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Dishonesty, Reputation, Competition, Financial Markets, Experiment

JEL codes:

C91, D01, G41, M21

The Way People Lie in Markets*

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September 18, 2019

Abstract

In a finitely repeated game with asymmetric information, we experimentally study how reputation and standard market mechanisms change the nature of fraudulent announcements by experts. While some lies can be detected *ex post* by investors, other lies remain deniable. Lying behavior suggests that individuals care more about the *consequences* of being caught, rather than the act of lying *per se*. Allowing for reputation reduces the frequency of lies that can be detected but has no impact on deniable lies: individuals simply hide their lies better and fraud persists. Competition without reputation increases risky lies and never protects investment.

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1 Introduction

Motivation. “Capitalism is based on self-interest and self-esteem; it holds integrity and trustworthiness as cardinal virtues and makes them pay off in the marketplace, thus demanding that men survive by means of virtue, not vices.” This quote from A. Greenspan (1967) highlights a central tenet of an economic system based on free trade: trust and honesty in economic transactions. Trust and honesty are fundamental in financial markets where investors rely on the ethics of banks and financial advisers that benefit from private information about the expected returns of investments (*e.g.*, Guiso et al. (2008); Gennaioli et al. (2015); Gurun et al. (2018)). In fact, such reliance is widespread: Hung et al. (2008) estimate that 73% of investors consult a financial adviser before buying shares, and Egan et al. (2019) indicate that 56% of American households ask financial professionals for advice.

Yet, financial misconduct is not rare. In financial markets fraud can take the form of dishonest schemes, promises of unrealistic returns, or book cooking (*e.g.*, Cooper and Frank (2005); Mullainathan et al. (2012); Piskorski et al. (2015); Brown and Minor (2016); Anagol et al. (2017)). After building a large dataset of financial advisers in the United States from 2005 to 2015, Egan et al. (2019) found that about seven percent of advisers have misconduct records, and this percentage goes up to 15 percent at some of the largest advisory companies. In short, fraudulent behavior is a pervasive feature of the industry. This misconduct is costly: Grasshoff et al. (2017) estimate that the penalties and legal costs from misconduct cases inflicted to banks represent about USD 321 billion since 2008.¹ The cost of scandals for investors, as a result of direct or indirect investment losses, is also fairly large, though more difficult to estimate.²

Frauds are frequent not only because of their expected financial return, but also because they are detectable only to varying degrees. Some will almost surely be detected, for example the creation of fake bank accounts, as in the 2018 Wells Fargo scandal, or Ponzi schemes like in the 2008 Madoff scam. But others are deniable, for example inflated earnings announcements by companies (Roychowdhury, 2006; Beyers et al., 2010), or a purposeful increase in the complexity of financial disclosures (Zhe Jin et al., 2018). Financial scandals have occurred in companies benefiting from a high reputation and in a highly competitive context (*e.g.*, Enron, Lehman Brothers, WorldCom, Deutsche Bank). This is surprising since losing reputation entails large costs and competition is expected to resolve the conflict of interest between sellers and customers by reducing gains from lying (*e.g.*, Bolton et al. (2007)).

In this paper we experimentally study the *nature* of lies by project managers, and evaluate how the introduction of reputation and competition affect the kinds and frequency of lies that

¹See also the report on misconduct risks in the financial sector by the Financial Stability Board to the G20 leaders (FinancialStabilityBoard (2017)).

²For example, in the Madoff scandal, the size of direct wealth losses was estimated around \$17 billion but Gurun et al. (2018) estimate that the reduction in investment due to the trust shock was around \$430 billion, implying that the losses of direct victims represent less than 4% of the liquidation of risky assets. Graham et al. (2002) evaluate the impact of financial scandals on the economy. They estimate that the Enron and subsequent accounting scandals led to a reduction of the U.S. GDP between 0.2 and 0.5% over a one-year period and between 1.05 and 2.5% over ten years.

project managers make. In our setting, project managers are privately informed about the quality of their financial products, and have to attract uninformed investors to invest with them, which gives them an incentive to exaggerate the announced expected returns of investment. Investors have some chance of discovering fraudulent announcements *ex post*, which depends on the nature of these lies. Indeed, the market itself delivers *ex post* transparent information about the actual return of projects. Thus, lies become identifiable when realized outcomes are incompatible with the announcements. But in other cases, realized outcomes do not contradict the announcements, making lies *deniable*. In such a context, does the introduction of reputation-building increase truth-telling? Is the threat of investors exiting the market enough to “police” the market?³ Or does reputation simply change *how* project managers lie, and make them shift from detectable to deniable lies? Does competition increase truth-telling? Or does it lead project managers to make more risky lies to look more attractive compared with their competitors? Is reputation a necessary complement to allow competition to reduce the prevalence of lies?⁴

The Experimental Design. Involving 579 subjects in total, our laboratory experiment uses a finitely repeated Investment Game with asymmetric information in which project managers announce the likely return of their funds to investors. More precisely, the project manager receives three cards that represent a portfolio of projects. Each card has an independent 0.5 probability of displaying a star, indicating a successful project. The number of cards displaying a star is the project manager’s private information. The project manager makes a cheap-talk announcement to the investor on his number of true stars. After observing the announcement, the investor decides whether or not to invest his endowment with the project manager. Finally, Nature draws one of the project manager’s three cards. Both the project manager and the investor see the face of the card Nature draws. Whether or not there is a star on the drawn card determines the success or failure of the investment. Thus, it is mutually profitable for the project manager and the investor if he invests when the state of nature is good (there are “many” stars among the three cards), but interests are not aligned when the state is bad (there are “few” or no stars among the three cards).

The message space of project managers, richer than a dichotomous “invest / do not invest” message space, allows us to identify four types of lies. “**Extreme**” lies lead to outcomes inconsistent with the announcement: reporting three stars when the truth is zero. These lies are detected *ex post* with certainty. “**High Risk**” and “**Low(er) Risk**” lies lead to outcomes that can be inconsistent with the announcement, for example reporting three stars when the truth is one or two. These lies are detected ex-post with a high (67.7%) and low(er) probability (33.3%), respectively. “**Deniable**” lies lead to outcomes that are always consistent with the announcement, for example reporting two stars when the truth is zero or one. These lies can never be detected since

³For example, [Wilson and Wu \(2017\)](#) and [Bernard et al. \(2018\)](#) show that having the option to walk away affects cooperation between players in prisoners’ dilemma and gift exchange games.

⁴For example, [Brown et al. \(2004\)](#) show that in competitive labor markets reputation is necessary to increase punishment effectiveness on cooperation.

both a blank card and a card with a star are consistent with a 2-star announcement. Thus, our design allows the project manager to choose the “intensity” of the lie he can tell.

We compare behavior across four treatments. In the “**Random Pairs**” (baseline) treatment, at the beginning of a new period, each project manager is randomly rematched with an investor. In this setting, there is no competition and no possibility of reputation building with a given investor. In the “**Fixed Pairs**” treatment, pairs remain fixed throughout the session. This setting allows project managers to build a reputation with their investor. It also allows investors to update their beliefs regarding the honesty of their project manager. In the “**Random Triplets**” treatment, each investor is matched with two project managers who compete to attract the investor’s money, as the investor can only invest with one of them. Importantly, each project manager has his own portfolio, only knows the expected return of his own portfolio, and communication with the investor is simultaneous. Finally, in the “**Fixed Triplets**” treatment, triplets remain fixed throughout the session. This treatment allows us to measure the combined effects of reputation and competition on the frequency and nature of lies.

The Results. Our results show evidence of widespread dishonesty. Reputation significantly reduces the overall frequency of lies but is far from eliminating them: about one third of announcements remain fraudulent. However, it does fundamentally change the way informed players lie: reputation eliminates Extreme and High Risk lies and reduces the relative frequency of Low(er) Risk lies, but it has no effect on Deniable lies. In other words, it does not make project managers more honest, it simply leads them to change the nature of their lies so as to lower their likelihood of being identified as liars when they are in fixed relationships with the investor. Competition, instead of encouraging more honesty, can lead project managers to take more risks to attract investors.

Investors are frequently able to detect false announcements. Adding reputation increases the likelihood of investing, as it makes announcements more credible. In contrast, competition can decrease investment when there is no reputation. An important difference in the Fixed Pairs and Fixed Triplets treatments, (*i.e.*, comparing treatments where reputation is present but competition may or may not be) is related to investor behavior after a detected lie. In the Fixed Pairs treatment, investors punish project managers by exiting the market. In contrast, in the Fixed Triplets treatment, they stay in the market and switch to investing with the other project manager. This results in a higher level of investment in the Fixed Triplets treatment compared with the others.

Overall, given the investors’ preferences revealed in a prior game with truthful announcements, reputation decreases the relative frequency of two types of “mistakes:” investing when one should not and not investing when one should. Although exaggerated announcements help risk averse people invest in situations where they should (in view of higher expected benefits), the analysis of strategies and earnings never supports the paternalistic view according to which project managers lie to the benefit of investors. Using data from a series of additional tasks, we also reject the view that project manager behavior is driven by concerns for efficiency, social preferences, or a high

score in manipulativeness. Instead, the nature of lies respond to the institutions in place. Our main conclusions are robust to the introduction of an indefinite time horizon in the game.

Relation to prior literature. Beyond contributing to the literature on misconduct in the financial sector (*e.g.*, Cohn et al. (2014); Pool et al. (2016); Anagol et al. (2017); Gibson et al. (2017); Egan et al. (2019)), we contribute to three other literatures. First, we contribute to the study of lying and reputation. Compared to extant studies, our focus is on the *nature* of lies, and whether allowing for a richer set of lies impacts behavior in different market environments. Second, we contribute empirically to the literature on cheap talk, competition and reputation. Third, since our analysis could apply to a wider range of markets than the financial market, we contribute to the debate in economics on whether or not market mechanisms erode morals (Falk and Szech, 2013; Bartling et al., 2015).

How and when individuals lie has been studied both in individual decision-making contexts as well as in situations where strategic considerations play a role. The main empirical results regarding lying in individual decision-making contexts is that even when there is no scrutiny, no negative externalities to lying on another subject and lies are profitable, not all individuals lie, most liars do not lie in full, and the size of lies does not necessarily increase with the level of incentives (see the meta-analysis of Abeler et al. (2019)). Likewise, in games of strategic information transmission *à la* Crawford and Sobel (1982), empirical investigations have found that subjects often tell the truth.⁵

The main models put forward to explain these patters are that (1) people suffer from lying aversion because of self-image concerns;⁶ and (2) people care about how others (the experimenter or the person they are paired with) think of them: people suffer from perceived cheating aversion, have reputational costs of lying or suffer from guilt aversion and tend to keep their promises because they do not want to let others down.⁷ Depending of the degree of these aversions, individuals may not lie at all or only partially lie.

Our results suggest that the intrinsic cost of lying may play very differently in games in which subjects interact with one another and can make lies with different levels of detectability. First, we find that the reputational costs associated with the probability that a statement is perceived to be dishonest do not play a large role in our setting: a large majority of subjects make lies that can be detected by another player. That is, subjects take actions whose consequences go beyond being *perceived* as a liar: they are *identified* as liars. What determines the frequency of such lies is whether or not project managers are in fixed matches with investors who in turn punish detected liars. In short, we find that a large majority of subjects show little concern about being exposed as a liar if they can avoid the direct negative consequences of such behavior. Models in which players primarily care either about their self-image or their perceived image are at odds with this

⁵Empirical investigations include Austen-Smith (1993); Khrisna and Morgan (2001); Battaglini (2002); Gneezy (2005); McGee and Yang (2013); Vespa and Wilson (2016); Rantakari (2016); Li et al. (2016); Schmidbauer (2017).

⁶See, for example, Mazar et al. (2008); Shalvi et al. (2011); Fischbacher and Föllmi-Heusi (2013).

⁷See, for example, Charness and Dufwenberg (2006); Kajackaite and Gneezy (2017); Dufwenberg and Dufwenberg (2018); Gneezy et al. (2018); Abeler et al. (2019); Kholmetski and Sliwka (2019).

commonly observed behavior.

In addition, we find that costs of lying are not necessarily related to the distance between the true state of the world and what is reported. Indeed, our experiment allows for sizes of equal magnitude to have different probabilities of detection. Lies in which project managers go from seeing 1 star to announcing 3 (lies of magnitude 2), which are detectable with a 66% chance, happen far more frequently in the absence of reputation (where investors cannot directly punish a liar) than in its presence. Lies in which project managers go from seeing 0 stars to announcing 2 stars (also lies of magnitude 2), which cannot be detected, are not affected by the market structure. In short, deniable lies are uniform across treatments while those that can be detected are not, even if the “size of the lie” is identical. Thus, in our setting, “how much to lie” depends on whether there are costly consequences to getting caught, rather than the magnitude of the lie itself.

Can truth-telling ever be sustained empirically in an environment with strategic interactions? In a framework with multiple senders and a multi-dimensional model, [Vespa and Wilson \(2016\)](#) show that even where full revelation is an equilibrium, partial revelation is the norm. [Wilson and Vespa \(2019\)](#) demonstrate that in an indefinitely repeated game with fixed partners, honesty has to be rewarded for truth-telling to be sustained, even if it is an equilibrium. In our setting, dishonesty is easier to conceal, leading our subjects to favor dishonest schemes, even in our indefinitely repeated treatment. By allowing for a richer set of lies, our experiment allows experts to modulate how they lie. Our results suggest that the relative low frequency of lying in some sender-receiver games may be due to the binary nature of information transmission, where a receiver cannot verify information, or can always know whether a lie has occurred. In other words, the breadth in the types of lies that individuals can make has behavioral implications that span both finitely and indefinitely repeated games.

The question of whether (dis-)honesty or morality fluctuate with the environment has been the focus of recent work. For some, by their fundamental nature, markets erode moral norms (see for example [Sandel \(2012\)](#) and [Falk and Szech \(2013\)](#) who show that market mechanisms lead people to violate their own moral standards). On the other hand, others have insisted on the role of culture ([Bartling et al. \(2015\)](#)), social norms ([Bartling and Ozdemir \(2017\)](#)), the diffusion of responsibility ([Kirchler and Sutter \(2016\)](#)) or the degree of consumers’ dishonesty-aversion ([Pigors and Rockenbach \(2016\)](#)), in explaining moral conduct.

