sunstein, 2009), it is important to note that the utilization of game-like techniques, such as leaderboards, badges, milestones, and rewards, may have adverse effects. These gamification stimuli can divert investors' attention from rational financial decision-making towards emotional aspects and social responses (Seasholes and Wu, 2007). Consequently, they are likely to accentuate behavioral biases frequently observed among individual investors, including overconfidence and suboptimal diversification. In particular, similar to games of chance, individuals may misinterpret luck as skill when experiencing wins and become overconfident (Gao *et al.*, 2021). These techniques also carry the risk of promoting harmful behaviors, including excessive trading and investment in complex and high-risk products on trading platforms. Glaze (2022) confirms that Robinhood users tend to heavily sell securities that experienced price increases of 5% or more during a day. Since this effect is not observed in the event of a drop of more than 5% during the day, this observation suggests an accentuation of the disposition bias due to the push notifications triggered from the platform for price increases. Moreover, Arnold *et al.* (2022) showed that risk-taking behavior increases when traders receive push notifications from brokers to signal strong price movements. In the same vein, risk taking is significantly amplified when trading orders are executed via smartphones (Kalda *et al.*, 2021).

Additionally, certain online investment platforms have been reported to employ manipulative techniques. For instance, research by ESMA (2022) revealed that these platforms use vibrant colors to highlight buy or sell buttons, while simultaneously downplaying the visibility of the cancel order button. Another example is provided by Werbach and Hunter (2020), who found that Robinhood displays the price of bitcoin in pink. In the same vein, some platforms collaborate with influencers to promote specific products, raising concerns regarding potential conflicts of interest.

Furthermore, an increasing number of Internet platforms (e.g., *eToro*, *ZuluTrade*, or *Tradeo*) offer copy trading options, allowing users to automatically replicate the investment decisions of other users. This practice of copy trading can have significant behavioral implications, particularly regarding investors' willingness to adopt risky choices. Despite the limited research in this area, it is worth noting the work of Apesteguia *et al.* (2020), who conducted an experimental study on financial asset markets and found that copy trading leads to excessive risk-taking behavior. Interestingly, their research also revealed excessive risk-taking in a treatment where participants received information solely about the success of others, without any copy trading option. This finding suggests that the driving force behind the heightened risk-taking is the social pressure generated by sharing information on others' investment decisions, rather than the mere technical ability to replicate trades. This last result seems to confirm the impact of social competition and rankings on risk taking in portfolio choices (Dijk *et al.*, 2014; Kirchler *et al.*, 2018, 2020[1]). Additionally, some papers studying the impact of groups and peer effects on economic decision-making conclude that peer pressures may stimulate risk taking (e.g., Sutter, 2009; Bougheas *et al.*, 2013).[2] In the same vein, Pelster and Hofmann (2018) used data from *eToro* to demonstrate that leader-traders, who are being followed by other investors, exhibit a higher susceptibility to the disposition bias compared to traders who are not being followed. This finding suggests that leader-traders may experience a fear of losing followers when admitting a poor decision or attempting to manage their social image.

Researchers have employed laboratory experiments to conduct a more precise evaluation of the benefits and drawbacks of gamification techniques. Unlike field data analysis methods, this approach enables the investigation of the impact of gamification stimuli without a specific context, as compared to a study carried out on a trading platform using gaming elements, for example. The participants are selected based on specific criteria, such as age, while eliminating self-selection, for example the greater participation of certain individuals than others in gamified

[1] Note that some of the experiments by Kirchler *et al.* (2018, 2020) are run with financial professionals.
[2] More generally, there is strong evidence that peers influence risk attitudes (e.g., Ahern *et al.*, 2014). Such peer effect, that rests on a desire of conformity, is particularly significant in the domain of risky health choices in children and adolescents (e.g., Gardner and Steinberg, 2005).

trading apps. More generally, experiments in economics are commonly used to minimize endogeneity issues, since the experimenter has control over exogenous stimuli that affect the participants.

One of the most prominent experiments in the field of gamification is the study conducted by Chapkovski *et al.* (2021) to assess the impact of gamification on financial risk-taking. The experiment involved an online trading platform designed as an experimental market. The trading platform was presented to participants in both a non-gamified treatment and a gamified treatment. The gamified version included visual elements such as falling confetti on the screen when the price of the risky asset crossed specific thresholds, success badges based on the duration of their presence on the platform and encouraging messages using vocabulary inspired by the Reddit forum. A total of 605 participants, many of whom had experience in proprietary trading, were recruited for the study, which consisted of 8 rounds. The experimental setting consisted in a variation of BRET (Bomb Risk Elicitation Task) from Crosetto and Filippin (2013). In each round, participants were given a risky asset that they could sell at any time. The price of the asset was updated every two seconds, either increasing or crashing to zero value based on a known probability distribution. Each round lasted a maximum of 60 seconds and would end immediately in the event of a crash. If no crash occurred, participants received a monetary reward equivalent to the value of the risky asset at the end of the round. Selling the risky asset resulted in participants receiving the monetary equivalent of the selling price of the risky asset. The parameters of the probability distribution for the price of the risky asset (or the occurrence of a crash) changed in each round, allowing the researchers to test the influence of market volatility levels on participants' risk-taking behavior. Chapkovski *et al.* (2021) found that gamification stimuli increased participants' risk-taking behavior, particularly in markets characterized by high volatility and among individuals with limited financial literacy and experience. For example, they found that an increase by one standard deviation in the financial literacy score of participants resulted in a decrease of 56% in the impact of the gamification stimuli. Besides, participants who were first exposed to the gamified treatment and second to the non-gamified one exhibit a 3.5 times higher reaction in comparison with the reverse ordering.

Senol and Onay (2023) conducted a study comparing the trading behavior of customers of a Turkish bank when they conducted transactions on their securities account versus participating in a simulated financial market game provided by the bank. The study focused on 693 investors who willingly participated in the experimental trading game. The authors found that for these individuals, certain behavioral biases, such as overconfidence and the disposition bias, were reduced after their participation in the experimental market. However, other biases, such as the familiarity bias (measured by security buybacks) and the status quo bias (reflected in the absence of transactions), increased because of their participation in the game.

In this paper, we offer a laboratory experiment that aims to achieve two objectives: first, to examine the impact of gamification on financial decision-making, and second, to investigate the impact of copy trading on such decisions. Unlike the study by Chapkovski *et al.* (2021), our experimental task consists in a standard portfolio allocation task adapted from Langer and Weber (2008) who introduced a multiplicative version of the well-known investment game originally proposed by Gneezy and Potters (1997). This portfolio allocation task has the advantage to closely resemble a real-world financial market, since returns are compounded over successive periods. However, unlike the study of Senol and Onay (2023), it is conducted under laboratory conditions which enables the investigation of the impact of gamification stimuli without any specific context. Besides, the experiment takes place at the laboratory so that participants well-understand that they are all engaged in performing the same task.

In our between-subjects setting, we have developed experimental treatments that encompass two distinct categories of gamification stimuli. These include hedonic gamification stimuli, as well as private and social gamification stimuli in the form of achievement badges. Moreover, our study also incorporates a copy trading setting. In each of our treatments, we closely analyze the impact of gamification stimuli on participants' propensity to take risks. Additionally, we also investigate which individual profiles exhibit a heightened susceptibility to increased risk-taking behavior in response to gamification stimuli.

We find that the use of achievement badges has a high nudging power, since they drive the direction of changes in risk taking in our treatments. Hedonic gamification stimuli do not, however, have any significant effect on risk

taking. We also find that the copy trading setting creates an environment leading to more risk-taking behavior and that being a female has a strong and positive effect on the intensity to copy.

The remainder of the paper is organized as follows. Section 2 presents the experimental portfolio choice, the experimental design, and our main hypotheses. Section 3 presents the results. Section 4 summarizes our findings.

2. EXPERIMENTAL PROCEDURES AND HYPOTHESES

The experiment includes 7 treatments, that is one baseline treatment, 5 gamified treatments and one copy trading treatment. Each experimental treatment consists in two parts. In the first part, participants play 16 successive decision periods of a variation of the experimental portfolio choice offered by Langer and Weber (2008), which is detailed in 2.1. The instructions are the same in all treatments, including the baseline one (see Appendix A). In the second part of the experiment, participants answer a questionnaire (section 2.5. and Appendix B). Participants are paid at the end of the experiment up to their final wealth at the end of the 16 decision periods of the first part and the remuneration of correct answers to some questions of the second part. Table 1 summarizes the main characteristics of the 7 experimental treatments.

2.1 THE EXPERIMENTAL PORTFOLIO CHOICE (NE)

We use the portfolio allocation task proposed by Langer and Weber (2008). This task is inspired by the widely used Gneezy and Potters (1997)'s investment game.[3] Gneezy and Potters rely on an additive approach, with subjects facing each period the same investment opportunities and their final payoff being the sum of all single decision outcomes. More precisely, subjects receive an initial endowment of X and choose the amount x they want to bet in a risky lottery and the amount $(X - x)$ they keep as a safe option. The amount invested in the lottery yields a return of kx ($k > 1$) with probability p but is lost with probability $1 - p$. Hence, the payoffs are $(X - x + kx)$ with probability p, and $(X - x)$ with $1 - p$. In order to make the expected value of investing higher than the expected value of not investing, the values of p and k are chosen so that $p \times k > 1$.[4] This task allows eliciting risk preferences: the more risk averse, the less the subject is attracted by the lottery, and, thus, the lower the amount x invested in the risky asset.[5] Hence, this amount invested in the risky asset is a measure of the individual's attitude toward risk. In this framework, subjects start each period with the same endowment X and the final wealth over T periods is the sum of the payoffs from each period, i.e., $FW = \sum_{t=1}^{T} X\{\alpha(t)[1 + r(t)] + [1 - \alpha(t)]\}$, where $\alpha(t)$ is the proportion of endowment invested in the risky asset in period t ($0 \leq \alpha(t) \leq 1$), and $r(t)$ the return on the risky asset in period t.

Langer and Weber (2008) proposed a multiplicative adaptation of the Gneezy-Potters framework. In their approach, the returns from the periods are compounded, so that subjects' initial endowment are transferred from period to period according to the outcomes of the investment choices. Following Langer and Weber, let us note Y the initial endowment, $\alpha(t)$ the proportion of current wealth invested in the risky asset in period t, $r(t)$ the return on the risky asset in period t, and T the planning horizon. In the multiplicative approach, a subject's final wealth FW' writes: $FW' = Y \prod_{t=1}^{T}\{\alpha(t)[1 + r(t)] + [1 - \alpha(t)]\}$.

[3] The Gneezy-Potters task is one of the most widely used designs to elicit risk preferences (Charness *et al.*, 2013). It has been used to study, e.g., myopic loss aversion in the financial decisions of students (Gneezy and Potters, 1997; Charness and Gneezy, 2010) and professional traders (Haigh and List, 2005), group and peer effects on risk taking (Sutter, 2009; Bougheas *et al.*, 2013), gender differences in risk attitudes (Gneezy et al., 2009; Charness and Gneezy, 2012), the risk preferences of financial professionals (Cohn *et al.*, 2015, 2017), the change in risk attitudes following a loss (Imas, 2016), or the relationship between testosterone and risk preferences (Apicella *et al.*, 2008).

[4] In the experiments of Gneezy and Potters (1997), values were as follows: X = 200 cents, k = 3.5 and p = 1/3. Note that Gneezy and Potters present things differently, saying that, with probability 1/3, the subject earns her endowment plus 2.5 times her investment in the risky asset, hence a value of k equal to 3.5 in our presentation.

[5] Note that only risk-averse people may invest less than the whole endowment, since risk-neutral or risk-seeking individuals should invest their entire endowment in the risky asset.

2.2 THE BASELINE TREATMENT

In our experimental treatments, participants receive an initial endowment of $Y = €22$ to participate in 16 decision periods, during each of which they must decide what proportion of their endowment $\alpha(t)$ they wish to invest in a risky asset (referred as "risky asset account" or "investment account" in the instructions and on computer screens during the experiments) and, consequently, the proportion $1 - \alpha(t)$ kept without risk or saved ("safe account" or "savings account"). Their unique choice is made by dragging a slider between 0 and 100.

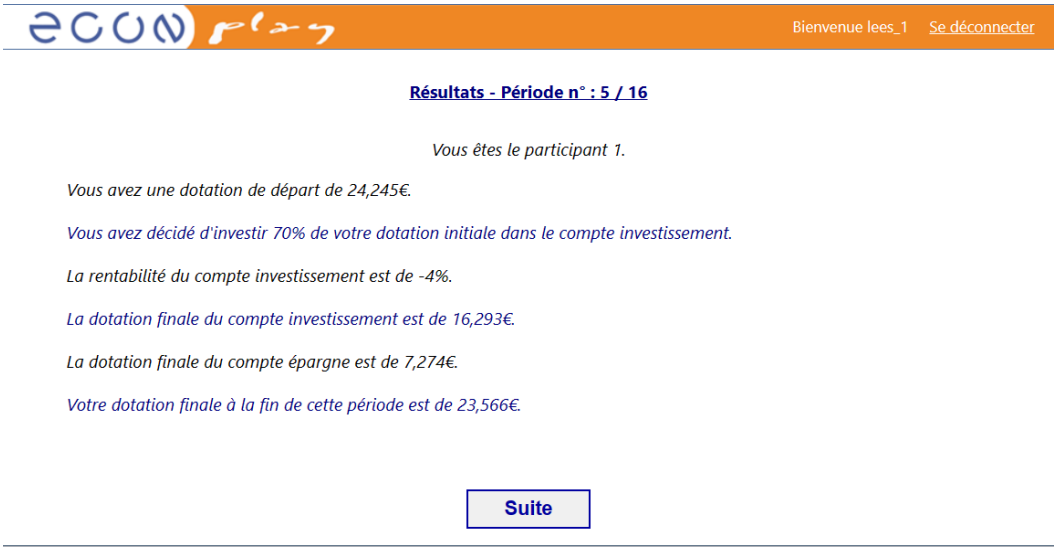
In the experiment, the risky asset is represented by the lottery L = (+6%, .5; –4%, .5), that is yielding a return of +6% and –4% with equal probability 0.5. Starting period t with a current wealth of $W(t)$, a subject chooses the proportion $\alpha(t)$ of this wealth to invest in the risky asset. With probability 0.5, the risky asset yields a return of +6% and the subject's wealth at the end of period t and at the start of period $t + 1$ is $W(t)\{\alpha(t) \times 1.06 + [1 - \alpha(t)]\}$; with probability 0.5, the risky asset yields a return of –4% and the subject's wealth at the end of the period and at the start of the next period is $W(t)\{\alpha(t) \times 0.96 + [1 - \alpha(t)]\}$. In this multiplicative design, the returns of the periods are compounded, so that the subject's wealth at the start of period $t + 1$ is the outcome of the investment in period t plus the amount invested in the safe asset, i.e., $W(t + 1) = W(t)\{\alpha(t)[1 + r(t)] + [1 - \alpha(t)]\}$.

The risky asset has an expected return of +1% with a standard deviation of 5%, i.e., parameters comparable to those of the distribution of monthly returns of the Eurostoxx 50 index over the last 10 years and like the ones used in Gneezy and Potters (1997) and Langer and Weber (2008). The return on the safe asset is zero in accordance with Gneezy and Potters (1997) and Langer and Weber (2008). Importantly, we imposed a zero-skewness distribution of the risky asset returns so that there should be no specific effect on risk taking from using a multiplicative instead of an additive approach (Hinck *et al.*, 2022).

The participants are informed of the distribution of the returns of the risky asset and the independence of the random draws at the different periods, as well as of the return of the safe asset.

At the end of each period, the participants observe on their computer screen the result of the random draw relating to the risky asset, their final wealth as well as its decomposition into two components, that is the "risky asset account" and the "safe account", as displayed graphically in the example of Figure 1.

Figure 1: Screenshot example of final wealth decomposition



In the baseline treatment (*BASELINE*), subjects play 16 rounds of the portfolio allocation task without any gamification stimuli.

2.3 THE GAMIFIED TREATMENTS

The experiment includes 5 gamified treatments: one pure gamification treatment (*PUREGAME*) and gamified treatments that involve the awarding of badges based on performance.

The *PUREGAME* treatment differs from the baseline treatment solely by introducing hedonic elements on the participants' screens, such as falling confetti during the random drawing, and encouragement messages such as “Well done!”, “Good job!”, “What a great performance!”, etc…

In the gamified treatments with badges, two factors are manipulated: badges are either private or social badges and performance relates to either the risky asset achievements or the safe asset achievements. This results in a 2x2 design with treatments named $PRIVBADGE^{RISK}$, $PRIVBADGE^{SAFE}$, $SOCBADGE^{RISK}$, and $SOCBADGE^{SAFE}$.

Thus, in the $PRIVBADGE^{RISK}$ treatment, participants receive badges privately on their computer screen based on their wealth on their "risky asset account" at the end of the period. Similarly, in the $SOCBADGE^{SAFE}$ treatment, participants receive badges privately on their computer screen based on their wealth on their "safe account” but also receive complete information on the existence of the badges and on the distribution of badges among all the subjects on all “safe accounts”.

In all gamified treatments, the stimuli are initially introduced starting from the end of period 4. The possibility of winning trophies is not specified in the instructions. Therefore, subjects play the 4 first periods of gamified treatments exactly as in the baseline treatment but are confronted unexpectedly with the gamification stimuli at the end of period 4. Badges yield no pecuniary advantage and are thus “symbolic” rewards. Accordingly, the introduction of achievement badges should not influence people’s choices and, thus, falls under nudging.

In the gamified treatments with badges, subjects are once again unexpectedly presented with badges at the end of each block of four rounds, which corresponds to the end of round 8, 12, and 16 after the first unexpected stimuli at the end of round 4. We pre-programmed threshold values for getting bronze, silver, gold, and platinum badges/trophies. In case where the subject reaches the threshold value at the end of period 4, a bronze trophy appears on the screen, with a short congratulation message such a “Congrats! You win the bronze trophy!!”…

2.4 THE COPY TRADING TREATMENT

The experiment also includes one copy trading treatment (*COPYTRAD*). In this treatment, at the end of each sequence of 4 periods, subjects receive information on the identity of the participant who has accumulated the highest performance over the last 4 previous decisions. They have the possibility to copy this participant's strategy automatically and in real time during the next 4 periods or to continue to make their decision alone. This treatment allows assessing the profile of subjects who deliberately choose to copy.

2.5 QUESTIONNAIRE

The second part of the experiment is a questionnaire on the characteristics of the participants (gender, age, field of study, level of study, socio-professional category of parents, etc.). The questionnaire is presented in Appendix B.

In addition, we employ survey-type questions to evaluate subjects' objective (Lusardi et Mitchell, 2008) and subjective financial literacy, as well as their risk aversion and self-assessed risk aversion. We also include questions that aim to inquire about the sources of their financial education and their cognitive abilities. Regarding social interactions, our survey includes questions related to subjects' gaming experience, experience with social networks, attitudes towards competition, and their propensity for mimicry. We additionally ask questions about participants’ investment experience in various financial instruments.

Regarding financial literacy, we rely on 6 questions (questions 3 a) to f)): the Big 3 questions from Lusardi et Mitchell (2008), 2 questions inspired by Bianchi (2018) about the knowledge of financial instruments and 1 graphical question taken from PISA. We follow Bianchi (2018) to assess subjects’ subjective, or self-assessed, financial literacy

(question 4) and use his lottery choices and scale to assess risk aversion (question 6). Following Dohmen *et al.* (2011), we measure self-assessed risk tolerance by using their 10 points scale standard question (question 7: "How willing are you to take risks, in general?"). We take two questions from Apesteguia *et al.* (2020) to assess subjects' propensity for mimicry (questions 8 a) and b)). Finally, cognitive abilities are assessed through the cognitive reflection test (CRT, question 11 a) to c)) by Frederick (2005) completed by the self-assessed level in mathematics by Falk *et al.* (2018) (question 11 d)). Finally, we employ Fallucchi *et al.* (2020) degree of agreement with the sentence "Competition brings the best out of me" to measure preferences for competition (question 12).