The empirical work on credence goods markets and on trust and other games shows that in that context institutions matter. The main sets of results on credence goods are that in contrast to liability, reputation and verifiability (the obligation for the seller to charge the price corresponding to the quality delivered) have little effect on the honesty of transactions, and competition between providers even increases underprovision of services ([Dulleck and Kerschbamer, 2006](#); [Dulleck et al., 2011](#); [Schneider, 2012](#); [Balafoutas et al., 2013](#); [Beck et al., 2014](#); [Mimra et al., 2016](#); [Rasch and](#)

Waibel, 2018).⁸⁹ On the other hand, in a Trust Game, Huck et al. (2012) identifies the joint role of identifiability and competition in the management of moral hazard. As long as trustors can identify trustees, competition among trustees is sufficient to achieve almost full efficiency, while adding reputation through information on the full history of play offers no improvement.^{10,11}

Our results on the impact of competition on honesty parallels those described above, suggesting that the “downside” of competition exists in a broad range of markets, particularly when there is no verifiability or identifiability.¹² Indeed, in the absence of reputation, competition never reduces lying and in fact can increase the rate of risky lies by project managers. On the other hand, reputation has a clear impact in our setting: it lowers fraudulent behavior, though not uniformly across all types of lies. The frequency of detectable lies is dampened, but deniable lies, which cannot be detected, are just as prevalent as they are without reputation. In short, traditional market mechanisms fail to root out fraud in our setting, perhaps because verifiability is only one-sided: an investor cannot ever know if the project manager told the truth, but may find out if he lied. These results have crucial implications for increasing trust-building especially in financial markets, as they show the importance of reinforcing reputation mechanisms, but also the need for more severe audit regulations and increased responsibility of advisers in order to limit the prevalence of deniable lies.

The remainder of the paper is as follows. Section 2 describes our experiment. In Section 3 we introduce our main hypotheses. In Section 4 we analyze the data and present several robustness tests. Finally, in Section 5 we discuss our results relative to the literature on honesty, as well as in the context of financial markets outside the laboratory.

2 Design and Procedures

2.1 Design

The Investment Game

The Investment Game has a finite, but unknown, horizon. Subjects are informed that they will play this game for a minimum of 20 and a maximum of 40 periods. We introduced such

⁸In contrast, theoretical studies have found that in markets with verifiability, if consumers process information on the market conditions, competition should solve the fraudulent expert problem (Emons, 1997). Even without verifiability, agents who do not observe the same information transfer more information to the principal as their number increases (Li et al. (2016)).

⁹In a different setting, Feltovich (2018) shows that by manipulating the strength of competition between firms, competition and dishonesty are mutually reinforcing.

¹⁰In contrast, other studies considering only the role of reputation through feedback on past behavior without competition have found a positive impact of reputation on efficiency (*e.g.*, Charness and Garoupa (2000); Bohnet et al. (2005) for sequential games with moral hazard and Grosskopf and Sarin (2010) for Trust Games).

¹¹Manipulating the strength of competition between firms, Feltovich (2018) shows that competition and dishonesty are mutually reinforcing.

¹²In particular, in contrast to credence goods our investors know which quality they prefer for a given cost and the quality of the realized project is observable *ex post*. In addition, the fraudulent nature of announcements is only sometimes recognized.

uncertainty to avoid end game effects. The actual number of periods was actually fixed at 27 in all sessions. It is common knowledge that the total number of periods and the period randomly drawn for payment have been determined before the beginning of the experiment. At the end of the session subjects learn which period was randomly selected for payment; the decisions made in this period determine the subject’s payoff in the Investment Game. The game was played in four between-subject treatments: the Random Pairs treatment (which constitutes our baseline), the Fixed Pairs treatment, the Random Triplets treatment and the Fixed Triplets treatment. We describe each treatment successively.

Random Pairs Treatment: This treatment corresponds to a setting without reputation and without competition. Half of the subjects are randomly assigned the role of a project manager (“participant A” in the instructions, see [Appendix A](#)) and the other half the role of an investor (“participant B”). Roles are fixed throughout this part. In each period, a project manager (PM, hereafter) is matched with an investor and pairs are randomly rematched at the beginning of each new period. We now describe the timing of each period.

(i) First, Nature randomly draws a set of three cards for each PM. The cards convey information on the quality of the PM’s projects. Each card has a (independent) 0.5 probability of displaying a star, which indicates a successful project. If the card does not display a star, it is blank. Only the PM can observe his three cards and see how many of display a star. The total number of stars τ is then in the $\{0, 1, 2, 3\}$ set.

(ii) Then, the PM sends a cheap-talk message m to the investor regarding the number of cards that display a star, where $m \in \{0, 1, 2, 3\}$. Although this possibility is not stated in the instructions, m can differ from τ : a PM can misreport the number of stars observed to motivate the investor to invest.

(iii) The investor receives an endowment of 100 tokens. After observing m , the investor decides on an action $a \in \{Invest, Not\ Invest\}$. If $a = Invest$, the entire endowment has to be invested.

(iv) Nature randomly draws one of the PM’s three cards, which determines the quality of the selected project, $\theta(\tau) \in \{Star, No\ Star\}$. If the selected card displays a star, the investment is a success; if the card is blank, it fails.

(v) Finally, both the PM and the investor learn θ , regardless of whether the investor invested or not. A history box is also displayed on the subjects’ screen. This history box lists (m, a, θ, π^i) for each past period. The past values of τ are only part of the history box for the PMs and investors never learn τ .

The PM’s payoff is state independent and determined entirely by a :

$$\pi^{PM}(a) = \begin{cases} 30 & \text{if } a = \text{Not Invest} \\ 230 & \text{if } a = \text{Invest} \end{cases}$$

The PM earns a fixed amount of 30 tokens plus 200 tokens if the investor invests, regardless

of θ , the quality of the selected project.¹³

The investor's payoff is state dependent and also depends on a :

$$\pi^I(a, \theta) = \begin{cases} 100 & \text{if } a = \text{Not Invest} \\ 30 & \text{if } (a, \theta) = (\text{Invest}, \text{No Star}) \\ 300 & \text{if } (a, \theta) = (\text{Invest}, \text{Star}) \end{cases}$$

If he does not invest, the investor earns his initial endowment (100 tokens). If he invests in a failed project, his net payoff is 30 tokens. If he invests in a successful project, his net payoff is 300 tokens, triple of the amount invested. Thus, interests are aligned when the initial state of nature is good (*i.e.*, so long as $\tau \geq 1$ since a perfectly informed risk neutral investor should rationally invest if the set of cards includes at least one star). But they are unaligned when it is bad: when $\tau=0$, PMs would like the investor to invest, but by doing so the investor would lose most of his endowment.

Fixed Pairs Treatment. This treatment allows us to isolate the impact of reputation-building on truth-telling and investment. The rules are similar to those of the baseline, except that the PM and the investor remain in a fixed pair throughout all the periods of the Investment Game.

Random Triplets Treatment. This treatment allows us to isolate the impact of competition between project managers on truth-telling and investment. In this treatment, two thirds of the subjects are assigned the role of PM (participants "A1" and "A2" in the instructions) and one third of the subjects are assigned the role of investor. In each period, two PMs are randomly re-matched with one investor. In other words, triplets are reshuffled at the beginning of each period. Nature randomly and independently draws three cards for each PM ($\tau^{PM1} \in \{0, 1, 2, 3\} \perp \tau^{PM2} \in \{0, 1, 2, 3\}$), and a PM can only observe his own set of cards. Then, simultaneously, each PM sends a message to the investor (m^{PM1}, m^{PM2}). After receiving the two messages, the investor decides on an action $a \in \{\text{Not Invest}, \text{Invest with } PM_1, \text{Invest with } PM_2\}$. Then, Nature randomly draws one of the three cards from each PM: $\theta(\tau)^{PM1} \in \{\text{Star}, \text{No Star}\} \perp \theta(\tau)^{PM2} \in \{\text{Star}, \text{No Star}\}$. Finally, both the PMs and the investor are informed on whether the two cards randomly drawn (one for each PM) show a star or not. The history box shows the two PMs' announcements, whether the two selected cards displayed a star or not, whether the investor invested and with which PM, as well as that player's payoff. In addition, each PM also saw his past values of τ .

The investor's payoff is determined as in the Random Pairs treatment: if he does not invest he earns his endowment (100 tokens); he earns 300 tokens if he invests in a successful project and 30 if he invests in a failed project. A PM earns 230 only if he is selected by the investor, otherwise

¹³This captures both the high share of variable pay in the earnings of advisers in financial institutions and the fact that variable pay depends on the ability to sell given products, not on the success of these products.

he earns 30 tokens. The PM's payoff is modified as follows:

$$\pi^{PM_i}(a) = \begin{cases} 30 & \text{if } a \in \{\text{Not Invest, Invest with PM}_j\} \\ 230 & \text{if } a = \text{Invest with PM}_i \end{cases}$$

Fixed Triplets Treatment. This treatment allows us to measure the combined effects of reputation and competition on truth-telling and investment. The rules are similar to those of the Random Triplets treatment, except that the same two PMs and investor remain matched together in a fixed triplet in all the periods of the Investment Game.

The Simplified Investment Game

The outcome of the investment involves compound lotteries and we know that individuals may face difficulties calculating the return of an investment with such compound lotteries (*e.g.*, Abdellaoui *et al.* (2015)). To facilitate subjects' understanding and to better understand their risk preferences, before subjects play the Investment Game we implemented a simplified version of it in which subjects are paired with a truth-telling computer.¹⁴ All subjects play the role of an investor and they play 16 such periods as practice.¹⁵

After the practice periods, subjects make decisions that can each matter for payment. Subjects have to decide on whether to invest or not in *each* of four scenarios corresponding to $\tau = (0, 1, 2, 3)$. At the end of the session, the program selects three cards for each subject, determining the relevant scenario. It then draws one of these three cards and computes the payoff of the subject corresponding to his action in the realized state θ . This determines the subject's payoff in the Simplified Investment Game.

Social Preferences and Other Individual Characteristics

In the Investment Game, decisions may be influenced by social preferences. Therefore, it is important to control that the subjects have the same distribution of social preferences across treatments. To assess whether this is the case, directly following the Investment Game, subjects play the Allocation Game. In both Pairs treatments (Fixed and Random Pairs), in each round of the Allocation Game, subjects are paired randomly. In each pair one subject has the role of the X player and the other has the role of the Y player. Roles and partners are assigned randomly and independently from the roles and pairs assigned in the Investment Game. All the subjects have to make 15 decisions as player X under the veil of ignorance. Then, a random draw assigns a role to each subject and selects one decision for payment. Only the decisions of the X players matter

¹⁴The rules are the same regardless of the treatment implemented in part 2, and subjects are not aware of the rules for part 2 when they play the Simplified Investment Game.

¹⁵Subjects are informed on the probability of observing each number of stars among the three cards. Moreover, to facilitate learning, the program was built such that all the subjects can experience the distribution of probabilities in the practice periods: in two periods the three cards show no stars, in six periods they show one star, in six periods they show two stars, and in two periods they show three stars, all displayed in a random order at the individual level.

for payment. In the Triplets treatments (Fixed and Random Triplets), there are three roles, X, Y and Z, and all subjects make 18 decisions as X players under the veil of ignorance. In all cases, the order in which the decisions are presented to the subjects is randomized at the individual level. In each round, the X player has to choose between two allocations that determine payoffs for himself as well as the person (or people) he is matched with. All rounds are detailed in Table C1 in Appendix C.

Finally, we administer the Machiavellianism (Mach IV) test to collect a psychological measure of manipulateness. Subjects have to report how much they agree or disagree with each of 20 statements on a 7-point scale. Then, they receive a feedback on their payoffs in each part and answer to a standard socio-demographic questionnaire. All the Mach IV questions are in Appendix A.

2.2 Procedures

We first describe the experimental flow. In Part 1 of the experiment, subjects participate in the Simplified Investment Game. In Part 2 they play 27 periods of the Investment Game. In Part 3 subjects participate in the Allocation Game. In Part 4 subjects take the Mach IV test. Finally, subjects answer a standard socio-demographic questionnaire.

The experiment was run at the GATE-Lab in Lyon, France. A total of 579 participants (56.65% of female) were recruited via HRoot (Bock et al., 2014) mainly among students from local engineering, business and medical schools. We ran 18 sessions for the main experiment: 4 sessions with 84 subjects in the Random Pairs treatment, 4 sessions with 78 subjects in the Fixed Pairs treatment, 5 sessions with 117 subjects in each of the Triplets treatments. We also ran two robustness treatments (for a total of ten sessions with 183 subjects), which we describe in Section 4.7. The experiment was programmed using z-Tree (Fischbacher, 2007).

Upon arrival, subjects randomly drew a ticket from an opaque bag indicating their terminal number. The instructions for each part were distributed at the beginning of each part and read aloud. Sessions lasted about 1.5 hour. Subjects were paid the sum of their payoffs in the first three parts: the payoff for the payoff-relevant decision in the Simplified Investment Game, the payoff for one randomly chosen round in the Investment Game, and the payoff for one randomly chosen round in the Allocation Game. Subjects were informed on their payoff in each part only at the end of the session. In addition, subjects received a 5-Euro show-up fee. The average earnings were 17.78 Euros. Subjects received their earnings in cash and in private in a separate payment room at the end of the session they participated in.

3 Predictions

3.1 No behavioral types

Selfish preferences

As in other cheap talk games, there are multiple equilibria in our Investment Game. We show

that with risk-neutral players with selfish motives and no behavioral types, truth-telling cannot be supported in our treatments.