Questions about financial education sources (question 2) and questions about whether subjects follow influencers in their investment decisions (question 5) were taken from Autorité des Marchés Financiers. We also ask for current and past holding of various financial instruments (question 9) and video games experience (question 10).

Answers to questions relating to participants' financial literacy and CRT are remunerated €0.10 per correct answer (concerns 9 questions). The questions that are remunerated are clearly specified on subjects' computer screens.

2.6 HYPOTHESES

We derive our hypotheses relative to $\alpha(t)$ which is the key decision subjects have to make in all treatments where $\alpha(t)$ is the percentage of endowment invested in the risky asset in period t ($0 \leq \alpha(t) \leq 1$). Let's denote α' and α'' the average percentage invested over the 4 first rounds and over the remaining 12 rounds, respectively. With respect to the baseline, our 5 gamified treatments and the copy trading one, we add the subscripts B, PG, PBR, PBS, SBR, SBS and C to α' and α'' to denote the average percentage invested in each treatment. Thus, for example, α'_B denotes the average percentage invested over the 4 rounds in the baseline treatment and α'_{PBR} is the same but measured in the *PRIVBADGE*^{RISK} *treatment*. Likewise, α''_B denotes the average percentage invested over the last 12 rounds in the baseline treatment and α''_{PBR} is the same but measured in the *PRIVBADGE*^{RISK} *treatment*.

Based notably on attention effects discussed in the introduction (for example, Arnold *et al.*, 2022), our first hypotheses state that gamification stimuli will increase the average percentage invested in the risky asset in *PUREGAME, PRIVBADGE*^{RISK} and *SOCBADGE*^{RISK} and decrease it in *PRIVBADGE*^{SAFE} and *SOCBADGE*^{SAFE} relative to the baseline treatment *(gamification impact between treatments).* However, no difference in the average percentage invested in the risky asset must be observed over the first 4 rounds without gamification stimuli and the baseline (*consistency*). We formulate the following hypotheses accordingly:

Hypothesis 0 (Consistency): $\alpha'_B = \alpha'_{PG} = \alpha'_{PBR} = \alpha'_{PBS} = \alpha'_{SBR} = \alpha'_{SBS}$

Hypothesis 1 (Gamification impact between treatments): $\alpha''_{PG} > \alpha''_B$; $\alpha''_{PBR} > \alpha''_B$; $\alpha''_{PBS} < \alpha''_B$; $\alpha''_{SBR} > \alpha''_B$; $\alpha''_{SBS} < \alpha''_B$

Since the gamification stimuli we consider are of various types, based on the literature demonstrating that social competition (Dijk *et al.*, 2014; Kirchler *et al.*, 2018, 2020) or peer pressure (Sutter, 2009; Bougheas *et al.*, 2013) lead to increases in risk-taking, we expect the risky allocations to be higher in social achievement badges treatments than in private achievement badges treatments when badges are attributed based on the performance on risky asset accounts. Formally, this writes as the following (between treatment) hypothesis:

Hypothesis 2 (Social vs. private achievement badges on the risky asset): $\alpha''_{PBR} < \alpha''_{SBR}$

Likewise, we expect the risky allocations to be lower in social achievement badges treatments than in private badges when badges are attributed based on the performance on safe asset accounts, that is:

Hypothesis 3 (Social vs. private achievement badges on the safe asset): $\alpha''_{SBS} < \alpha''_{PBS}$

Since the previous hypotheses rely on differences between treatments, we also expect within treatment differences over time, that is between the non-gamified 4 first rounds and the 12 next gamified rounds. We

formulate Hypothesis 2 accordingly, stating expected increases when badges relate to the risky asset achievements and decreases when they relate on the safe asset achievements:

Hypothesis 4 (Gamification impact within treatments): $\alpha''_{PG} - \alpha'_{PG} > 0$; $\alpha''_{PBR} - \alpha'_{PBR} > 0$; $\alpha''_{PBS} - \alpha'_{PBS} < 0$; $\alpha''_{SBR} - \alpha'_{SBR} > 0$; $\alpha''_{SBS} - \alpha'_{SBS} < 0$

In the copy trading treatment, following the results obtained by Apesteguia *et al.* (2020), we develop hypotheses on the percentages invested since the copy trading treatment could also create an environment leading to excessive risk-taking behavior.

We first state a consistency hypothesis in accordance with H0.

Hypothesis 5 (Consistency): $\alpha'_B = \alpha'_C$

Previous experimental research has shown that copy trading leads to excessive risk-taking behavior, allowing us to state the following third hypothesis:

Hypothesis 6 (Copy trading increases risk-taking): $\alpha''_C > \alpha''_B$

Table 1: Summary of treatments characteristics

	Treatment characteristics			
Treatments	**Common features**	**Gamification type**	**Copy type**	**Stimuli onset time**
BASELINE	Part 1: 16 rounds of the experimental portfolio choice, identical instructions (achievement badges and the possibility to copy are not provided), initial endowment €22, 2 sessions per treatment. Part 2: questionnaire on subjects' characteristics	No		
PUREGAME		Hedonic elements and encouragement messages on the participants' screens (length: 10 seconds)		Each round, from end of round 4 onwards
PRIVBADGE^{RISK}		Private achievement badges based on the "risky asset account" performance		End of each block of 4 rounds: end of rounds 4, 8, 12 and 16
PRIVBADGE^{SAFE}		Private achievement badges based on the "safe account" performance		
SOCBADGE^{RISK}		Same as *PRIVBADGE*^{RISK} but complete information on the existence of the badges and on the distribution of badges among all the subjects based on the "risky asset account" performance		
SOCBADGE^{SAFE}		Same as *PRIVBADGE*^{SAFE} but complete information on the existence of the badges and on the distribution of badges among all the subjects based on the "safe account" performance		
COPYTRAD			Information on participant who has accumulated the highest performance over the last 4 previous decisions and offered possibility to copy his strategy automatically during the next 4 periods or to make decision alone	

3. RESULTS

3.1 DESCRIPTION OF THE EXPERIMENT AND SUBJECTS

The experiment was carried out face-to-face at the Strasbourg Experimental Economics Laboratory (LEES) on May 25-26th and June 7-8th 2023. The 366 participants were students from various disciplines at the University of Strasbourg.

Upon arrival at the laboratory, the participants are directed to individual cubicles where they are seated in front of a computer. Subsequently, the participants read the instructions provided in Appendix A and were given the opportunity to ask questions. The first part of the experiment commences once all participants confirm their understanding of the instructions by clicking the "start experiment" button displayed on their computer screens.

53 individuals participated in the reference treatment, 56 in the simple gamification treatment, 54, 50, 53, 51 respectively in the *PRIVBADGE*^{RISK}, *PRIVBADGE*^{SAFE}, *SOCBADGE*^{RISK}, and *SOCBADGE*^{SAFE} treatments and 49 in *COPYTRAD*.

On average, one experimental session lasted 50 minutes[6], 15 minutes to read the instructions, 15-20 minutes for the 16 decisions of the first part and 15 minutes to answer the questions of the second part. At each session of the experiment, more individuals than the required number of participants have been invited to ensure good data collection and, as far as possible, to approach gender parity of participants; excess individuals were compensated by the fixed remuneration of €5. Participants' average final wealth was €23.90 (minimum and maximum are €17 and €37). Two sessions per treatment were organized, making a total of 14 sessions.

Table 2 provides descriptive statistics on the main subjects' characteristics in the 7 treatments of the experiment.

On average subjects are 22 years old, with around 3 years of studies and the sample is quite balanced between the two genders. The average percentage invested in the risky asset is around 52%, in accordance with previous experiments using the same investment task. Regarding financial literacy, our subjects show a very high level of objective financial literacy, together with a low average number of "Do not know" answers and in terms of subjective financial literacy, they consider themselves as average (that is close to "2"). They exhibit a high risk aversion and a medium self-assessed risk tolerance. A few of them (6.83%) declare they follow the advice of influencers for their investment decisions. However, their answers to questions 8 a) and b) indicate an average imitation index (for general decisions taken in their life). Their average cognitive reflection test (CRT) is low and the average knowledge in mathematics is medium. Finally, subjects declare, on average, having a positive view of competition.

[6] Social treatments lasted 65 minutes and private treatments lasted 45 minutes on the average.

Table 2: Descriptive statistics on experimental subjects

Variables	Obs	Mean	Std. Dev.	Min	Max
% invested in risky asset	366	52.221	35.038	0	100
Age	366	22.404	4.199	17	55
Gender	366	1.557	0.497	1	2
- Male (0)		44.66%			
- Female (1)		55.74%			
Degree Level	365	2.953	1.416	1	6
Financial Literacy (Obj.)	366	5.139	1.001	1	6
Financial Literacy (Dnk)	366	0.243	0.552	0	3
Financial Literacy (Sbj.)	366	1.923	0.619	1	3
Risk aversion (Bianchi)	366	3.123	1.132	1	4
Self-ass. risk tolerance (Dohmen)	366	4.773	2.006	0	10
Follow influencer/invt	366	1.932	0.253	1	2
- Yes (1)		6.83%			
- No (0)		93.17%			
Imitindex[7]	366	2.5464	0.853	1	5
CRT	366	1.254	0.912	0	3
Math	366	5.721	2.469	0	10
Competition	366	4.525	1.573	1	7

3.2 AVERAGE ALLOCATIONS OVER THE FIRST FOUR ROUNDS IN THE GAMIFIED TREATMENTS

We first check the comparability of α (t) during the initial four periods of the experiment across all treatments in Table 3 (Hypothesis 0).

Table 3: Average allocations over the initial four periods

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

Table 3 indicates that average and median risky allocations are close to 50% in all treatments. Using a Mann-Whitney one-tailed, we cannot reject the null hypothesis (*p<1%*) of no difference between the average percentage invested in the risky asset between the baseline and each treatment over the 4 non-gamified rounds in all gamified treatments except *PUREGAME* (*p=0.037*). For that reason, this treatment will be analyzed with a special care in the next steps.