Theorem 1. *In the absence of behavioral types, a truth-telling equilibrium ($m = \tau$) cannot be supported in the Fixed Pairs, Random Pairs and Random Triplets treatments, and babbling equilibria always exist. In these treatments, project managers do not make announcements that lead to no investment ($m > 0$), and a risk neutral investor invests in all periods. A sufficiently risk averse player never invests.*

Proof. In expectation, investors are always better off investing than not.¹⁶ Therefore, in the last period, project managers do not send a signal that leads to no investment (or reduces its likelihood), so truth-telling leads to a lower payoff than not telling the truth. Consequently, payoffs in last period are given. The same rationale applies to the period before last, and to the previous ones. \square

Theorem 2. *In the Fixed Triplets treatment, truth-telling can be sustained for some number of periods that depends on how many periods a subject believes are left.*

Proof. Here we describe how such “temporary” truth-telling can be sustained. During the truth-telling phase the investor invests with the PM who makes the highest announcement (assuming it is greater than 0). After the truth-telling phase he invests with the PM who was most likely to have told the truth during the truth-telling phase. Intuitively, if there are sufficiently many periods left, PMs will prefer to tell the truth and sacrifice early investment in order to increase the likelihood of later guaranteed investment. The full proof is in [Appendix B](#). \square

The role of preferences for efficiency

We note that if we assume that subjects have preferences for efficiency, then investment occurs in every period. Indeed, investment coincides with the efficient choice, regardless of the true number of stars. Thus, preferences for efficiency also lead to investment in every period and the PM announcements are irrelevant.

3.2 Behavioral Conjectures

However, behaviorally, project managers may be reluctant to tell lies, especially if these lies may be detected, and investors may react adversely to detected lies. Therefore, we consider the following behavioral conjectures.

Behavioral Conjectures for Project Managers. Project managers avoid making lies:

- because project managers have a preference for being honest: they have a fixed cost of lying (pure lying aversion);

¹⁶Indeed, it is profitable to invest when at least one star is drawn: the expected profit from investing with $\tau=1$ is 120 ($= (300 \cdot 0.33 + 30 \cdot 0.67)$), which is higher than the certain payoff of 100 if one does not invest. Investors do not observe τ but the expected number of stars being 1.5, they should always invest except when $m=0$.

- because they have a preference for being seen as honest by the investors (they suffer a reputational cost if investors see them as being dishonest).
- because they care about the material consequences of being caught lying.¹⁷

Behavioral Conjecture for Investors. Investors punish project managers after a detected lie.

4 Results

Our results are organized as follows. We start by showing that our data do not support the predictions of a model with no behavioral types, whether subjects have “selfish” preferences or preferences for efficiency. After doing so, we analyze the project managers’ announcements and test whether the nature of lies is affected by competition and reputation. We then turn to investor behavior and study investment decisions as a function of announcements as well as punishment strategies in reaction to detected lies. We analyze investors’ earnings and refine the analysis of the PMs’ motivations. Finally, we describe and report the results of our “indefinite time horizon” and “no communication” robustness treatments.

In the main text we report the results of non-parametric tests. To construct these statistics we first average values at the individual level, and then across individuals; thus, tests are run using a single observation per individual and they are two-sided except when otherwise specified. In all that follows, unless otherwise stated, the p -values when comparing across treatments are the results of Mann-Whitney rank-sum tests, and the p -values when comparing within treatment are the result of Wilcoxon matched-pairs signed-ranks tests. Our results are confirmed via the use of regressions with standard errors clustered at the session or individual level, with or without controls for observables and/or social preferences and Machiavelian measures. In the interest of space, in [Appendix D](#) we only report a subset of these regressions, though any additional ones are available upon request.

4.1 Overall lying and investment behavior

The top panel of [Table 1](#) presents statistics on how frequently project managers lie as well as how early in the game lying happens. In the bottom panel, we show the fraction of subjects who never or always invest.

We start by pointing out that the vast majority of subjects lie by the end of the game. These fractions range between 83.3% and 97.4%, for a weighted average of 92.2%. Thus, our first observation is that few subjects exhibit lying aversion that would outweigh the perceived benefits of lying.

The data presented in [Table 1](#) also allow us to reject the predictions of [Theorems 1 and 2](#). [Theorem 1](#) is clearly rejected by looking at investor behavior. Indeed, according to its predictions,

¹⁷The combination of the first two arguments is in line with the recent models of [Abeler et al. \(2019\)](#); [Gneezy et al. \(2018\)](#); [Khalmetski and Sliwka \(2019\)](#) on preferences for truth-telling in individual decision-making tasks.

Table 1: Lying and Investment Rates Across Treatments

Treatments	Random Pairs	Fixed Pairs	Random Triplets	Fixed Triplets
Project Managers				
Fraction of untrue announcements	50.4%	30.5%	60.1%	33.2%
Fraction who lie in the first period	21.4%	15.3%	47.4%	28.2%
Fraction who lie within the first 5 periods	73.8%	69.2%	85.9%	69.2%
Fraction who lie by the last period	83.3%	97.4%	92.3%	92.3%
Investors				
Fraction of subjects who never invest	0%	0%	2.6%	0%
Fraction of investors who always invest	2.4%	0%	7.7%	12.8%

a given subject should only behave in one of two ways: risk-neutral subjects (as well as subjects with a “low enough” level of risk aversion) should always invest, whereas those who are moderately or very risk averse should never invest. Yet, as the bottom two rows of Table 1 show, we do not observe many subjects who always invest, nor do we observe many subjects who never invest. Instead, most subjects invest in some periods and do not invest in others. This behavior is also inconsistent with preferences for efficiency, as described in Section 3. Theorem 2 as well is rejected as PMs in the Fixed Triplets treatment do not lie less often than in all other treatments, even at the beginning of the game.¹⁸

Incidentally, it is interesting to note that in both Triplets treatments a high proportion of PMs lie starting from the very first period of play (47.4% in Random Triplets and 28.2% in Fixed Triplets). That is, PMs lie before they learn anything about a possible discrepancy between the announcement and the drawn card of their competitor. This rules out that the high fraction of liars in these treatments is due to subjects learning about the “norms of dishonesty” in the population.

Result 1: On average, 92% of subjects lie at least once, showing a very small fraction of truth-tellers. However, the data are not consistent with a “standard” theory with no behavioral types in which subjects only care about their expected earnings or have preferences for efficiency.

Overall, the treatment differences visible in Table 1 suggest behavioral responses of our subjects, which we explore in detail in the remainder of our results.

¹⁸A series of tests of proportions comparing the Fixed Triplets treatment with the others shows that whether in the first or first five periods, the fraction of lies is no different than in the Random or Fixed Pairs treatments ($p > 0.10$ in all cases) and that it is only lower than the Random Triplets treatment (the highest p -value is $p = 0.053$).

4.2 A Typology of Lies

Before exploring how PMs’ announcements depend on what they observe, we start by presenting the empirical and expected distribution of announcements in Table 2. This gives an overview of the difference in PM behavior compared with what is expected in each of the four treatments. In particular, the fraction of “low” announcements (0 or 1 stars) is significantly lower than the fraction of “high” announcements (2 or 3 stars), when they should be equal if PMs told the truth ($p < 0.001$ in all 4 treatments).¹⁹

Table 2: Distribution of Announcements

Treatments	Random Pairs	Fixed Pairs	Random Triplets	Fixed Triplets	Expected Distribution
0 Stars Announced	3.7%	6.7%	4.3%	6.9%	12.5%
1 Star Announced	11.4%	21.3%	6.9%	19.5%	37.5%
2 Stars Announced	47.7%	53.5%	43.8%	52.5%	37.5%
3 Stars Announced	37.2%	18.5%	45.0%	21.1%	12.5%
<i>Total</i>	<i>100%</i>	<i>100%</i>	<i>100%</i>	<i>100%</i>	<i>100%</i>
Mean Announcement	2.2	1.8	2.3	1.9	1.5

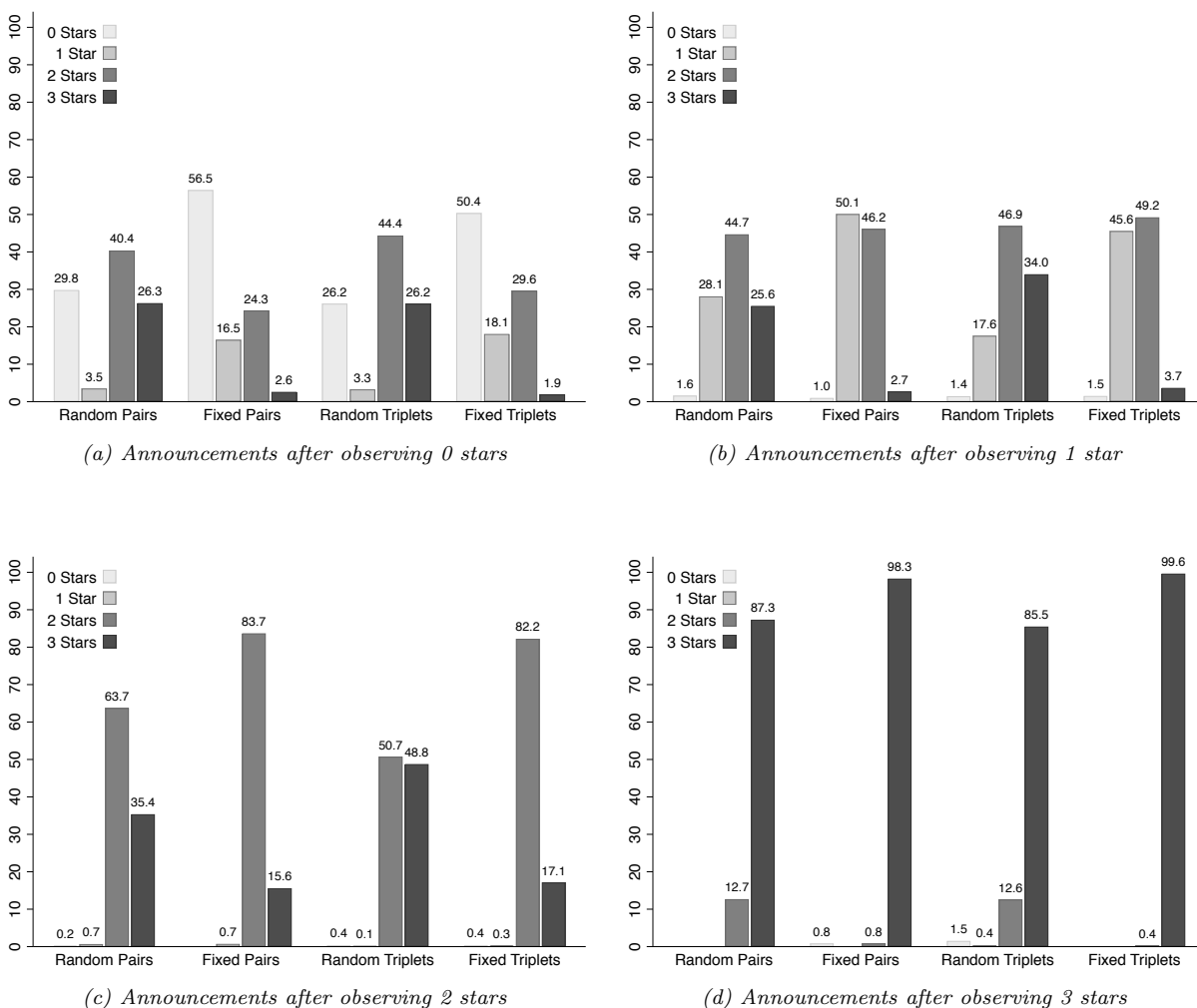
More informative perhaps is relating announcements to the true number of stars observed. We present evidence that PMs’ lies are not uniform and instead vary based on both the treatment and the number of true stars observed. For each treatment, Figure 1 displays the distribution of announcements after observing 0, 1, 2 and 3 stars (Subfigures 1a, 1b, 1c and 1d). It makes obvious that the magnitude of lies is greatly impacted by how many stars were actually observed and on the treatment. For example, in the Fixed Pairs and Triplets treatments, after observing 0 stars (Subfigure 1a), 24.3% and 29.5% of announcements, respectively, are of 2 stars (lies of magnitude 2). In contrast, after observing 1 star (Subfigure 1b), lies of magnitude 2 occur only 2.7% and 3.7% of the time, respectively, in these treatments. Lies of magnitude 1 are also more common after observing 1 star (Subfigure 1b) than after 2 stars (Subfigure 1c). For example in the Fixed Pairs treatment, these fractions go from 46.2% to 15.6%, and in the Fixed Triplets from 49.2% to 17.1%. This suggests that when PMs decide on which announcement to make, strategic considerations dominate a possible moral cost of lying that would be measured by the size of the lie.

To show that PMs adapt their lying behavior to the environment they face, we categorize lies into four mutually exclusive types. “**Extreme**” lies are lies that will be detected *ex post* with 100% certainty (*i.e.*, announcing 3 stars when one has none); “**High Risk**” lies are lies that will be detected *ex-post* with probability 2/3 (*i.e.*, announcing 3 stars when one has only 1); “**Low(er) Risk**” lies are lies that will be detected *ex-post* with probability 1/3 (*i.e.*, announcing 3 stars when one has only 2); “**Deniable**” lies are lies that cannot be detected *ex-post*, *i.e.*, announcing

¹⁹Here we calculate the probability of an announcement greater or equal to 2 for each subject and then compare the sample proportion to 50% using a test of proportion.

2 stars when one has observed fewer than 2, or announcing 1 when one has observed none.²⁰

Figure 1: Distribution of announcements conditional on the observed number of stars, by treatment.



The top panel of Table 3 shows the fraction of times subjects make such lies for each treatment, appropriately conditioned on the true observed number of stars (for example, for Extreme lies we look at cases when a subject actually saw no stars and calculate the fraction of times that subject made an extreme lie). In other words, we focus on the intensive margin of lies. The bottom panel of this Table shows the fraction of subjects who engage in each type of lies at least once (extensive margin).