3.3 AVERAGE ALLOCATIONS FROM ROUND 5 ONWARDS IN THE GAMIFIED TREATMENTS

Table 4: Average allocations over periods 5 to 16

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

First, we test Hypothesis 1 by comparing the average percentage invested in the risky asset in each gamified treatment with the one of the baseline treatment over the 12 gamified rounds.

[7] Imitindex is computed as the average of answers to questions 8 a) and b).

We reject the null hypothesis of no difference in the average percentage invested in the risky asset between each treatment and the baseline over the 12 gamified rounds in *PUREGAME*, *PRIVBADGE*^{RISK}, *SOCBADGE*^{RISK}, (Mann-Whitney one-tailed, p<1%) *and SOCBADGE*^{SAFE} *(*p<5%*)*, but we cannot reject the null hypothesis in *PRIVBADGE*^{SAFE} *(*p>10%*).*

Hence, in only one gamified treatment (*PRIVBADGE*^{SAFE}) the average percentage invested in the risky asset over the 12 gamified rounds is not significantly different from the one in the baseline treatment.

Second, we test Hypotheses 2 and 3 by comparing the differences in average allocations between treatments *PRIVBADGE*^{RISK} and *SOCBADGE*^{RISK} and between *PRIVBADGE*^{SAFE} and *SOCBADGE*^{SAFE} respectively, in the 12 gamified rounds.

A Mann-Whitney one-tailed test does not allow rejecting the null hypothesis of no difference in the average allocations between the social and private badges on risk achievements (p>10%), and between the social and private badges on safe achievements, albeit with a lower probability (p=7%). Specifically, the social badges are not significantly more powerful in increasing the percentage allocated to the risky asset (or equivalently, in increasing the percentage allocated to the safe account).

Figures 2 and 3 illustrate the average risky allocations over time in all treatments. Interestingly, and contrary to Langer and Weber (2008), we notice that risk taking does not increase over time in BASELINE in our experiment. We suggest that this is due to our choice of imposing a zero-skewness distribution of the risky asset returns which resulted, as expected according to Hinck et al. (2022), in no specific effect on risk taking.

Figure 2: Average risky allocations over 16 periods

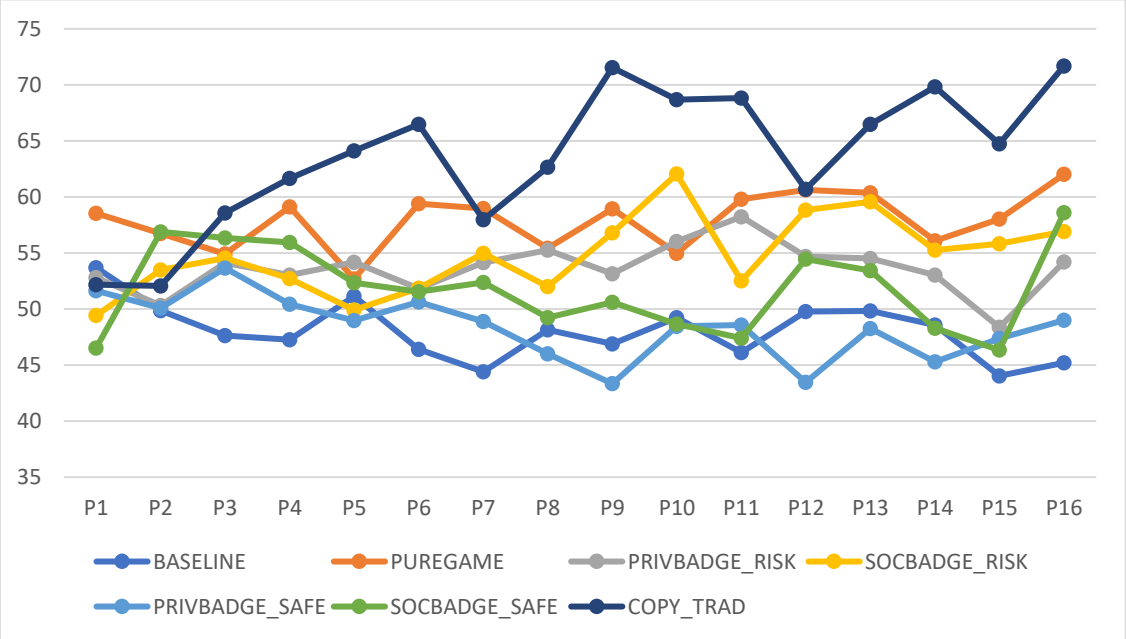
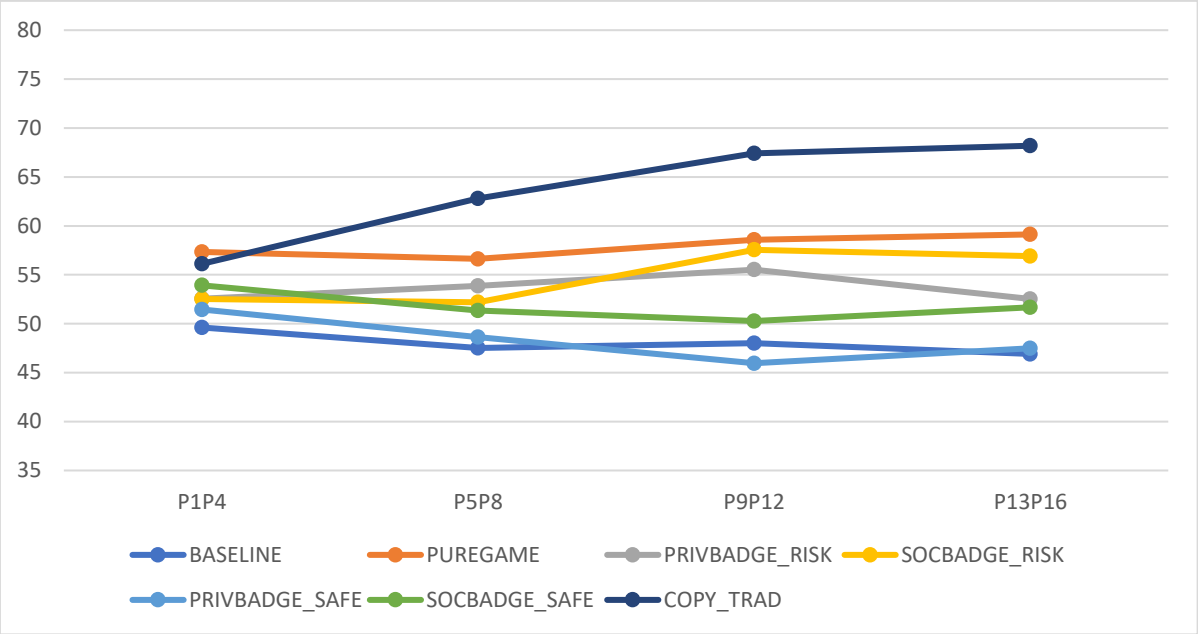


Figure 3: Average risky allocations over 4-periods blocks



Finally, to test Hypothesis 4, we compute the change in average allocations between the two parts of the experiments, that is the difference $\alpha'' - \alpha'$ within all treatments, in Table 5.

Table 5: 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 risk increases are observed in the gamified treatments with badges that relate to risky asset achievements (*PRIVBADGE^{RISK}* and *SOCBADGE^{RISK}*) and significant risk decreases are observed in the gamified treatments with badges that relate on the safe asset achievements (*PRIVBADGE^{SAFE}* and *SOCBADGE^{SAFE}*).

We do not observe any difference over the two blocks of periods in the baseline treatment. In *PUREGAME*, a significant decrease in risky allocations is observed, allowing us to reject Hypothesis 4 for this treatment (for which Hypothesis 0 was already rejected).

These findings indicate that gamification stimuli such as achievement badges nudge individuals in the expected directions.

3.4 THE COPY TRADING TREATMENT

In the copy trading treatment, we first check the consistency of our data with the baseline treatment (columns 2 and 3 of Table 6). We cannot reject the null hypothesis of no difference between the average percentage invested in the risky asset between the baseline and the copy trading treatment over the first 4 rounds (Mann-Whitney one-tailed test of Hypothesis 5, *p=7%*).

Next, we test Hypothesis 6 by comparing the average percentage invested in the risky asset in the copy trading treatment with the one of the baseline over the 12 next rounds (columns 4 and 5 of Table 6). We reject the null hypothesis of no difference between the two (Mann-Whitney one-tailed, p<1%), indicating an increase in risk-taking in the copy trading environment[8].

Note that, on the average 1 out of 5 subjects chose to copy, that is 14.89% after the first block of 4 periods, 25.53% after the second block and 19.15% after the third one.

We additionally check that differences in risky allocations are also significant (*p<1%*) for non-copying subjects. These findings indicate that the copy trading setting creates an environment leading to more risk-taking behavior, since risky allocations increase for all subjects, that is, including the non-copying ones.

Table 6: Average allocations in first 4 rounds and in the remaining 12 rounds for the copy trading and the baseline treatments

	α' (t)		α'' (t)	
	BASELINE	*COPYTRAD*	*BASELINE*	*COPYTRAD*
	n=53	n=49	n=53	n=49
Mean	49.61	56.12	47.48	66.14
Median	50	51.5	42	70

3.5 MULTIVARIATE ANALYSES

We run multivariate analyses to understand the individual determinants of i) the change in the percentages invested in the risky asset between the two blocks of periods (i.e. without stimuli vs. with stimuli) in all treatments, and ii) the intensity to copy in *COPYTRAD.*

Appendix C presents pairwise correlations of the main variables and their significance. Not surprisingly, "objective financial literacy" and the number of "do not know" answers to financial literacy questions are highly and significantly correlated. Other high and significant correlations exist between *Risk aversion (Bianchi)* and *Risk tolerance (Dohmen)*, between *CRT* and *Math* and between *Age* and *Degree Level*.

First, in Table R1 we analyze the individual determinants of the differences $\alpha'' - \alpha'$ in all treatments, that is the change in risky allocations between the first block of 4 periods and the second block of 12 periods.

Independent variables are individual sociodemographic (Age and Female), financial literacy (objective or subjective), attitudinal variables (CRT or Math, Competition, Imitindex), and a set of numerous individual controls taken or built from the questionnaire. These controls include the degree type, the socio-professional category of father, sources of financial education, investment experience in financial instruments and video games experience. Coefficients for these control variables are not reported due to non-significance.

We account for past decisions and experiences of subjects by adding the average risky allocations over the first four rounds, and the percentages of successful lottery rounds, i.e. the relative number of rounds in which the risky

[8] We also check (although not stated in our hypotheses) that there is a significant increase in the risky allocations between the first 4 periods and the 12 remaining ones (Wilcoxon signed rank test, *p<1%*, 28 subjects >0, 18 <0 and 3 nulls).

asset yielded a return of +6%[9]. For sake of comparability between treatments, we do not consider the number of achievement badges obtained by subjects.

We do not incorporate risk aversion or risk tolerance as regressors. In fact, risk aversion/risk tolerance are endogenous variables to our regressions, which are already considered through the average risky allocations over the four first periods.[10]

In all models, we find that changes in risky allocations are significantly higher for past successes, and lower for high risky allocations in the 4 first periods. Importantly, changes in risky allocations are significantly lower in women.

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

	1		2		3		4		5	
% of lottery successes P1P4	0.137	***	0.140	***	0.138	***	0.138	***	0.137	***
	(0.047)		(0.047)		(0.047)		(0.048)		(0.047)	
Average risky allocations P1P4	-0.284	***	-0.283	***	-0.284	***	-0.284	***	-0.285	***
	(0.033)		(0.033)		(0.033)		(0.033)		(0.033)	
Age	-0.039		-0.043		-0.045		-0.035		-0.037	
	(0.235)		(0.235)		(0.236)		(0.240)		(0.240)	
Female	-5.653	**	-5.556	**	-5.416	**	-5.800	**	-5.685	**
	(2.667)		(2.702)		(2.722)		(2.753)		(2.752)	
Financial literacy (Obj.)			1.184		1.077					
			(1.153)		(1.134)					
Financial literacy (Sbj.)							0.283		0.373	
							(1.983)		(2.029)	
CRT			-0.518				-0.237			
			(1.331)				(1.291)			
Math					0.051				0.129	
					(0.467)				(0.475)	
Competition	0.239		0.307		0.283		0,253		0.214	
	(0.805)		(0.803)		(0.841)		(0.810)		(0.845)	
Imitindex	0.296		0.352		0.337		0.292		0.274	
	(1.261)		(1.263)		(1.272)		(1.262)		(1.271)	
Individual controls	X		X		X		X		X	
Intercept	7.282		1.079		1.177		6.839		6.264	
	(12.074)		(13.182)		(13.187)		(13.646)		(13.586)	
Adjusted R-squared	0.191		0.189		0.189		0.186		0.186	
Observations	366		366		366		366		366	

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

Next, in Table R2, we run similar regressions by adding dummies for nudge treatments, that is *T_Nudge_Risk* takes a value of 1 for $PRIVBADGE^{RISK}$ and $SOCBADGE^{RISK}$, 0 otherwise (respectively *T_Nudge_Safe* takes a value of 1 for $PRIVBADGE^{SAFE}$ and $SOCBADGE^{SAFE}$, 0 otherwise). We find a negative and significant coefficient for *T_Nudge_Safe*,

[9] We alternatively use a dummy variable indicating that the final wealth of subjects increased over the last rounds and find similar results in our multivariate analyses. Results are available upon request.

[10] Qualitatively similar results are obtained when risk tolerance is introduced instead of the average risky allocations over the four first periods and we find a positive and significant effect of risk tolerance on the change in risky allocations. Results are available upon request.

indicating the expected nudge direction. This finding supports the robustness of our experimental design and shows that nudges play a significant role in the change in risk taking behavior induced by gamification.

Finally, in Table R3, regressions are run in each treatment separately. We keep the main variables identical in all regressions. Findings show some differences in significant variables across treatments except for past risky allocations, which is always negative and significant. For example, CRT has a negative and significant impact in $PRIVBADGE^{RISK}$ whereas its effect is positive and significant in $SOCBADGE^{RISK}$ and $SOCBADGE^{SAFE}$. Since its effect is also negative but no significant in $PRIVBADGE^{SAFE}$, one can wonder whether this sign difference has to do with the difference between private and social achievements.[11] This question is left for future analyses. Besides, in *COPYTRAD*, *Age* has a positive and significant effect on the differences in risk taking between the two blocks of periods, indicating that experience plays a specific role in this treatment.

In Table R4, we run a regression to assess the profile of subjects who deliberately choose to copy in *COPYTRAD*. The explained variable is the intensity of copy trading, that is the number of times each subject copied, which takes the values of 0 (56.25%), 1 (29.17%) or 2 (14.58%) and is computed for 48 subjects (*i.e.* 49 subjects minus one). Explanatory variables include past successes and average risky allocations over the first 4 periods, individual sociodemographic (Age, Female and Field of study: Economics/Management) and individual attitudes that are included one by one. In a second step, we replace average risky allocations over the first 4 periods by risk aversion and risk tolerance alternatively.

In all models, we find that being a woman significantly increases the intensity of copying. Besides, although similar results are obtained when using risk tolerance instead of past risky allocations, we also find a positive and significant effect of risk tolerance over the copying intensity.[12]

This last finding contradicts the one of Apesteguia *et al.* (2020) who found that the more risk-averse subjects are, the more likely they copy others. Note that they measured risk aversion through a first experiment involving lottery choices, whereas we measure risk tolerance and use questionnaire answers at the end of the experiment.

[11] We also run the regression alternatively with and without *Financial literacy* and *CRT* (they correlate significantly at 0.26) and still observe significant effects of *CRT*.

[12] We also used risk aversion instead: this variable has a negative but not significant effect on the probability to copy trades. Therefore, we do not provide the results, they are available upon request.

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 successes P1P4	0.136	***	0.138	***	0.137	***	0.137	***	0.135	***	0.138	***	0.141	***	0.139	***	0.138	***	0.137	***
	(0.047)		(0.047)		(0.047)		(0.047)		(0.047)		(0.047)		(0.047)		(0.047)		(0.047)		(0.047)	
Average risky allocations P1P4	-0.285	***	-0.285	***	-0.286	***	-0.285	***	-0.286	***	-0.283	***	-0.283	***	-0.283	***	-0.283	***	-0.284	***
	(0.033)		(0.033)		(0.033)		(0.033)		(0.033)		(0.033)		(0.033)		(0.033)		(0.033)		(0.033)	
T_Nudge_Risk											1.772		1.756		1.756		1.763		1.758	
											(2.367)		(2.361)		(2.360)		(2.382)		(2.380)	
T_Nudge_Safe	-5.213	**	-5.109	**	-5.101	**	-5.224	**	-5.216	**										
	(2.100)		(2.084)		(2.087)		(2.104)		(2.109)											
Age	-0.041		-0.044		-0.047		-0.037		-0.040		-0.050		-0.054		-0.057		-0.047		-0.049	
	(0.233)		(0.234)		(0.235)		(0.238)		(0.239)		(0.235)		(0.236)		(0.237)		(0.241)		(0.242)	
Female	-5.513	**	-5.452	**	-5.293	*	-5.666	**	-5.529	**	-5.722	**	-5.625	**	-5.485	**	-5.852	**	-5.738	**
	(2.654)		(2.684)		(2.711)		(2.744)		(2.748)		(2.666)		(2.702)		(2.725)		(2.755)		(2.755)	
Financial literacy (Obj.)			1.057		0.938								1.179		1.071					
			(1.144)		(1.122)								(1.155)		(1.135)					
Financial literacy (Sbj.)							0.246		0.343								0.231		0.319	
							(1.948)		(1.988)								(2.000)		(2.047)	
CRT			-0.555				-0.306						-0.517				-0.238			
			(1.326)				(1.285)						(1.332)				(1.293)			
Math					0.070				0.139						0.051				0.126	
					(0.462)				(0.470)						(0.468)				(0.477)	
Competition	0.310		0.369		0.338		0.323		0.281		0.253		0.320		0.296		0.264		0.226	
	(0.806)		(0.802)		(0.838)		(0.810)		(0.843)		(0.806)		(0.802)		(0.840)		(0.810)		(0.845)	
Imitindex	0.175		0.229		0.211		0.172		0.153		0.321		0.377		0.361		0.318		0.301	
	(1.252)		(1.251)		(1.263)		(1.250)		(1.262)		(1.268)		(1.269)		(1.279)		(1.268)		(1.278)	
Individual controls	X		X		X		X		X		X		X		X		X		X	
Intercept	9.096		3.603		3.708		8.798		8.135		5.990		-0.172		-0.074		5.672		5.108	
	(12.194)		(13.193)		(13.196)		(13.680)		(13.629)		(12.104)		(13.101)		(13.119)		(13.649)		(13.570)	
Adjusted R-squared	0.202		0.200		0.199		0.197		0.197		0.190		0.188		0.188		0.185		0.185	
Observations	366		366		366		366		366		366		366		366		366		366	

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

Table R3: Individual determinants of change in risky allocations between P1P4 and P5P16, per treatment