The only market mechanism that leads to a decrease in lies is reputation. However, this is not uniform across all types of lies. Indeed, the impact of reputation is dramatic in terms of Extreme

²⁰There is another category of lies: “Downward” lies, *i.e.*, announcing fewer stars than actually observed. For the sake of concision we do not comment on them, as they are uncommon across subjects and seldom happen (see Figure 1).

Table 3: A Typology of Lies – Intensive and Extensive Margins

Treatments	Random Pairs	Fixed Pairs	Random Triplets	Fixed Triplets
<u>Intensive Margin</u>				
Extreme Lies	25.0%	1.4%	28.3%	1.8%
High Risk Lies	25.6%	2.5%	33.1%	3.4%
Low(er) Risk Lies	34.6%	16.3%	49.1%	16.7%
Deniable Lies	43.4%	45.5%	46.7%	47.2%
<hr/>				
<u>Extensive Margin</u>				
Extreme Lies	39.5%	2.7%	49.3%	6.6%
High Risk Lies	52.1%	12.8%	73.1%	21.8%
Low(er) Risk Lies	64.3%	48.7%	85.9%	50.0%
Deniable Lies	81.4%	94.9%	85.9%	88.5%
<hr/>				
Detectable Lies	69.0%	48.7%	89.7%	55.1%

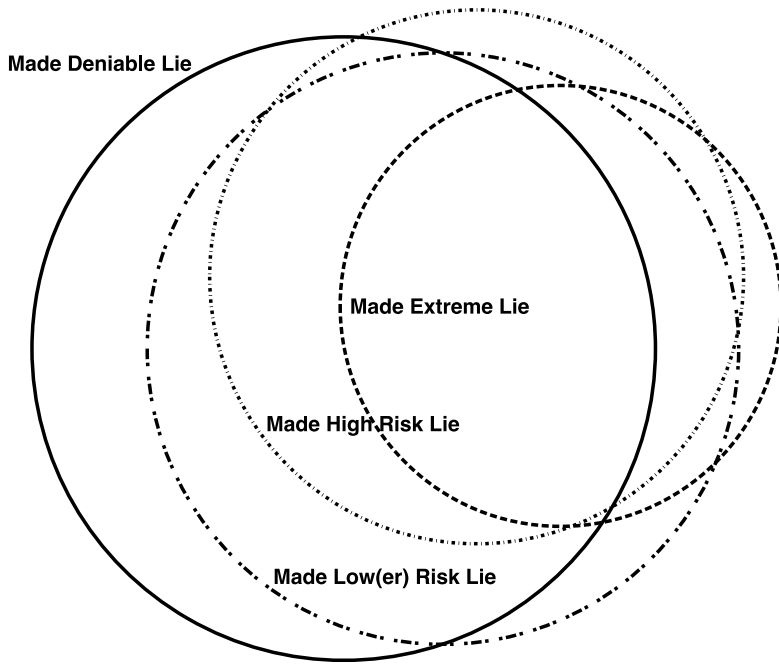
Note: The intensive margin is given by the fraction of times subjects make lies in each treatment, conditioned on the true observed number of stars. The extensive margin is given by the fraction of subjects who engage in each type of lies at least once.

lies, as it practically eliminates them, both at the intensive and extensive margins. While a non-negligible portion of PMs engage in High Risk lies when they can build a reputation (12.8% and 21.8% in the Fixed Pairs and Triplets treatments, respectively), the frequency at which they do so is quite low, and significantly lower than in the absence of reputation (25.6% versus 2.5% in the Pairs treatments and 33.1% versus 3.4% in the Triplets treatments — $p < 0.001$ in both comparisons). We see less of an effect of reputation on Low(er) risk lies: while fewer subjects engage in these lies in the Fixed treatments compared with the Random treatments, almost half of subjects still make at least one such lie, and on average make them in one in every six opportunities they have.

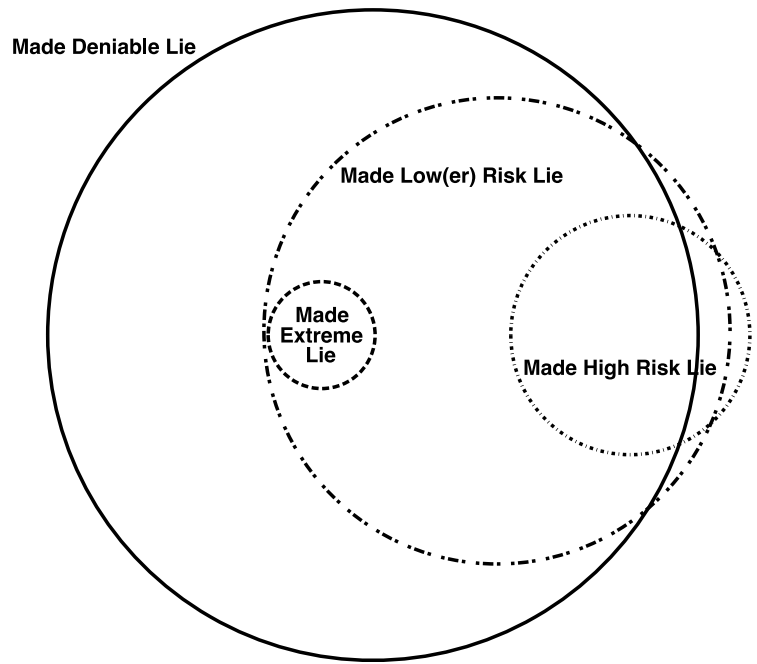
In the last row of this Table we show the fraction of subjects who make at least one detectable lie (that is, make at least one Extreme, High Risk or Low(er) Risk lie). The fraction of subjects who make such lies at least once is relatively high in all treatments, including in the presence of reputation: 48.7% and 55.1% of subjects (in the Fixed Pairs and Fixed Triplets treatments, respectively) are willing to risk their reputation at least once. These fractions are even higher in the treatments without reputation (and reach up to 89.7% in the presence of competition).

The prevalence of Deniable lies, on the other hand, is entirely unaffected by the presence of reputation ($p > 0.10$ in all pairwise comparisons), and is above 40% in all treatments. This high level of prevalence is not the result of the average of some subjects who consistently make them and others who never do. Rather, we note that a large majority of subjects engage in them at least once (between 81.4% and 94.9% depending on the treatment), and that reputation does not

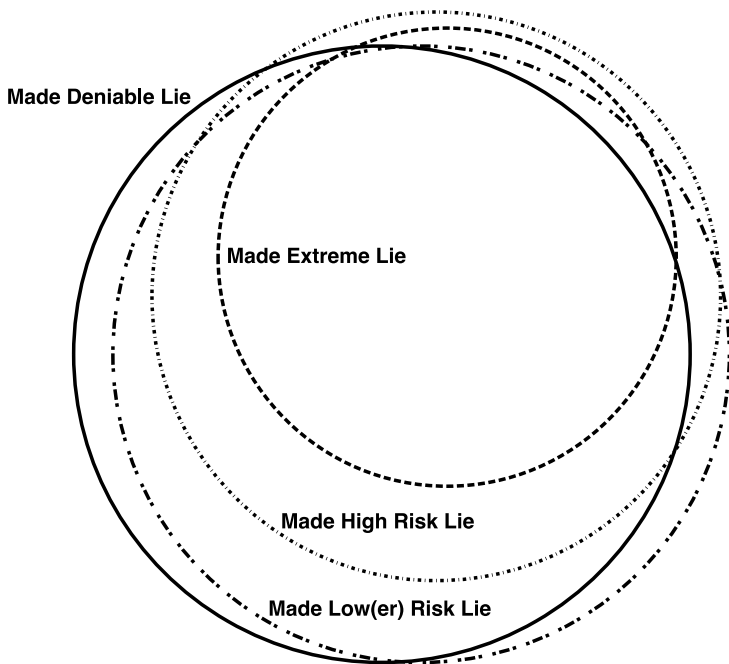
Figure 2: Venn Diagrams Representing the Types of Lies Project Managers Make (drawn to proportion relative to Deniable lies)



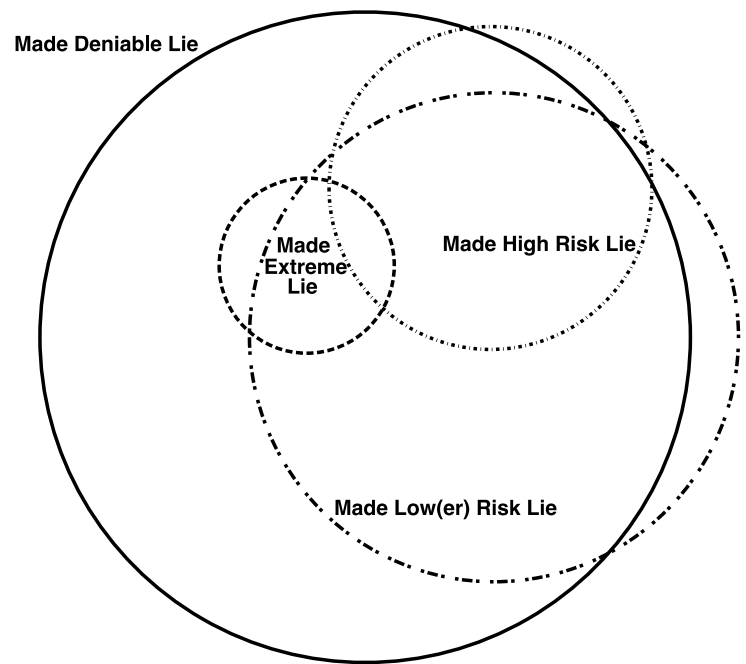
(a) Random Pairs



(b) Fixed Pairs



(c) Random Triplets



(d) Fixed Triplets

decrease their extensive margin.^{21,22}

What about the role of competition? While reputation changes the nature of lies in stark ways across treatments and leads to less lying overall, we see that competition never reduces any of the four types of lies. In fact, it can even increase some lying, as is the case in the absence of reputation when looking at the intensive and extensive margins of Low(er) risk lies ($p = 0.027$ and $p = 0.006$), or the extensive margin of High Risk lies ($p = 0.023$). In the other situations, it has no statistically significant impact.

In order to better understand the different types of lies individual subjects are willing to make, we built Figure 2, which displays a series of Venn diagrams, each drawn to proportion, showing the overlap in the types of lies subjects make relative to Deniable lies. These diagrams allow us to present within-subject patterns of lying. Comparing panels 2a and 2b, as well as panels 2c and 2d, we note two large differences. First, adding reputation shrinks the fraction of subjects who make detectable lies, whether Extreme, High Risk or Low(er) Risk ($p < 0.064$ in both sets of comparisons). Second, in the Reputation treatments there are far more subjects who only make Deniable lies ($p < 0.001$ in both sets of comparisons). This confirms that at the subject level, the presence of reputation shifts the nature of lying among PMs.

Result 2 summarizes the analysis of project managers' announcements.

Result 2: There are large treatment differences regarding when and how PMs lie. Reputation protects investors against extreme and high risk lies, but less against lies that have a lower risk of detection, and not at all against deniable lies. Competition does not eliminate lies and tends to increase less risky lies. At their highest level, 90% of the PMs in the Random Triplets treatment make detectable lies at least once, but “only” 48.7% of PMs in the Fixed Pairs treatment. This suggests that how much PMs value not being detected as a liar depends on the possible consequence of the detection on their reputation, rather than the detection *per se*.

4.3 Detectability of Lies and Credibility of PMs

Project managers' lies are frequently discovered by investors. This occurs when Nature draws a blank card after a 3 star announcement. Table 4 reports the frequency with which subjects in each treatment detected a lie, as well as the fraction of PMs who get caught and how early lies are detected on average.²³

Our data shows that in the Random treatments, without the presence of reputation, investors are very frequently aware that they have been lied to, as would be expected given PM announcement behavior. Reputation drastically lowers the number of times investors detect a lie: the percentage of investors who never detect a lie increases from 4.8% to 66.7% in the Pairs treatments and from 0 to 35.9% in the Triplets treatments.²⁴ While fewer PMs get caught than

²¹Tests of probabilities are both above 0.10.

²²These analyses are confirmed by regressions, as reported in Table D1 in Appendix D.

²³If both PM lied in a period in the Triplets treatments, this counted as a single lie.

²⁴ $p < 0.001$ in Fisher exact tests (non-aggregated distribution).

Table 4: Distribution of the Number of Periods an Investor has been Lied to and Knows it

Treatments	Random Pairs	Fixed Pairs	Random Triplets	Fixed Triplets
Never	4.8%	66.7%	0%	35.9%
1-3 times	38.1%	25.7%	2.6%	46.2%
4 time or more	57.2%	7.7%	97.4%	18.0%
% PM who get caught	71.1%	32.4%	84%	43.2%
Period first lie detected (average)	6.8	11.9	6.2	10.0

Notes: In the Triplets treatments, for comparability, we count a lie across PMs. So, if in a period an investor can tell he has been lied to by at least one PM, this will count as one lie. If both PMs lie, this still counts as one lie. Regarding the fraction of PMs who get caught, this is conditional on having seen 0 stars at least once.

without reputation, a significant fraction of subjects in our Fixed treatments discover that the PM they are matched with (or one of the PMs in the case of the Fixed Triplets treatment) has in fact lied to them: the fraction of PMs who get caught is substantial at 32.4% and 43.2% in the two treatments. Further, in addition to lowering the instances of detected lies, reputation delays detection, though this detection is still relatively early in the game: on average, periods 11.9 and 10 in the Fixed Pairs and Triplets treatments, *vs.* 6.8 and 6.2 in the Random Pairs and Triplets when reputation is absent.²⁵

How credible are individual announcements? We now turn to how investors react to various announcements knowing that some are fraudulent. Table 5 shows how frequently subjects invest for a given announcement, as well as the fraction of subjects who invested in the Simplified Investment Game where announcements were truthful.²⁶

Before analysing the impact of market structure on the credibility of announcements, we note that there are no treatment differences in how subjects behaved in the Simplified Investment Game. In particular, investment rates are statistically no different in the face of one-star announcements, ruling out that subjects in the different treatments had different tolerances towards risk.²⁷

Regardless of the market structure, when announcements are low (0 or 1 star), investors generally find them credible and invest at similar rates compared with the Simplified Game: they almost never invest when the announcement is 0 and do so infrequently when it is 1.