	BASELINE					*PUREGAME*				
	1	2	3	4	5	1	2	3	4	5
% of lottery successes P1P4	0.006	-0.029	-0.048	0.025	-0.005	0.120	0.143	0.123	0.109	0.104
	(0.068)	(0.077)	(0.070)	(0.080)	(0.076)	(0.086)	(0.093)	(0.087)	(0.089)	(0.089)
Average risky allocations P1P4	-0.221 ***	-0.203 ***	-0.168 ***	-0.193 ***	-0.164 **	-0.224 ***	-0.212 **	-0.221 ***	-0.210 ***	-0.207 ***
	(0.062)	(0.065)	(0.061)	(0.064)	(0.063)	(0.080)	(0.080)	(0.079)	(0.073)	(0.070)
Age	0.327	0.476	0.507	0.460	0.396	-0.090	-0.033	-0.093	-0.078	-0.163
	(0.651)	(0.717)	(0.650)	(0.663)	(0.654)	(0.310)	(0.297)	(0.332)	(0.293)	(0.338)
Female	-6.330	-7.789	-9.485 *	-11.905 **	-11.204 **	-6.898	-7.963	-6.717	-4.637	-2.964
	(6.317)	(6.685)	(5.570)	(5.877)	(5.321)	(4.611)	(5.513)	(5.663)	(4.964)	(4.787)
Financial literacy (Obj.)		1.449	2.392				1.426	0.329		
		(2.531)	(2.195)				(2.586)	(2.324)		
Financial literacy (Sbj.)				7.323 *	3.386				-8.780 *	-8.751
				(4.057)	(4.388)				(4.935)	(5.418)
CRT		-2.940		-2.016			-3.381		-3.617	
		(2.888)		(2.359)			(3.743)		(3.552)	
Math			-2.630 **		-2.049 **			-0.073		-0.617
			(0.999)		(0.943)			(1.331)		(1.406)
Competition	0.269	0.165	1.245	0.018	0.911	1.644	1.873	1.692	1.424	1.441
	(1.954)	(1.988)	(1.951)	(1.806)	(1.873)	(2.100)	(2.190)	(2.178)	(2.168)	(2.198)
Imitindex	-1.466	-0.880	0.286	-1.138	0.131	0.371	-0.143	0.402	0.887	1.330
	(2.679)	(2.732)	(2.643)	(2.734)	(2.892)	(3.596)	(4.146)	(4.540)	(4.042)	(4.072)
Intercept	7.575	1.360	-1.690	-5.895	3.891	4.245	-0.631	2.414	23.658	22.425
	(21.911)	(28.277)	(23.938)	(23.991)	(21.125)	(20.591)	(29.205)	(34.157)	(26.996)	(30.888)
Adjusted R-squared	0.142	0.122	0.242	0.172	0.234	0.143	0.121	0.107	0.181	0.167
Observations	53	53	53	53	53	56	56	56	56	56

OLS regressions with robust SE, top row=coeff & bottom row=SE; ***/**/*=1/5/10%
PRIVBADGE^{RISK}

AUTORITÉ DES MARCHÉS FINANCIERS

AMF

Table R3 followed

	PRIVBADGE^{RISK}					*SOCBADGE*^{RISK}				
	1	2	3	4	5	1	2	3	4	5
% of lottery successes P1P4	0.063	0.125	0.059	0.098	0.037	0.203	0.204 *	0.183	0.198	0.145
	(0.097)	(0.095)	(0.099)	(0.088)	(0.094)	(0.122)	(0.118)	(0.118)	(0.118)	(0.109)
Average risky allocations P1P4	-0.332 ***	-0.351 ***	-0.328 ***	-0.364 ***	-0.339 ***	-0.286 ***	-0.314 ***	-0.331 ***	-0.290 ***	-0.316 ***
	(0.072)	(0.066)	(0.072)	(0.070)	(0.073)	(0.078)	(0.089)	(0.090)	(0.084)	(0.089)
Age	-0.041	-0.028	-0.023	0.194	0.161	0.426	0.614	0.509	0.618	0.404
	(0.385)	(0.378)	(0.388)	(0.389)	(0.420)	(0.519)	(0.517)	(0.559)	(0.515)	(0.603)
Female	-16.281 ***	-18.969 ***	-17.663 ***	-20.681 ***	-18.309 ***	-6.118	-2.968	-2.894	-3.272	-6.223
	(5.636)	(5.755)	(6.090)	(5.511)	(5.905)	(6.532)	(6.514)	(7.086)	(7.670)	(8.237)
Financial literacy (Obj.)		0.908	0.674				3.893	3.781		
		(1.881)	(2.091)				(3.167)	(3.471)		
Financial literacy (Sbj.)				9.259 **	8.137 *				-1.692	4.878
				(4.350)	(4.772)				(5.960)	(6.557)
CRT		-6.489 *		-6.774 **			6.670 *		7.777 **	
		(3.234)		(2.846)			(3.557)		(3.631)	
Math			-0.990		-0.504			1.887		2.646 *
			(1.268)		(1.181)			(1.343)		(1.346)
Competition	-2.911	-2.769	-2.240	-1.730	-1.670	2.297	2.700	2.078	2.399	1.461
	(2.164)	(2.084)	(2.626)	(1.754)	(2.233)	(1.994)	(1.894)	(1.896)	(2.070)	(2.138)
Imitindex	0.717	-0.485	0.591	-0.325	0.874	2.533	1.292	2.037	1.524	2.811
	(3.194)	(2.934)	(3.264)	(2.739)	(3.084)	(3.554)	(3.383)	(3.329)	(3.589)	(3.414)
Intercept	39.100 **	44.510 **	39.021 **	24.889	18.857	-14.334	-45.486 *	-42.386	-23.588	-31.145
	(15.951)	(16.963)	(16.204)	(18.336)	(22.604)	(17.670)	(25.785)	(25.262)	(18.174)	(21.911)
Adjusted R-squared	0.277	0.318	0.255	0.377	0.299	0.116	0.199	0.167	0.174	0.156
Observations	54	54	54	54	54	50	50	50	50	50

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

Table R3 followed

	PRIVBADGE^{SAFE}					*SOCBADGE*^{SAFE}				
	1	2	3	4	5	1	2	3	4	5
% of lottery successes P1P4	0.140	0.164	0.134	0.162	0.133	0.377 ***	0.357 ***	0.369 ***	0.352 ***	0.367 ***
	(0.106)	(0.111)	(0.104)	(0.112)	(0.106)	(0.130)	(0.122)	(0.130)	(0.125)	(0.134)
Average risky allocations P1P4	-0.163 ***	-0.169 ***	-0.167 ***	-0.172 ***	-0.168 ***	-0.181 ***	-0.183 ***	-0.199 ***	-0.188 ***	-0.198 ***
	(0.059)	(0.061)	(0.061)	(0.062)	(0.061)	(0.066)	(0.066)	(0.069)	(0.067)	(0.071)
Age	-0.537	-0.512	-0.524	-0.448	-0.498	0.539	0.404	0.392	0.378	0.425
	(0.847)	(0.817)	(0.813)	(0.831)	(0.824)	(0.496)	(0.440)	(0.475)	(0.484)	(0.543)
Female	-4.909	-4.675	-2.610	-5.704	-3.403	5.295	3.520	5.284	4.162	5.813
	(4.899)	(4.314)	(4.419)	(4.665)	(5.239)	(5.266)	(5.137)	(5.290)	(5.247)	(5.539)
Financial literacy (Obj.)		1.632	0.752				0.258	-0.342		
		(3.060)	(2.965)				(2.856)	(3.032)		
Financial literacy (Sbj.)				-0.463	0.244				-2.508	-2.161
				(3.164)	(3.129)				(2.898)	(3.404)
CRT		-3.315		-2.624			4.970 **		4.859 **	
		(2.309)		(2.448)			(2.011)		(1.892)	
Math			0.935		0.905			0.926		0.648
			(0.834)		(0.894)			(0.801)		(0.954)
Competition	-0.120	-0.284	-0.497	-0.304	-0.431	2.044	1.663	1.886	1.427	1.723
	(2.423)	(2.511)	(2.541)	(2.610)	(2.647)	(1.237)	(1.280)	(1.211)	(1.311)	(1.281)
Imitindex	-0.294	0.296	-0.361	-0.057	-0.478	0.784	0.275	0.053	0.725	0.641
	(2.422)	(2.279)	(2.339)	(2.516)	(2.444)	(2.252)	(2.336)	(2.136)	(2.370)	(2.305)
Intercept	13.345	6.813	5.249	15.348	8.641	-36.486 *	-36.009 *	-32.724	-29.033	-30.621
	(21.252)	(21.360)	(19.870)	(22.482)	(22.405)	(19.239)	(20.749)	(20.964)	(19.659)	(19.989)
Adjusted R-squared	0.084	0.078	0.063	0.067	0.060	0.201	0.256	0.178	0.266	0.184
Observations	53	53	53	53	53	51	51	51	51	51

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

Table R3 followed

	COPYINFL				
	1	2	3	4	5
% of lottery successes P1P4	0.226 *	0.250 *	0.242 *	0.272 **	0.256 *
	(0.125)	(0.140)	(0.140)	(0.131)	(0.127)
Average risky allocations P1P4	-0.723 ***	-0.713 ***	-0.725 ***	-0.698 ***	-0.716 ***
	(0.113)	(0.117)	(0.115)	(0.131)	(0.121)
Age	1.827 **	1.957 *	1.860 *	1.851 **	1.718 *
	(0.878)	(1.012)	(0.997)	(0.877)	(0.885)
Female	-7.202	-8.624	-7.937	-9.795	-8.762
	(6.784)	(6.888)	(6.648)	(7.110)	(6.631)
Financial literacy (Obj.)		-1.826	-1.988		
		(4.112)	(4.126)		
Financial literacy (Sbj.)				3.312	2.763
				(7.349)	(6.900)
CRT		-2.006		-2.671	
		(3.480)		(4.064)	
Math			-0.656		-0.852
			(1.717)		(1.824)
Competition	2.250	2.197	2.544	2.117	2.515
	(1.620)	(1.917)	(1.922)	(1.808)	(1.897)
Imitindex	2.092	1.437	1.735	1.649	2.071
	(4.401)	(4.732)	(4.594)	(4.556)	(4.464)
Intercept	-11.901	-1.833	1.106	-16.299	-11.968
	(23.328)	(23.796)	(25.472)	(29.123)	(28.951)
Adjusted R-squared	0.423	0.402	0.400	0.403	0.399
Observations	49	49	49	49	49

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

Table R4: Individual determinants of the intensity to copy

	1	2	3	4	5	6	7	8	9
% of lottery successes P1P4	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.001	0.001
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Average risky allocations P1P4	-0.006	-0.005	-0.005	-0.006	-0.005	-0.005	-0.006	-0.005	-0.005
	(0.004)	(0.004)	(0.005)	(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
		(0.028)	(0.030)	(0.029)	(0.029)	(0.027)	(0.025)	(0.028)	(0.028)
Female		0.442 **	0.421 **	0.491 **	0.432 **	0.357 *	0.298	0.442 **	0.436 **
		(0.191)	(0.186)	(0.214)	(0.190)	(0.187)	(0.192)	(0.206)	(0.191)
Field of study: Eco/Mgt		-0.153	-0.153	-0.171	-0.137	-0.177	-0.018	-0.153	-0.164
		(0.215)	(0.216)	(0.222)	(0.221)	(0.218)	(0.224)	(0.238)	(0.222)
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)
Intercept	0.857 **	-0.208	-0.295	-0.429	0.125	-0.131	0.709	-0.209	-0.153
	(0.366)	(0.748)	(0.814)	(0.872)	(0.933)	(0.731)	(0.862)	(0.887)	(0.775)
Adjusted R-squared	0.004	0.076	0.058	0.058	0.061	0.084	0.121	0.053	0.055
Observations	48	48	48	48	48	48	48	48	48

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

Table R4: followed

	1		2		3		4		5		6		7		8	
% of lottery successes P1P4	0.000		0.000		0.000		0.000		0.001		0.001		0.001		-0.001	
	(0.004)		(0.004)		(0.004)		(0.004)		(0.004)		(0.004)		(0.004)		(0.004)	
Risk tolerance (Dohmen)	0.122	*	0.123	*	0.124	*	0.119	*	0.105		0.095		0.129	*	0.124	*
	(0.063)		(0.064)		(0.069)		(0.063)		(0.064)		(0.066)		(0.068)		(0.063)	
Age	0.035		0.030		0.034		0.037		0.038		0.028		0.034		0.033	
	(0.030)		(0.032)		(0.030)		(0.030)		(0.030)		(0.028)		(0.030)		(0.029)	
Female	0.536	**	0.508	**	0.521	**	0.528	**	0.462	**	0.429	**	0.513	**	0.528	**
	(0.204)		(0.197)		(0.222)		(0.202)		(0.215)		(0.212)		(0.214)		(0.206)	
Field of study: Eco/Mgt	-0.238		-0.234		-0.231		-0.229		-0.246		-0.156		-0.206		-0.255	
	(0.202)		(0.203)		(0.207)		(0.210)		(0.205)		(0.224)		(0.231)		(0.211)	
Imitindex			0.094													
			(0.135)													
Competition					-0.013											
					(0.074)											
Financial literacy (Obj.)							-0.041									
							(0.126)									
CRT									-0.098							
									(0.110)							
Math											-0.065					
											(0.066)					
Financial literacy (Sbj.)													0.113			
													(0.231)			
FL_dnk															-0.085	
															(0.097)	
Intercept	-0.935		-1.036		-0.864		-0.749		-0.790		-0.304		-1.192		-0.840	
	(0.690)		(0.735)		(0.759)		(0.905)		(0.642)		(0.813)		(0.872)		(0.696)	
Adjusted R-squared	0.120		0.108		0.099		0.101		0.114		0.120		0.105		0.105	
Observations	48		48		48		48		48		48		48		48	

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

4. CONCLUSION

In this paper, we have experimentally shown that providing individuals with gamification stimuli in the form of achievement badges on risk-taking or information on the success of others with the possibility to copy their decisions increases risk taking. On the contrary, risk taking decreases when gamification is achieved through achievement badges on the safe asset allocations. These findings suggest that social trading could be detrimental to individual welfare and need further scrutiny from policymakers and regulators. Additionally, our findings also indicate that achievement badges could also nudge individuals towards “positive” behaviors such as savings, since we observed this effect in an investment game that usually favors risky allocations.

However, we do not observe any significant effect for hedonic stimuli such as confetti or encouragement messages. Studying further why this happened (for example, the size of our confetti) is needed since we cannot definitively conclude that hedonic stimuli have no effect on risk taking behaviors.

We also find that being a female has a strong and positive effect on the intensity to copy.

There are many fruitful avenues for future research using the bulk of available data. First, a higher scrutiny must be devoted to the mechanisms underlying the gendered effects that we found. In fact, these may be related to the well-known higher risk aversion or lower confidence in one’s own financial knowledge in women than in men. Second, in gamified treatments with achievement badges, we could consider the number of badges earned by subjects (the total number, the qualitative type of badges, as well as their dynamics over time), to deepen the impact of the intensity of gamification stimuli over time.

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Appendix A: Instructions (translated in English)

Introduction

Welcome to the Laboratory of Experimental Economics of the University of Strasbourg (LEES). The experiment you are about to take part in will last approximately one hour and consists of two parts. Upon completion of the experiment, you will receive your payment in cash. The amount you receive will depend on your decisions and some chance elements. All your choices will be made using the computer in front of you, where your participant number is displayed. Please refrain from talking to other participants during the experiment. If you have any questions, simply raise your hand, and a staff member will assist you. You are welcome to use paper and pencil to take notes.

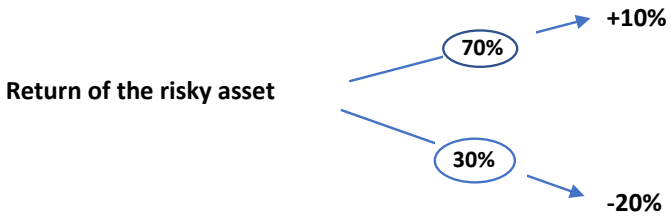
The experiment consists of two parts. Part 1 involves a series of repeated investment decisions that you will be required to make. Part 2 consists of a questionnaire. At the conclusion of the experiment, your payment will be based on the accumulated amount from your decisions in Part 1, as well as the payment for answering specific questions in Part 2. You will receive your payment in cash at the end of the experiment.

Part 1

At the beginning of the experiment, you will receive an initial endowment of €22. The experiment consists of 16 periods, and at each period, you can invest a portion or the entirety of your current endowment in a risky asset. The remaining portion of your endowment that is not invested is considered safe and can be retained.

You will specify the percentage of your current endowment that you wish to invest in the risky asset. For instance, you may choose to invest 60% of your endowment (i.e., 60% x €22 = €13.2) in the "risky asset account" or "investment account," while keeping the remaining 40% (i.e., 40% x €22 = €8.8) in the "safe account" or "savings account."

The risk profile of the risky asset will be presented visually on your screen in the lottery format below:



The risk profile provided offers the following possibilities for returns on the risky asset:

- A return of 10% with a probability of 70%
- A return of -20% with a probability of 30%

The portion of your endowment that you have placed in the safe account will be retained with certainty for the next period without any risk.

It is important to note that the results of the lottery in the experiment will be randomly and individually generated by the computer, reflecting the indicated probabilities. There is no manipulation of the draw results.

Based on the previous example you provided, where 60% of the initial endowment was invested and a random return of 10% was generated, the final endowment at the end of the period is the sum of the value in the "risky asset account" or "investment account" and the "safe account" or "savings account."

In this case, the final endowment would be calculated as follows:

€14.52 (from the risky asset account) + €8.8 (from the safe account) = €23.32

This is illustrated in the diagram below:

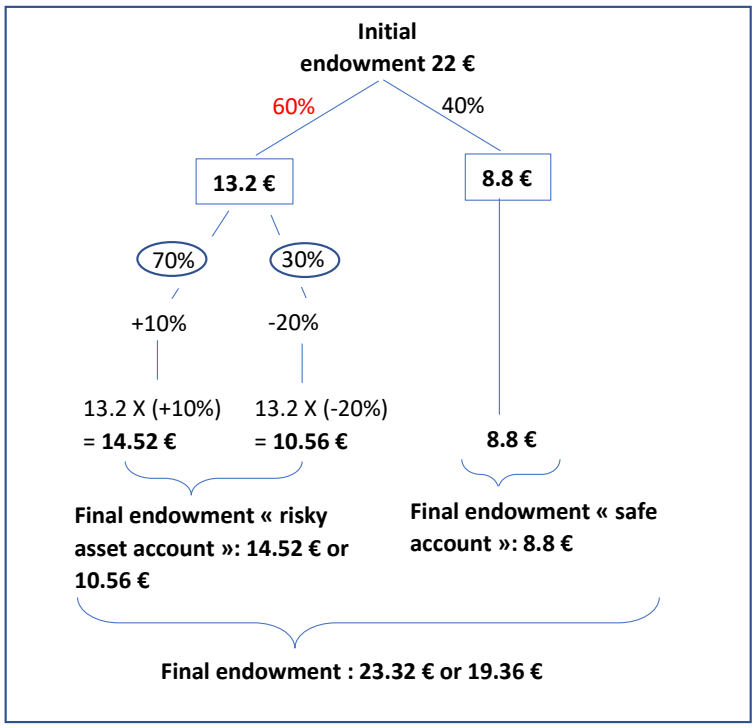


Diagram of the different final allocations for an investment decision of 60% of the initial allocation in the “risky asset account” (i.e., 40% of the initial allocation in the “safe account”).

If a random return of -20% had been generated for this period, the final endowment would be as follows:

Risky Asset Account: €10.56

Safe Account: €8.8

Thus, the total final endowment would be €10.56 (from the risky asset account) + €8.8 (from the safe account) = €19.36.

The final endowment at the end of one period becomes the initial endowment for the subsequent period. Therefore, in the next period, you will need to decide how much of the new initial endowment you want to invest in the "risky asset account" or "investment account," and correspondingly, the portion to be retained in the "safe account" or "savings account."

It's important to note that the draws in each period are independent, meaning the results of previous draws do not influence the probability of future draw results.

Part 2

Part 2 of the experiment involves answering a series of questions, which will take approximately 15 minutes to complete. Some of the questions will have correct and incorrect answers. For each correct answer to questions marked with an asterisk (*), you will receive a remuneration of €0.10.

The experiment will commence once all participants have finished reading the instructions. When you have completed reading these instructions, click the "Start Experiment" button on your computer screen. Good luck!

Appendix B: Questionnaire (translated in English)

* indicates when correct answers are paid €0.10 each.