Credibility is an issue in all treatments after a 2-star announcement. Neither reputation nor competition lead to investment levels consistent with those under truthful revelation. Indeed, investors invest significantly less than they did in the Simplified Game, realizing that such an-

²⁵ $p < 0.012$ in Fisher exact tests.

²⁶In the Triplets treatments the announcements refer to the highest announcement across both PMs in a triplet. There are periods when both PMs announced the same number of stars: this happened in 38.6% and 36.2% of the periods in the Random and Fixed Triplets treatments, respectively. In the Triplets treatments, investors can choose to invest with the PM who did not announce the highest number of stars: this happened in 15.6% and 4.5% of periods where an investment took place in the Random and Fixed Triplets treatments, respectively.

²⁷The p-values on tests of proportions in all pairwise comparisons are above 0.10.

Table 5: Investment in the Investment and Simplified Investment Games, by Treatment

Treatments		Random Pairs	Fixed Pairs	Random Triplets	Fixed Triplets
0 stars announced:	% Investment Game	0.0% (25)	0.0% (30)	0.0% (3)	0.0% (6)
	% Simplified Inv. Game	2.4%	0.0%	0.0%	0.0%
1 star announced:	% Investment Game	11.4% (40)	9.0% (38)	0.0% (6)	15.6% (28)
	% Simplified Inv. Game	11.9%	7.7%	17.3%	15.4%
2 stars announced:	% Investment Game	65.1% (42)	72.6% (39)	58.3% (39)	73.6% (39)
	% Simplified Inv. Game	92.9%	97.4%	96.0%	92.3%
3 stars announced:	% Investment Game	77.4% (42)	92.3% (39)	66.4% (39)	92.6% (39)
	% Simplified Inv. Game	100%	97.4%	97.3%	97.4%

Notes: The Table shows the fraction of times investors invest in the Investment Game on the first line, and in the Simplified Investment Game on the second line (where announcements were truthful). In the Triplets treatments the announcements refer to the highest announcement across both PMs in a triplet. The number of subjects who faced a particular announcement is indicated in parentheses.

nouncements can, in fact, be (deniable) lies.²⁸

On the other hand, reputation significantly impacts how investors react to 3-star announcements relative to behavior in the Simplified Investment Game. With or without the presence of competition, reputation protects investment levels compared with behavior in the Simplified Investment Game.²⁹ In other words, with reputation, subjects behave no differently than if they knew the 3-star announcement was truthful.

Investors' investment behavior is summarized in Result 3.

Result 3: Investors are frequently able to detect lies. Low level announcements are found to be credible. However, investors understand that 2-star announcements may be fraudulent. Reputation leads to behavior consistent with that under truthful revelation when 3 stars are announced, and investment levels are protected. Competition, in contrast, never protects investment levels.

4.4 Punishment After Discovering a Lie

Figure 3 shows how subjects invest in the period directly following a detected lie in both the Pairs treatments (panel 3a) and Triplets treatments (panel 3b).³⁰

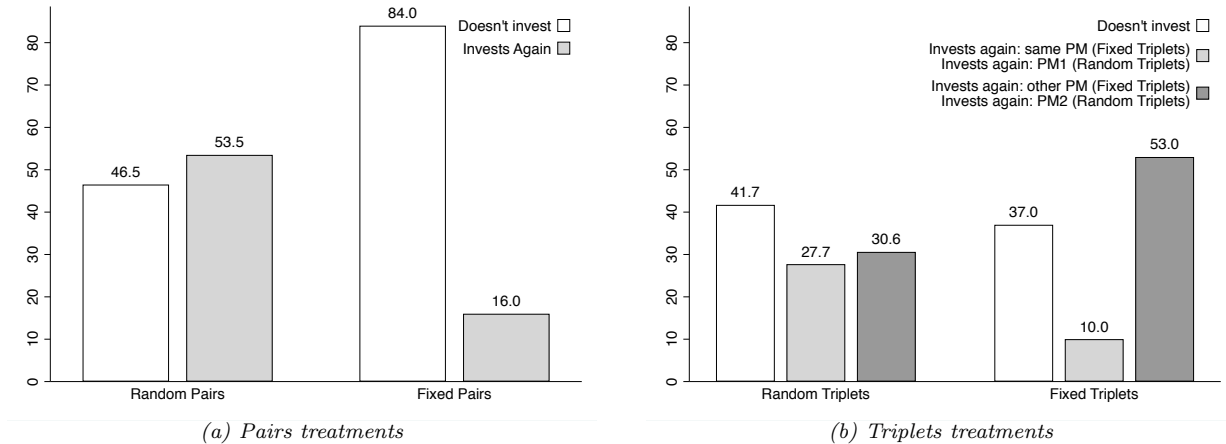
In the Random Pairs treatments, following a detected lie the average investment rate is 53.5%, compared with a 62.1% investment rate in periods after no lie was detected. At the individual level, subjects are no less likely to invest after a lie than after a period in which no lie was detected

²⁸ $p < 0.001$ in all treatments.

²⁹ $p=0.267$ and 0.564 , when comparing behavior with that in the Simplified Investment Game, in Fixed Pairs and in Fixed Triplets, respectively. When reputation is not present, investment drops compared with behavior in the Simplified Investment Game ($p < 0.001$ in both Random Pairs and Random Triplets).

³⁰To keep treatments comparable, we did not consider periods after which both PMs were discovered to have lied. This type of event is quite rare: 2.66% of periods in Random Triplets and 0.09% in Fixed Triplets.

Figure 3: Investment rates in periods directly following a detected lie.



($p = 0.104$). Thus, investors do not punish the current PM if the PM in the previous match was identified as a liar, showing no evidence of immediate indirect punishment.

In contrast, when matching is fixed, following a detected lie, the average investment rate is 16% compared with 58.4% when no lies were detected. At the individual level, subjects are significantly less likely to invest with a detected liar ($p = 0.013$). This is the case even though the average announcement following a detected lie is no lower than the average announcement following an announcement not detected as a lie ($p = 0.861$). This provides an explanation as to why PMs in Fixed Pairs only seldom make Extreme and High Risk lies: investors punish liars.

In the Random Triplets treatment, following a detected lie the average investment rate is 58.3% compared with 65.7% in periods following no detected lie. While the magnitude of the difference in average investment is not large, significantly more subjects lower their likelihood of investing rather than increase it, which suggests some indirect punishment in this treatment ($p = 0.005$).

In the Fixed Triplets treatment, following a detected lie 63% of subjects invest again, a fraction statistically no different than 73.5%, the investment rate after periods in which no lie was detected ($p = 0.389$). However, investors are significantly less likely to invest with the project manager who just lied, and the likelihood of reinvesting with that same PM is only 10% ($p = 0.003$). That is, in contrast with the Fixed Triplets treatment instead of exiting the market, they shift to investing with the PM who was not revealed to be a liar in the previous period. Here as well, we can rule out that this difference is due to lower announcements by the PM who just lied, compared with the announcement of the “non-lying” PM ($p = 0.412$). Thus, when reputation is present competition allows subjects to punish liars without exiting the market.

Finally, an extreme form of punishment is “permanent” exit. For each subject, we identify the final period they invested in and compare it across treatments. Table 6 shows the fraction of investors who exit before the 15th, 20th and 25th periods as well as average investment rates over the course of the game.

Table 6: Fraction of investors who permanently exit markets and average investment rates.

	Random Pairs	Fixed Pairs	Random Triplets	Fixed Triplets
% who exit before 15th period	2.4%	2.6%	12.5%	2.6%
% who exit before 20th period	4.8%	7.7%	15.4%	2.6%
% who exit before 25th period	14.3%	23.1%	28.2%	2.6%
Average investment rate	60.%	57.6%	63.5%	77.9%

It is only in the Fixed Triplets treatment that investors continue to participate in the market until the end: indeed, only 2.6% of subjects no longer invest by the 25th period in that treatment, compared with between 14.3% and 28.2% in the others.³¹ Thus, while competition does not make PMs more truthful, it does allow investors to punish a PM who lied and was detected *without* exiting the market. This directly translates into a higher level of overall investment in that treatment. Indeed, regarding the average fraction of periods in which investors invest, the Random Pairs, Fixed Pairs and Random Triplets treatments are, statistically speaking, equivalent. Only the Fixed Triplets treatment has a level of investment significantly higher than the others.^{32,33}

Result 4 summarizes investors’ punishment strategies:

Result 4: When reputation is present, investors punish PMs who are caught lying by not investing with them. In the absence of competition, they do so by exiting the market in the next period. In the presence of competition, they switch to investing with the other project manager and do not exit the market. Reputation, when accompanied by competition, results in higher investment levels.

4.5 Mistakes in Investment Decisions and Earnings

We next study whether and how investors are penalized by PM behavior. We document two types of errors that asymmetric information generates. Type 1 errors describe periods in which investors do not invest, but would if they believed the announcement. Type 2 errors describe periods in which investors invest, but would not if they knew the true number of stars the PM faced. To determine whether a choice is a mistake or not, we look at whether the choice in the Investment Game is consistent with that in the Simplified Investment Game where announcements are truthful. Table 7 reports the average fraction of periods investors make Type 1 and Type 2 errors. We show these numbers for all periods without conditioning, as well as conditioning on no investment for the Type 1 errors and on investment happening for the Type 2 errors.

³¹The highest p -value in a series of pairwise comparisons of the Fixed Triplets treatment with the others is 0.061.

³²The highest p -value in a series of Rank-sum tests is $p = 0.063$.

³³These analyses are confirmed by the regressions, as reported in Table D2 in Appendix D.

Table 7: Type 1 and Type 2 Errors, by Treatment

Treatments	Random Pairs	Fixed Pairs	Random Triplets	Fixed Triplets
<i>All Periods</i>				
Type 1 Errors	23.9%	16.9%	32.5%	16.5%
Type 2 Errors	21.4%	16.5%	19.4%	19.6%
Periods with Errors	45.3%	33.4%	51.9%	36.1%
<i>Conditional</i>				
Type 1 Errors	60.8%	39.9%	89.1%	74.7%
Type 2 Errors	35.3%	28.7%	30.5%	25.1%

Notes: This Table reports the average fraction of periods an investor faces a given type of error. Type 1 errors occur when investors do not invest while they would if they had believed the announcement; Type 2 errors occur when investors invest while they would not have if they knew the true number of stars. For conditional values, these fractions are based on Type 1 errors occurring in the sole periods where investment does not happen, and on Type 2 errors occurring in the sole periods where investment happens.

Table 7 shows that both Type 1 and Type 2 errors are common. For example, in the Random Pairs treatment Type 1 errors happen in 23.9% of periods. That is, in close to 1 in 4 periods they miss out on good opportunities (in their eyes). Type 2 errors occur in 21.4% of periods in this treatment. Thus, in more than 1 in 5 periods investors are the victims of fraudulent announcements. These numbers are even more staggering if we look at the conditional fractions: 60.8% of non-investments are missed opportunities and 35.3% of investments are the result of fraudulent announcements in this treatment. Note that the fraction of mistakes across periods is at least a third in all treatments. Thus, asymmetric information leads to a high level of mistakes, even in the presence of reputation.

To what extent are investors financially penalized by PMs who lie? In the Simplified Investment Game, when announcements were truthful, on average only 16% of the investors invested when 1 star was announced, showing risk aversion. Because in expectation they would be better off financially if they did invest at 1 star, one could make the argument that by lying, regardless of their true motivations, PMs may actually help investors make “better” decisions when the truth is 1 star. To answer this question we look at earnings in the Investment Game and compare them with expected earnings if investors had known the truth, using behavior in the Simplified Investment Game to know what subjects would have done under truthful revelation.

We find that investor earnings in the Investment Game are not significantly different in the Random Pairs, Fixed Pairs and Random Triplets treatments, where they amount to 154.7, 154.9 and 151.0 tokens, respectively.³⁴ Investors earn substantially more in the Fixed Triplets treatment, 180.1 tokens on average, than in any other treatment.³⁵ However, in all treatments, including the

³⁴The lowest p -value on a series of rank-sum tests is $p = 0.776$.

³⁵All pairwise comparisons result in $p < 0.001$. Also, the lowest p -value in Kolmogorov-Smirnov tests comparing the distribution of earnings in the Random Pairs, Fixed Pairs and Random Triplets treatments is $p = 0.224$, and

Fixed Triplets treatment, earnings are lower than what they would be if investors knew the truth (166, 164.5, 202.5 and 201.2 in expectation in the Random Pairs, Fixed Pairs, Random Triplets and Fixed Triplets treatments, respectively).³⁶ In other words, overall, while investors may be pushed to invest more at 1 star than they otherwise would, the gains from these investments are far outweighed by the losses that come from the Type 1 and Type 2 errors that the asymmetric information generates.

Finally, although investors in all treatments are hurt by the asymmetry in information, we point out that the difference in earnings relative to a truth-telling situation is particularly large in the Random Triplets treatment. Indeed, when investors are matched with two PMs, investors are more likely to face an attractive investment opportunity. However, in the Random Triplets treatment, lying behavior results in investors implementing costly punishment strategies. Indeed, permanent exits from the market are highest in this treatment (as seen in Table 6, leading to earnings that are no higher than in either of the Pairs treatments: competition without reputation does not lead to better market outcomes for investors.

Result 5 summarizes the analysis of investors' errors and earnings:

Result 5: Investors make frequent Type 1 and Type 2 errors in all treatments. They fare better in the Fixed Triplets treatment, but in all treatments clear and large losses arise from the lack of transparency.

4.6 On the True Motivation of Project Managers

In this section we provide evidence that PMs' actions are not guided by paternalistic motives, by preferences for efficiency, their Machiavellianism score or other observable characteristics measured in the questionnaire. Indeed, one could argue that PMs are trying to get investors to invest because they have their best interests at heart: as already mentioned, very few investors invest after a one star announcement although it is profitable in expectation.