1. **Individual characteristics**
   Age in years: …
   Gender: 1 masculine, 0 feminine
   Degree level: L1, L2, L3, M1, M2, PhD (specify the year of doctoral registration)
   Field of study: arts/letters/languages/history, law, economics/management, political sciences, natural sciences, mathematics and computer science, physical sciences/chemistry, engineering sciences, human and social sciences, educational sciences, medicine/dental/pharmacy, sports science, other (specify).
   Parents professional occupation category: Farmers / Craftsmen, shopkeepers, business owner; entrepreneur / Executives / Intermediate professions / Skilled employees / Low-skilled employees / Skilled workers / Low-skilled workers)

2. **Financial education sources [AMF]**
   "What are your sources of financial education (please select all that apply):
   - Finance courses at the University
   - Information documents on financial products (product description, prospectus, website)
   - Online comparison platforms
   - Specialized media in finance (websites, radio, television, newspapers, etc.)
   - General media outlets (websites, radio, television, newspapers, etc.)
   - Social networks - excluding influencers
   - Influencers or online financial communities or well-known individuals providing investment advice
   - Banking or financial advisors
   - Bank or financial institution websites or social media pages
   - Relatives: parents, friends, colleagues
   - Websites of public savings protection authorities (AMF, ACPR)
   - Academic documents (articles, books)
   - I do not have a specific source of information

3. **Objective financial literacy* [Big 3 a) to c), Lusardi et Mitchell, 2008, d) to e) Bianchi 2018, g) PISA]**
   a) "Suppose you have €100 in a savings account, and the interest rate is 2% per annum. After 5 years, how much money would you have in the account?
   - More than €102**
   - Exactly €102
   - Less than €102
   - Don't know"

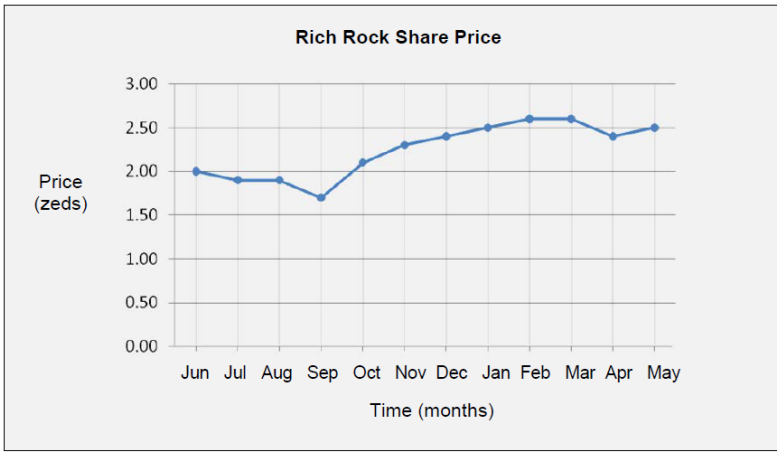
   b) "Imagine that the interest rate on your savings account is 1% per year, and inflation is 2% per year. After 1 year, how much would you be able to buy with the money in this account?
   - More than today
   - As much as today
   - Less than today**
   - Don't know"

   c) "Is the following statement true or false? 'Buying shares of a single company generally provides a safer return than a stock mutual fund.'
   - True
   - False**
   - Don't know"

d) "A share gives the right to a fixed revenue.
- True
- False**
- Don't know"

e) "Assurance vie contracts benefit from special fiscal treatment.
- True**
- False
- Don't know"

f) "The chart below shows the stock price performance of Rich Rock over the last 12 months."



"Based on this graph, is the following statement true or false?
Rich Rock stock is up about 50% over the year.
- True
- False**
- Don't know"

4. Subjective financial literacy [Bianchi, 2018]

a) "In terms of correct answers to the previous 6 questions, where do you think you stand compared to the average of the other respondents?
- Above the average
- At the level of the average
- Below the average"

b) "On a scale of 0 to 6, how would you rate your level of financial knowledge?"

5. Questions on influencers [AMF]

a) Do you follow the investment recommendations of influencers? [Yes/No]
b) If so, do you give more importance to the influencer if they have a high number of followers? [Yes/No]
c) Do you follow the investment recommendations of influencers from private discussion forums (e.g., Reddit) or private social networks (e.g., Facebook groups)? [Yes, private discussion forums; Yes, private social networks; No]

6. Risk aversion [Bianchi, 2018]

"You have two options: (a) win 400 euros for sure vs? (b) win 1000 euros with a 50% chance and zero otherwise. Which one would you choose?"

If (a) is chosen, a choice between (c) win 300 euros for sure and (d) win 1000 euros with a 50% chance and zero otherwise is offered.

If (b) is chosen, a choice between (e) win 500 euros for sure and (f) win 1000 euros with a 50% chance and zero otherwise is offered.

Risk aversion takes the value of 4 if (a) and (c) are chosen, 3 if (a) and (b) are chosen, 2 if (b) and (e) are chosen, and 1 if (b) and (f) are chosen.

7. Self-assessed risk tolerance [Dohmen *et al.*, 2011]

"How willing are you to take risks, in general? (scale of 0 to 10).

8. Propensity for mimicry [Apesteguia *et al.*, 2020]

a) "When I buy a new smartphone (or laptop), I usually read all test reports and then decide for the best one even if none of my friends has such a phone." I agree with this statement, on a scale from 0 to 5, at ...

b) How do you see yourself: Are you generally a person who follows the lead of others? (scale of 0 to 5)

9. Investment

a) "Which of the following financial instruments do you currently hold or have you held in the past? Please tick all that apply:

1) Stocks
2) Bonds
3) Equity Savings Plan
4) Livret A
5) Home Savings Account or Plan (CEL-PEL)
6) Other savings accounts
7) Retirement plans
8) Annuities
9) Mutual fund or SICAV
10) Bitcoins
11) Cryptos
12) Options/Warrants
13) Other (please specify)."

b) "How do you typically consult your positions and make decisions (purchase, sale) related to these financial instruments?

- Online banking platforms/app
- Online financial platforms/app
- Mobile phone platforms/app
- Other (please specify)"

c) "How often do you typically make decisions or consult your positions related to these financial instruments?

- At least once a day
- At least once a week
- At least once a month
- At least once a quarter
- At least once a year
- Less often"

10. Video games and social networks experience

a) "For each of the medias proposed below, indicate the average time you spend on your participation in online video games by selecting the appropriate option:"

Online video games media	Several times a day	Once a day	Between 2 and 6 times a week	Once a week	Less often
Computer					
Video games console					
Smartphone/tablet					

b) Are you registered with online video game platforms (for example Roblox, Battle.net, Rockstar Games Launcher,…) or do you practice cloud gaming?

Yes No

c) Do you participate in online video games at a competitive level (e-sport)?

Yes No

11. Cognitive abilities [a) to c), Frederick, 2005, d) Falk et al, 2018]

a)* A bat and a ball cost $1.10 in total. The bat costs $1.00 more than the ball. How much does the ball cost? _____ ***cents*** [Correct answer 0,05€]

b)* If it takes 5 machines 5 minutes to make 5 widgets, how long would it take 100 machines to make 100 widgets? _____ ***minutes*** [Correct answer 5 minutes]

c)* In a lake, there is a patch of lily pads. Every day, the patch doubles in size. If it takes 48 days for the patch to cover the entire lake, how long would it take for the patch to cover half of the lake? _____ ***days*** [Correct answer 47 days]

12. « I am good at math »

[Scale of 0 to 10]

13. Preferences for competition [Fallucchi *et al.*, 2020]

"Choose the scale to which the following statement describe you;

Competition brings the best out of me"

[7-points Likert scale: 1 « Not at all like me » to 7 « Exactly like me"]

Appendix C: Pairwise correlations of main variables (significance under parenthesis)

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) Risk	1.000							
(2) Gender	-0.056	1.000						
	(0.285)							
(3) Age	0.016	-0.024	1.000					
	(0.756)	(0.644)						
(4) Financial Literacy (Obj)	0.050	-0.167	-0.010	1.000				
	(0.344)	(0.001)	(0.846)					
(5) FL_"Do Not Know"	-0.048	0.014	-0.006	**-0.458**	1.000			
	(0.365)	(0.791)	(0.911)	**(0.000)**				
(6) Financial Literacy (Sbj)	-0.082	**0.352**	-0.032	-0.275	0.199	1.000		
	(0.119)	**(0.000)**	(0.537)	(0.000)	(0.000)			
(7) Risk aversion (Bianchi)	**-0.261**	**0.150**	0.096	-0.093	0.048	0.096	1.000	
	(0.000)	**(0.004)**	(0.068)	(0.077)	(0.355)	(0.068)		
(8) Risk tolerance (Dohmen)	**0.246**	**-0.211**	0.007	0.083	-0.076	**-0.208**	**-0.518**	1.000
	(0.000)	**(0.000)**	(0.899)	(0.115)	(0.146)	**(0.000)**	**(0.000)**	
(9) Imitindex	0.087	0.059	0.036	-0.006	-0.029	0.036	0.008	-0.010
	(0.096)	(0.263)	(0.493)	(0.902)	(0.575)	(0.496)	(0.877)	(0.853)
(10) CRT	0.075	**-0.204**	0.010	**0.264**	-0.090	-0.063	-0.091	0.033
	(0.150)	**(0.000)**	(0.855)	**(0.000)**	(0.084)	(0.233)	(0.081)	(0.528)
(11) Math	**0.164**	**-0.299**	-0.004	**0.190**	-0.039	**-0.322**	-0.132	0.149
	(0.002)	**(0.000)**	(0.941)	**(0.000)**	(0.462)	**(0.000)**	(0.012)	(0.004)
(12) Competition	0.079	**-0.280**	0.008	-0.003	-0.084	**-0.248**	-0.138	**0.279**
	(0.131)	**(0.000)**	(0.885)	(0.954)	(0.108)	**(0.000)**	(0.008)	**(0.000)**
(13) Degree_Level	0.064	-0.037	**0.579**	0.061	-0.014	-0.076	0.106	-0.023
	(0.226)	(0.480)	**(0.000)**	(0.247)	(0.794)	(0.147)	(0.042)	(0.662)

Variables	(9)	(10)	(11)	(12)	(13)
(9) Imitindex	1.000				
(10) CRT	0.076	1.000			
	(0.146)				
(11) Math	0.060	**0.425**	1.000		
	(0.252)	**(0.000)**			
(12) Competition	-0.041	0.062	**0.272**	1.000	
	(0.432)	(0.240)	**(0.000)**		
(13) Degree_Level	0.024	0.086	0.063	-0.076	1.000
	(0.649)	(0.102)	(0.230)	(0.145)	