We rule out that a majority of PMs have good *intentions* when they choose to lie. We do so by examining their behavior when they face 0 stars. In this situation, a PM knows for a fact that Nature will draw a blank card, resulting in a certain negative outcome for an investor who invests. If PMs were acting out of good will, we would not observe any lies when the true number of stars is 0, and no difference between treatments. Yet, a large majority of our subjects lie at least once when observing 0 stars. This is the case for 76.3% of PMs in the Random Pairs treatment, 62.2% in the Fixed Pairs treatment, 78.7% in Random Triplets treatment, and 68.4% in the Fixed Triplets treatment. Moreover, they do so frequently (70.1% of the times they observe 0 stars in Random Pairs, 42.8% in Fixed Pairs, 71% in Random Triplets, and 44.2% in Fixed Triplets), showing that this behavior is both commonplace and persistent.

all the p -values comparing the Fixed Triplets treatments and the others are lower than $p < 0.001$.

³⁶Signed-rank tests comparing average earnings to the earnings if investors knew the truth are at most $p = 0.031$ in those three treatments.

We also reject that preferences for efficiency are guiding project managers' announcements. First, we point out that subjects with preferences for efficiency should invest in all periods, as described in [Section 3](#). This is a behavior that we do not observe. Given the random assignment of the roles of PM and investor, we can assume that PMs in our experiment share the same social preferences as the investors. Second, we analyze PMs' specific choices in the Allocation Game in part 3 (see [Table C1](#) in [Appendix C](#)). In this task, all but one question presented subjects with efficiency trade-offs.³⁷ A series of two-sided tests of proportions show that subjects who do or do not display preferences for efficiency in the Allocation Game are no different in terms of whether they lie in the Investment Game, or whether they lie when they face 0 stars.³⁸ In addition, using Probit and OLS regressions we further find that the number of efficient choices in the Allocation Game also has no bearing on the probability of having lied at least once, the number of lies, or having lied at least once when 0 stars were observed (see [Tables D3, D4](#) and [D5](#) in [Appendix D](#)). Thus, PM behavior is unlikely to be driven by subjects' preferences toward efficiency.

Finally, regression analyses controlling for PM characteristics (number of efficient choices in the Allocation Game, Machiavellian score and gender) lead us to rule out that innate differences in individual characteristics drives PM behavior in the Investment Game. No clear pattern emerges regarding the impact of individual characteristics on a subject's probability of having lied at least once, the number of lies, or having lied at least once when seeing 0 stars, or making a detectable or Deniable lie (see [Table D1](#) in [Appendix D](#) for example). Thus, we state our last result as follows:

Result 6: Project managers' behavior is not driven by paternalism, preferences for efficiency or innate personality traits such as Machiavellianism. Instead, project managers' probability of lying is primarily determined by the market institutions they face and the consequences of their lying.

4.7 Robustness Tests

We ran two additional treatments to test the robustness of our results and better interpret them. In particular, in our main treatments the time horizon is uncertain but finite and this could explain that competition with reputation does not further reduce lying. In our first robustness treatments, we introduce an indefinite horizon in the Fixed Triplets treatment that supports the emergence of a truth-telling equilibrium. In our second robustness treatment, we remove communication in the Fixed Pairs treatment and measure the extent to which communication improves investors' earnings despite PM biases.

³⁷We note the caveat that choices in the Allocation Game might have been influenced by the events faced in the Investment Game.

³⁸The smallest p -value is $p = 0.195$ when looking at whether answering all Allocation Game questions in a way that is consistent with preferences for efficiency impacts the probability of lying.

Indefinite Horizon Fixed Triplets Treatment We recruited an additional 111 subjects for six sessions of the Indefinite Horizon Fixed Triplets treatment, using the same protocol as for the main treatments. This treatment introduces an indefinitely repeated game in the Fixed Triplets treatment. Subjects play 20 periods for sure after which we induce a $\delta = 0.85$ continuation probability in each period. It was also made common knowledge that subjects would be paid for one of the first 20 periods with $p = 0.75$ and one of the remaining periods with $p = 0.25$.^{39,40}

The data in the Indefinite treatment closely match those in the original Fixed Triplets treatment. On the project managers' side, the proportion of PMs who ever lie in the Indefinite treatment is not significantly different than in the Fixed Triplets treatment (90.5% *vs.* 92.3%, respectively, $p=0.697$). The proportion of PMs who participate in Extreme, Risky, Low(er) Risky and Deniable lies are no different either (5.4% in the Indefinite treatment *vs.* 6.6% in the Fixed Triplets treatment, 18.9% *vs.* 21.8%, 47.3% *vs.* 50.0%, and 87.8% *vs.* 88.5%, respectively (the smallest p -value is 0.660)). On the investor side, investors invest as frequently in both treatments (71.5% of periods in the Indefinite treatment *vs.* 77.8% in the Fixed Triplets treatment, $p=0.134$). They react to specific announcements similarly. When facing a 1 star announcement, investment rates are 7.1% *vs.* 15.6%, respectively ($p=0.203$). After a 2 star announcement, they are 68.8% *vs.* 73.6% ($p=0.631$). After a 3 star announcement, they are 89.8% *vs.* 92.6% ($p=0.702$). Also, the pattern of permanent exit of the market is similar: 0% *vs.* 2.6% drop out before the 15th period ($p=0.327$), and 5.9% *vs.* 2.6% drop out before the 25th period ($p=0.538$).⁴¹ Finally, investors' earnings are no different: 174.7 *vs.* 180.1 ($p=0.374$).

In summary, we find no statistical differences between the Indefinite treatment and the Fixed Triplets treatment. Thus, our results are not due to the finite nature of our setting: lying is common regardless, PMs continue to engage in a high proportion of Deniable lies, and investors are hurt even in an indefinitely repeated setting.

No Communication Random Pairs Treatment We recruited an additional 72 subjects for four sessions of the No Communication treatment (again using the same protocol as in the main treatments). This treatment was designed to test how investment behavior and earnings are modified in the absence of communication between project managers and investors. The No Communication treatment introduces two changes in the Random Pairs treatment. First, in each of the 27 periods of the Investment Game in the No Communication treatment, PMs still observe the three cards they are dealt but they take no action, and the investor has to make a decision

³⁹ This allows us to obtain at least 20 periods, just as in the Fixed Triplets treatment, and keep an exponential discount rate and stationarity with periods still reasonably likely to be played, even in the first 20 certain periods. The actual duration of the Investment Game in our six sessions was 21, 23, 25, 27, 30 and 33 periods in these sessions. We thank Alistair Wilson for the suggestion. For a presentation of various methods to introduce indefinite horizon in the lab, see Fréchet and Yuksel (2017).

⁴⁰ We acknowledge that in a laboratory setting subjects can anticipate that the game will not last forever, which may differ from the exact conditions of the theory. This being said, previous studies have shown how subjects in the lab change their behavior in indefinitely repeated and finitely repeated games of the same expected length, as predicted by theory (*e.g.*, Dal Bó (2005) on cooperation in Prisoners Dilemma Games).

⁴¹ When looking at the drop-out rate before the 25th period, we only include the Infinity sessions that had at least 27 periods, so that they are comparable to the Fixed Triplets treatment.

as to whether invest or not without facing any announcements. Second, in part 1 in addition to asking subjects how they would invest for various truthful announcements in the Simplified Investment Game, they play an 18th period where they have to decide whether to invest or not without knowing the content of the three cards.

Our results are the following. First, there are differences in the type of investment behavior that we observe across treatments. While in the Fixed Pairs treatment 0% of subjects either always invest or never invest, in the No Communication treatment, these fractions are significantly higher: 11.1% and 5.6%, respectively.⁴²

In the absence of information, how do subjects choose whether to invest or not? The investment decision in the Simplified Investment Game when subjects must choose whether to invest in a project without knowing the success rate is a strong predictor of how frequently investor invests in the Investment Game, as well as of the probability that an investor invests in any given period. This is true also controlling for any combination of the following: (1) whether a star was drawn in the previous period, (2) the running average of successful projects up to the current period, (3) the number of efficient choices in the Allocation Game, (4) an indicator as to whether a subject showed preferences for efficiency in the Allocation Game, (5) their Machiavellian score.⁴³ In other words, the primary identifiable driver of investment absent communication are subjects' risk preferences.

Finally, we find that earnings are substantially lower in the No Communication treatment: 137.4 tokens *vs.* 154.9 in the original Fixed pairs treatment (Rank-sum test: $p = 0.016$). This can be at least partially explained by the fact that absent communication, investors often invest when it is not profitable. On the other hand, when PMs can communicate, "low" announcements are credible and investors can avoid some of the bad projects.

In summary, these facts allow us to confirm that the discord between expected returns and returns given the announcements in the main treatments impacts investment behavior. In addition, investment behavior in the absence of information is mainly guided by individuals' risk preferences. This control treatment reveals that allowing for cheap talk communication does provide benefits to investors, as they are at least able to avoid investing when PMs announce 0 stars.

5 Discussion and Conclusion

In an economic environment where interest rates are very low, savings accounts usually pay mediocre monetary returns, which motivates more and more people to invest in risky assets. Given that a large fraction of individuals have low financial literacy, it is all the more important that these investors receive reliable advice from financial experts.⁴⁴ However, experts often receive

⁴²The p -values on two one-sided test of proportions are $p = 0.016$ and $p = 0.068$.

⁴³Any and all regressions are available upon request.

⁴⁴Lusardi and Mitchell (2014) reveal that a majority of people have trouble understanding financial notions such as compounding of interest rates, inflation and stock mutual funds with risk diversification. Only 34% of the respondents from a representative sample in the 2004 Health and Retirement Study in the U.S. were able to respond to three relatively easy questions (with multiple choice answers) correctly. These questions were: (1) Suppose you

sizeable bonuses that depend on their ability to attract investors and not necessarily on the success of their investments,⁴⁵ and so may be tempted to misrepresent their portfolio’s expected return. This type of misconduct is extremely difficult to measure with field data that can only document detected fraud and not the many lies that are deniable (Egan et al. (2019)).

Using a laboratory experiment we have shown that in the absence of reputation, project managers frequently make Extreme lies that will harm the investor with certainty (assuming he invests) *and* be detected. But project managers also frequently make lies that might not be detected (High Risk and Low(er) Risk lies), as well as Deniable lies that cannot be detected - precisely the type of behavior that cannot be identified with field data. This delivers two important findings: first, it is important to consider not only the prevalence of lies but also their nature; second, in a financial setting, fraudulent announcements are commonplace and the prospect of high earnings outweighs the intrinsic moral costs to lying.

These results are in sharp contrast with the literature on lying aversion based on individual decision making with no externalities. Indeed, this literature has shown the importance of pure lying aversion as well as concerns for self and social image (Fischbacher and Föllmi-Heusi (2013); Dufwenberg and Dufwenberg (2018); Gneezy et al. (2018); Abeler et al. (2019)). These explanations have also been applied to sender-receiver games with externalities. In our setting, the expected monetary benefits of lies weigh more than their associated moral costs, despite the immediate, direct and large negative externalities of lies, and the risk of being punished by investors. Indeed, if subjects care about not been perceived as liars, it is mainly for strategic reasons. For example, it is not the size of the lie that modulates a subject’s willingness to lie, but the implications that lying has on detectability and punishment. While reputation protects investors against Extreme and High Risk lies, it protects them far less against fraudulent announcements with a lower risk of detection, and it does not protect investors at all against Deniable lies. Importantly, experts do not become more honest when they have to build a reputation, they simply change the nature of their lies in order to not face the *financial costs* of being caught lying.

Our data also allow us to reject the assertion that liars are motivated by paternalistic motives, preferences for efficiency or a higher degree of Machiavellianism. Social preferences toward the investor and perceived cheating aversion have also a limited explanatory power here. Indeed, in the absence of reputation, up to 90% of project managers make lies that are detectable (Extreme,

had \$100 in a savings account and the interest rate was 2 percent per year. After 5 years, how much do you think you would have in the account if you left the money to grow: [more than \$102; exactly \$102; less than \$102; do not know; refuse to answer.]; (2) Imagine that the interest rate on your savings account was 1 percent per year and inflation was 2 percent per year. After 1 year, would you be able to buy: [more than, exactly the same as, or less than today with the money in this account; do not know; refuse to answer.]; (3) Do you think that the following statement is true or false? Buying a single company stock usually provides a safer return than a stock mutual fund. [true; false; do not know; refuse to answer.]. These findings replicate in France where our experiment was conducted (there, the percentage was 31%; see Arrondel and Savignac (2013)). Such low financial literacy has consequences on long-term economic decisions, such as retirement plans, and on naivete on these markets. Lusardi and Mitchell (2014) report a survey of financial decision makers above 60 years old indicating that one in five of them felt they had been misled or defrauded when investing in financial markets.

⁴⁵This is the case, among others, for mutual fund managers who are rewarded for fund flows even if they do not outperform passive benchmarks. See Jensen (1968) and Berk and Green (2004), for example.

High, and Low(er) risk lies), and even when reputation building is present this fraction remains high at close to 50%.

Instead, project managers mainly respond to the institutions in place. The institutions that matter are market institutions and not “informal” institutions such as empirical norms (what people see others do in the same situation). Indeed, in the Random Triplets treatment, project managers can learn the empirical norm in the session because they are able to observe possible inconsistencies between the announcements of their competitors and the final draw of those competitors. This might contribute to lowering morality at the session level. However, a normative explanation of lying behavior cannot explain our findings because the large majority of project managers lie in all treatments and because the higher frequency of lies in the Random Triplets occurs from the very first period, before any information on the empirical norm can disseminate.

Regarding the impact of competition, we find that it does not make project managers more honest on average (and in fact, in the absence of reputation, it can have the opposite effect). By focusing on the nature of lies, we show that some lies are more likely with competition than without (lower-risk lies), while other lies are not affected by competition (extreme and deniable lies). This suggests that analyzing the impact of competition on lying behavior has to account for the nature of possible lies. Focusing only on certain types of lies can lead to different conclusions on the impact of market mechanisms on morals.

In real financial markets the turnover of financial advisers is usually high, both within and across firms, and people can easily resurface with a “new” identity. For example, [Egan et al. \(2019\)](#) show that while half of the advisers whose misconduct was exposed lose their jobs, these same advisers are often rehired by other firms. In other words, the labor market partially undoes firm-level discipline and the presumed cost of losing one’s reputation is lessened. In our experiment, reputation, *i.e.*, the traceability of one’s adviser, is necessary to lower the amount of fraud. When reputation is not present, an investor cannot immediately or directly punish a project manager whose lie he detected, and the high prevalence of lies over time reveals the limited impact of punishment by investors. When reputation is present but competition is not, investors punish detected liars by not investing in the next period and the amount of detectable fraud decreases. However, when both reputation and competition are present, investors have more options in the face of a lie. They punish liars by switching to their competitor—which decreases the amount of detectable fraud and helps maintain a relatively high level of investment, unlike in the other market settings. Overall, analyzing the nature of lies suggests that in biased expert markets, decentralized punishment is not sufficient to guarantee honest advice, precisely because of plausible deniability.

Although investors earn more when there is both reputation and competition between project managers as compared to the other treatments, the lack of transparency entails losses for investors in our experiment. This is not to say that investors would fare better without advisers: our No Information treatment shows that when there is no communication, investors earn less since they make more Type-2 errors when the state of the world is bad. Moreover, we have to remain cautious about the external validity of our findings since our experiment did not involve real

actors in financial markets. With this caveat in mind, our findings call both for the development of different incentive schemes able to increase the personal responsibility of financial advisers, more traceability of advisers, and also probably both internal codes of ethics and more centralized investigations and sanctions in case of detected fraud. As claimed in [Greenspan \(2007\)](#), *“An area in which more rather than less government involvement is needed, in my judgment, is the rooting out of fraud. It is the bane of any market system.”* (p.375).

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A Instructions

Below we present the instructions that the subjects received in our experiment (translated from French).

INTRODUCTION (All treatments)

Welcome to this experiment on decision-making. Please switch off your mobile phone and store it. You are not allowed to communicate with the other participants throughout the experiment, or we must exclude you from the experiment and from payments.

This session consists of four successive parts. The first two parts are linked but the other parts are independent. The amount earned at the end of the session is the sum of your earnings in the different parts. During the session we do not speak in Euros but in tokens. The conversion rate of tokens into Euros is:

$$100 \text{ tokens} = 5 \text{ Euros}$$

At the end of the session, your total earnings will be paid to you in cash and confidentially in a separate room.

All the decisions you will make in the session are anonymous: you will never have to enter your name in the computer.

You have received the instructions for the first part. You will receive the instructions for each part after completing the previous part.

PART 1 (All treatments)

This part consists in 17 periods. The first 16 periods are practice periods and nothing that you will decide in these periods will count for determining your payoff. The only period that counts for your payoff in this part is the 17th (and last) period. We describe below the rules and the task, but for the 16 practice periods the announced payoffs are hypothetical.

(In the No Information treatment, this paragraph was replaced with this one: This part consists in 18 periods. The first 16 periods are practice periods and nothing that you will decide in these periods will count for determining your payoff. The only periods that count for your payoff in this part are the 17th and the 18th (and last) periods. At the end of the session the program will randomly select period 17 or period 18 and your payoff in the selected period will constitute your payoff for this part. Each of these two periods has 50 chances out of 100 to be drawn. We describe below the rules and the task, but for the 16 practice periods the announced payoffs are hypothetical.)

Description of the task

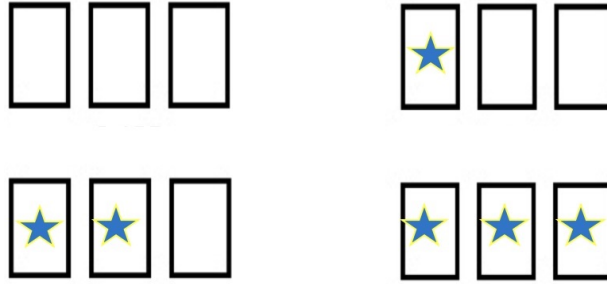
In each period, you receive an initial endowment of 100 tokens and you have to decide between keeping these tokens as the payoff of the period, or to invest them entirely in a project. If this project is a success, you earn three times the number of tokens invested, *i.e.*, 300 tokens. If this project is not a success, you earn 30 tokens.

Description of the investment project

In each period, 3 cards appear on your screen, face down. Each can hide the star symbol or be blank. Each card has 50 chances out of 100 to represent a star and 50 chances out of 100 to be blank. These chances are independent for each card.

Thus, your 3 cards can hide in total no star (which happens with 12.5 chances out of 100), in total 1 star (which happens with 37.5 chances on 100), in total 2 stars (what happens with 37.5 chances on 100), or in total 3 stars (which happens with 12.5 chances out of 100).

You have to press the "Reveal" button to discover your three cards. Depending on the case, the cards will always appear in the following format:



After revealing them, you have to choose whether you invest or not your 100 tokens. After you have made your choice, the program draws one of your three cards, each card having the same chance of being drawn (so, each card has a 1 in 3 chance of being selected).

- If the drawn card represents a star and you have invested, the project is a success and you earn 300 tokens (that is, the endowment of 100 - the investment of 100 + the gain of 300).
- If the drawn card is blank and you have invested, the project is not a success and you earn 30 tokens (that is, the endowment of 100 - the investment of 100 + the winning of 30).

If you have not invested your tokens, you keep your initial endowment of 100 tokens, thus you earn 100 tokens.

Whatever your choice, you are informed at the end of the period if the card drawn by the program among the three cards represents or not a star.

Remember that in these 16 practice periods, these payoffs are hypothetical and nothing that you decide in these periods counts to determine your actual payoff.

In addition, to ensure that you have met all possible scenarios, we have previously selected cases that correspond to the probabilities announced in the task description above.

Period 17

Period 17 determines your actual payoff for this part. The rules and the task are the same as in the previous 16 periods. The only difference is in the way you have to make your investment choice.

(In the No Information treatment, the first sentence was replaced with this one: If it is randomly selected at the end of the session, period 17 determines your actual payoff for this part.)

Your screen will reveal three cards, face down. Each card has 50 chances out of 100 to hide a star.

In this period, you have to make a decision in each of the following four scenarios. Would you invest or not in the project if the program revealed that among the three cards, there are:

- Scenario a) 0 stars?
- Scenario b) 1 star?
- Scenario c) 2 stars?
- Scenario d) 3 stars?

Once you have answered these questions, the program will inform you of the total number of stars among your three cards.

Your payoff

Your payoff is determined by the answer to the applicable scenario, that is, the one that corresponds to the total number of stars among your three cards. For example, suppose the three cards hide a total of two stars; in this case, it is your decision in scenario (c) that applies. Another example: suppose the three cards hide a total of three stars; in this case, it is your decision in scenario (d) that applies.

The program then draws one of your three cards.

- If you have invested in the project and the drawn card is a star, then you earn 300 tokens (endowment of 100 - investment of 100 + gain of 300).
- If you have invested in the project and the draw card is blank, then you earn 30 tokens (endowment of 100 - investment of 100 + gain of 30).
- If you did not invest, you earn the 100 tokens from your initial endowment.

As you can see, the principle is the same as the one that applies in the 16 practice periods, but here you make a decision in every possible scenario.

Since only one of your answers will count to determine your payoff, when you make your decision in each scenario it is in your interest to treat each scenario as if it were the one that actually counts for determining your payoff in this part. You will be informed of the draw and your payoff in this part at the end of the session.

(In the No Information treatment, the last paragraph was replaced with this one: Since only one of your answers will count to determine your payoff if this period is randomly selected for payment, when you make your decision in each scenario it is in your interest to treat each scenario as if it were the one that actually counts for determining your payoff in this part.)

(In the No Information treatment only) **Period 18**

If it is randomly selected at the end of the session, period 18 determines your actual payoff for this part. Like in the previous periods your screen will reveal three cards, face down. Each card has 50 chances out of 100 to hide a star. You have to decide again about whether you invest or not in the project. However, in contrast with the previous periods, you have to make a single decision without being informed on the number of cards with a star. It is only at the end of the session that the program will inform you of the total number of stars among your three cards.

Your payoff

If this period 18 is randomly drawn for payment, your payoff is determined as follows:

- *If you have invested in the project and the drawn card is a star, then you earn 300 tokens.*
- *If you have invested in the project and the draw card is blank, then you earn 30 tokens.*
- *If you did not invest, you earn the 100 tokens from your initial endowment.*

You will be informed of the period selected (17 or 18), the card drawn and your payoff in this part at the end of the session.

(All treatments) Please read again these instructions carefully. Whenever you have a question, please raise your hand or press the red button on the side of your desk. We will come immediately to your desk and answer to your question in private.

PART 2 (Random Pairs and Fixed Pairs treatment)

In this part, each of you will be assigned a role, either A or B. Half of the participants have role A and the other half have role B. Your role remains the same throughout part 2: you will never change role.

Part 2 has a **minimum** of 20 periods and a **maximum** of 40 periods. The exact number of periods was determined before the start of the session.

In each period, each of you is paired so that there is one participant A and one participant B in each pair. You will never know the identity of the people with whom you will be matched. At the beginning of each period, **you are re-paired with a new participant**. Given the number of participants in this session, it is highly unlikely that you will be paired with the same other participant several times in a row.

*(In the Fixed Pairs treatment the previous last two sentences were replaced with these ones: **Your pair remains the same during all the periods: you interact with the same participant throughout this part.**)*

Your task in each period

Participant A: Participant A can see three cards on his/her screen, face down. Each card can represent the star symbol (★) or be blank. Each card has 50 chances out of 100 to represent a star and 50 chances out of 100 to be blank. These chances are independent for each card. Thus, the participant A can have in total 0 star, 1 star, 2 stars or 3 stars. Participant A has the opportunity to see how many stars s/he has by pressing the "Reveal" button.

Participant A's task has then to announce his/her total number of stars to the participant B with whom s/he is paired. Participant B cannot see participant A's cards at any time.

Participant B: Participant B receives an initial endowment of 100 tokens and is informed of the announcement of the participant A with whom s/he is matched on his/her number of stars. Participant B has to decide if s/he is willing to keep his/her tokens or invest them in participant A's project.

Determination of payoffs

If you are a participant A: You earn a fixed amount of 30 tokens, plus 200 tokens if the participant B has invested in your project.

If you are a participant B: Once you have made your investment decision, the program draws one of the three cards of the participant A.

- If you have invested in the project and the drawn card represents a star, the project is a success and you earn 300 tokens (that is, endowment of 100 - investment of 100 + gain of 300).

- If you have invested in the project and the drawn card is blank, the project is not a success and you earn 30 tokens (that is, endowment of 100 - investment of 100 + gain of 30).
- If you did not invest, you earn 100 tokens from your initial endowment.

Whatever your choice, you are informed at the end of the period if the card drawn by the program among the three cards represents or not a star.

Your screen

On your screen will be a history box where you can see what happened in previous periods. Specifically, you will see four types of information:

(1) your announcements in the previous periods, if you are a participant A, or the announcements of the different participants A with whom you were matched, if you are a participant B;

(2) whether the card drawn in the previous periods represented a star or not, regardless of your role and your decision;

(3) if you have invested in previous periods, if you are a participant B, or if the participants B with whom you were matched have invested or not, if you are a participant A.

(4) your potential payoff in each previous period.

(In the Fixed Pairs treatment the previous sentences were replaced with these ones:

(1) your announcements in the previous periods, if you are a participant A, or the announcements of the participant A, if you are a participant B;

(2) whether the card drawn in the previous periods represented a star or not, regardless of your role and your decision;

(3) if you have invested in previous periods, if you are a participant B, or if the participant B has invested or not, if you are a participant A.

(4) your potential payoff in each previous period.)

A scroll bar will allow you to scroll through all previous periods.

For each of you, only one period has already been drawn by the program for payment and it is your decision in this period that will help determine your payoff for this part. Thus, it is in your interest to make your decisions in each period as if it was that period that counted to determine your payoff of the part.

Remember that pairs are rematched in each new period.

(In the Fixed Pairs treatment the previous sentence was replaced with this one: Remember that pairs are fixed for the entire part.)

Please read again these instructions. Whenever you have a question, please raise your hand or press the red button. We will immediately answer to your question in private.

PART 2 (Random Triplets, Fixed Triplets and Infinite treatments)

In this part, each of you will be assigned a role, either A or B. Two-thirds of the participants have role A and one third have role B. Your role remains the same throughout part 2: you will never change role.

Part 2 has a **minimum** of 20 periods and a **maximum** of 40 periods. The exact number of periods was determined before the start of the session.

*(In the Infinite treatment the previous paragraph was replaced with this one: Part 2 has a **minimum** of 20 periods. At the end of period 20 and of each following period there are 85 chances out of 100 that a new period starts. Thus, you do not know the exact number of periods in this part.)*

In each period, each of you is matched in a group of three so that there are two participants A (A1 and A2) and one participant B in each group. You will never know the identity of the people with whom you will be matched. At the beginning of each period, **you are rematched with two new participants**. Given the number of participants in this session, it is highly unlikely that you will be matched with the same two other participants several times in a row.

*(In the Fixed Triplets and the Infinite treatments the previous last two sentences were replaced with these ones: **Your group remains the same during all the periods: you interact with the same two participants throughout this part.**)*

Your task in each period

Participants A: Each participant A in the group can see three cards on his/her screen, face down. Each card can represent the star symbol (★) or be blank. Each card has 50 chances out of 100 to represent a star and 50 chances out of 100 to be blank. These chances are independent for each card. Thus, each participant A can have in total 0 star, 1 star, 2 stars or 3 stars. Each participant A has his/her own set of three cards and therefore each has an independent chance to have a total of 0, 1, 2 or 3 stars. Each participant A has the opportunity to see how many stars s/he has by pressing the "Reveal" button.

Each participant A's task is then to announce his/her total number of stars to the participant B in the group. A participant A cannot see the cards of the other participant A and the participant B cannot see the cards of any participant A at any time.

Participant B: Participant B receives an initial endowment of 100 tokens and is informed of the announcements of the two participants A in the group on their number of stars. Participant B has to decide if s/he is willing to keep his/her tokens or invest them in one of the two projects of the participants A, either A1's project or A2's project (it is not possible to invest in both projects) .

Determination of payoffs

If you are a participant A: You earn a fixed amount of 30 tokens, plus 200 tokens if the participant B has invested in your project.

If you are a participant B: Once you have made your investment decision, the program draws one of the three cards of each participant A.

- If you have invested in a project and the drawn card for this project represents a star, the project is a success and you earn 300 tokens (that is, endowment of 100 - investment of 100 + gain of 300).
- If you have invested in a project and the drawn card for this project is blank, the project is not a success and you earn 30 tokens (that is, endowment of 100 - investment of 100 + gain of 30).
- If you did not invest, you earn 100 tokens from your initial endowment.

Whatever your choice, you are informed at the end of the period if the card drawn by the program among the three cards represents or not a star.

Your screen

On your screen will be a history box where you can see what happened in previous periods. Specifically, you will see four types of information:

(1) your announcements in the previous periods and those of other participants A you were matched with if you are a participant A, or the announcements of each of the participants A with whom you were matched, if you are a participant B;

(2) whether the card drawn in the previous periods for each participant A with whom you were matched represented a star or not, regardless of your role and your decision;

(3) if you have invested and with which participant As you were matched with in previous periods, if you are a participant B, or if the participants B with whom you were matched have invested or not and with which participant As, if you are a participant A.

(4) your potential payoff in each previous period.

(In the Fixed Triplets and the Infinite treatments the previous sentences were replaced with these ones:

(1) your announcements in the previous periods and those of the other participant A if you are a participant A, or the announcements of each of the two participants A, if you are a participant B;

(2) whether the card drawn in the previous periods for each participant A represented a star or not, regardless of your role and your decision;

(3) if you have invested and with which participant A in previous periods, if you are a participant B, or if the participants B has invested or not and with which participant A, if you are a participant A.

(4) your potential payoff in each previous period.)

A scroll bar will allow you to scroll through all previous periods.

For each of you, only one period has already been drawn by the program for payment and it is your decision in this period that will help determine your payoff for this part. Thus, it is in your interest to make your decisions in each period as if it was that period that counted to determine your payoff of the part.

*(In the Infinite treatment the previous last paragraph was replaced with this one: For each of you, only one period will be randomly drawn by the program for payment and it is your decision in this period that will help determine your payoff for this part. If this part lasts for more than 20 periods, **there are 3 chances out of 4 that one of the first 20 periods will be randomly drawn for payment, and 1 chance out of 4 that it is a period after the 20th period that will be drawn for payment.** Thus, it is in your interest to make your decisions in each period as if it was that period that counted to determine your payoff of the part.)*

Remember that pairs are rematched in each new period. *(In the Fixed Triplets and Infinite treatment the previous sentence was replaced with this one: Remember that pairs are fixed for the entire part.)*

Please read again these instructions. Whenever you have a question, please raise your hand or press the red button. We will immediately answer to your question in private.

PART 2 (No Information Fixed Pairs treatment)

In this part, each of you will be assigned a role, either A or B. Half of the participants have role A and the other half have role B. Your role remains the same throughout part 2: you will never change role.

Part 2 has a **minimum** of 20 periods and a **maximum** of 40 periods. The exact number of periods was determined before the start of the session.

In each period, each of you is paired so that there is one participant A and one participant B in each pair. You will never know the identity of the people with whom you will be matched. **Your pair remains the same during all the periods: you interact with the same participant throughout this part.)**

Your task in each period

Participant A: Participant A can see three cards on his/her screen, face down. Each card can represent the star symbol (★) or be blank. Each card has 50 chances out of 100 to represent a star and 50 chances out of 100 to be blank. These chances are independent for each card. Thus, the participant A can have in total 0 stars, 1 star, 2 stars or 3 stars. Participant A has the opportunity to see how many stars s/he has by pressing the "Reveal" button.

Participant A has no task to perform. Participant B cannot see participant A's cards at any time.

Participant B: Participant B receives an initial endowment of 100 tokens and s/he has to decide if s/he is willing to keep his/her tokens or invest them in participant A's project. S/He is not informed of the number of stars on the cards of the participant A with whom s/he is matched.

Determination of payoffs

If you are a participant A: You earn a fixed amount of 30 tokens, plus 200 tokens if the participant B has invested in your project.

If you are a participant B: Once you have made your investment decision, the program draws one of the three cards of the participant A.

- If you have invested in the project and the drawn card represents a star, the project is a success and you earn 300 tokens (that is, endowment of 100 - investment of 100 + gain of 300).
- If you have invested in the project and the drawn card is blank, the project is not a success and you earn 30 tokens (that is, endowment of 100 - investment of 100 + gain of 30).
- If you did not invest, you earn 100 tokens from your initial endowment.

Whatever your choice, you are informed at the end of the period if the card drawn by the program among the three cards represents or not a star.

Your screen

On your screen will be a history box where you can see what happened in previous periods. Specifically, you will see four types of information:

(1) whether the card drawn in the previous periods represented a star or not, regardless of your role and your decision;

(2) if you have invested in previous periods, if you are a participant B, or if the participant B has invested or not, if you are a participant A.

(3) your potential payoff in each previous period.

A scroll bar will allow you to scroll through all previous periods.

For each of you, only one period has already been drawn by the program for payment and it is your decision in this period that will help determine your payoff for this part. Thus, it is in your best interest to make your decisions in each period as if it was that period that counted to determine your payoff of the part.

Remember that pairs are fixed for the entire part.)

Please read again these instructions. Whenever you have a question, please raise your hand or press the red button. We will immediately answer to your question in private.

PART 3 (Random Pairs, Fixed Pairs and No-Information treatments)

This part is independent of the previous parts.

In this part, there are two roles: participant X and participant Y. There is the same number of participants X and participants Y. The part consists of 15 periods.

At the beginning of each period, the program randomly matches each participant X with a new participant Y. Only participant X makes decisions that determine both his/her payoff and that of participant Y.

(In the Fixed Pairs and No-Communication treatments the previous paragraph was replaced with this one: At the beginning of the first period and for the whole part, the program randomly matches each participant X with a participant Y. Only participant X makes decisions that determine both his/her payoff and that of participant Y.)

At the beginning of the part, the program randomly assigns you one of two roles for the entire part, regardless of your role in the previous part. However, you will only be informed of your role at the end of the session. During the part, **you will all make decisions in the role of a participant X.**

If at the end of the session you learn that the program has assigned you the role of a participant Y, none of the decisions you have made will count. Your decisions will count only if the program has assigned you the role of a participant X.

In each period, in the role of participant X you have to choose between two payoff options for you and for participant Y. Here is an example of choices that are presented to you (the actual choices are different from this example):

Option 1: (50, 100) Option 2: (100, 80)

The first number in parentheses is always participant X's payoff and the second number is always participant Y's payoff. In the example above, assuming the period is drawn for payment, option 1 pays you 50 tokens and 100 tokens for participant Y; option 2 pays you 100 tokens and 80 tokens for participant Y.

In each period, you make the same type of decision. Once you have made your decisions in all periods, you will be informed about the period previously drawn for payment by the program. Given your actual role, it is your decision or that of the other participant with whom you are matched in this period that will determine your payoff.

Please read again these instructions. Whenever you have a question, please raise your hand or press the red button. We will immediately answer to your question in private.

PART 3 (Random Triplets, Fixed Triplets and Infinite treatments)

This part is independent of the previous parts.

In this part, there are three roles: participant X, participant Y, and participant Z. There is one third of participants X, one third of participants Y, and one third of participants Z. The part consists of 18 periods.

At the beginning of each period, the program randomly matches each participant X is with a new participant Y and a new participant Z. Only participant X makes decisions that determine both his/her payoff and that of participants Y and Z.

(In the Fixed Triplets and the Infinite treatments the previous paragraph was replaced with this one: At the beginning of the first period and for the whole part, the program randomly matches each participant X with a participant Y and a participant Z. Only participant X makes decisions that determine both his/her

payoff and that of participants Y and Z.)

At the beginning of the part, the program randomly assigns you one of the three roles for the entire part, regardless of your role in the previous part. However, you will only be informed of your role at the end of the session. During the part, **you will all make decisions in the role of a participant X.**

If at the end of the session you learn that the program has assigned you the role of a participant Y or a participant Z, none of the decisions you have made will count. Your decisions will count only if the program has assigned you the role of a participant X.

In each period, in the role of participant X you have to choose between two payoff options for you and for participants Y and Z. Here is an example of choices that are presented to you (the actual choices are different from this example):

Option 1: (50, 100, 110) Option 2: (100, 70, 80)

The first number in parentheses is always participant X's payoff, the second number is always participant Y's payoff, and the third number is always participant Z's payoff. In the example above, assuming the period is drawn for payment, option 1 pays you 50 tokens, 100 tokens for participant Y and 110 tokens for participant Z; option 2 pays you 100 tokens, 70 tokens for participant Y and 80 tokens for participant Z.

In each period, you make the same type of decision. Once you have made your decisions in all periods, you will be informed about the period previously drawn for payment by the program. Given your actual role, it is your decision or that of one of the two other participants with whom you are matched in this period that will determine your payoff.

Please read again these instructions. Whenever you have a question, please raise your hand or press the red button. We will immediately answer to your question in private.

PART 4 (All treatments)

You will see 20 statements about personality characteristics on your screen. Please indicate for each statement how much you agree or disagree with these statements. Choose the number that corresponds the most to your opinion.

1. Strongly Disagree
2. Disagree
3. Slightly Disagree
4. Neutral
5. Slightly Agree
6. Agree
7. Strongly Agree

- Never tell anyone the real reason you did something, unless it is useful to do so.
- The best way to handle people is to tell them what they want to hear.
- One should take action only when sure it is morally right.

- Most people are basically good and kind.
- It is safest to assume that all people have a vicious streak, and it will come out when they are given a chance.
- Honesty is the best policy in all cases.
- There is no excuse for lying to someone else.
- Generally speaking, people won't work hard unless they are forced to do so.
- All in all, it is better to be humble and honest than to be important and dishonest.
- When you ask someone to do something for you, it is best to give the real reasons for wanting it rather than giving reasons which carry more weight.
- Most people who get ahead in the world lead clean, moral lives.
- Anyone who completely trusts anyone else is asking for trouble.
- The biggest difference between most criminals and other people is that the criminals are stupid enough to get caught.
- Most people are brave.
- It is wise to flatter important people.
- It is possible to be good in all respects.
- P.T. Barnum was wrong when he said that there is a sucker born every minute.
- It is hard to get ahead without cutting corners here and there.
- People suffering from incurable diseases should have the choice of being put painlessly to death.
- Most people forget more easily the death of their parents than the loss of their property.

B Proofs of Theorem 2

Proof. Consider the following possible equilibrium for a game of duration T .

1. Investor invests with the Project Manager who announces the highest number of stars for the first k periods so long as that number is greater than 0 stars, and randomly chooses a PM if they both announce the same number of stars.
2. For all periods $> k$, both Project Managers babble and investor invests exclusively with the PM who is the most likely to have told the truth over the course of the first k periods.

Let us introduce the following point system:

- If the PM announced 0 stars: if a star is drawn, he gets -infinity points, otherwise he gets 1 point.
- If the PM announced 3 stars: if no star is drawn he gets -infinity points, otherwise he gets 1 point.
- If the PM announced 1 star: if a star is drawn, he gets 0 points; if no star is drawn he gets 1 point.
- If the PM announced 2 stars: if no star is drawn he gets 0 points; if a star is drawn, he gets 1 point.

We show that given PM2 is telling the truth, PM1 is worse off if he deviates. The tension that exists is that announcing a higher number than the truth leads to a higher chance of an immediate benefit (it raises the chances that the investor will invest with PM1), but comes at the cost of lowering the chances that PM1 will be chosen after the k periods.

We prove the above by showing that an equilibrium where PMs tell the truth in period 1 and then babble can be supported.

PM1 observes 1 star

Suppose he tells the truth:

Immediate return: Here we consider the chances that the investor will invest with PM1. With 12.5% chance he gets the investment (12.5% is the probability that PM2 has 0 stars), with 37.5% chance he has a 50% chance of getting the investment (37.5% is the probability that PM2 also has 1 star), and with 50% chance he doesn't get the investment (50% is the probability that PM2 has 2 or 3 stars). In expectation he earns: $0.125*230 + .375*.5*230 = 71.875$.

Future return: How much PM1 receives for the remaining periods depends on the number of points he collects relative to PM2. How many points does PM2 get?

- With 25% chance, PM2 has 0 or 3 stars and so receives 1 point for sure.
- With 75% chance, PM2 has 2/3 chances of getting 1 point and 1/3 chances of getting no points.
→ overall PM2 has a 75% chance of getting 1 star and a 25% chance of getting 0 stars.

How many points does PM1 get?

- with 2/3 chances, PM1 receives 1 point.
- with 1/3 chance, PM1 receives no points.

PM1 has a 50% chance of being chosen for all remaining periods if he and PM2 either both have 0 points (1/12 chance) or both have 1 point (50% chance). PM1 is chosen for all remaining periods for sure if he has 1 point and PM2 has none (1/6 chances), and PM1 is not chosen if he has 0 points and PM2 has 1 (25% chance).

The overall expected return of telling the truth is therefore:

$$71.875 + \frac{11 \times 230}{24} \times (T - 1) \quad (1)$$

Suppose he lies and announces 2 stars:

Immediate return: With probability 50% he receives the investment (50% is the probability that the other PM announces 0 or 1 stars) today and earns 230 tokens. With 37.5% PM2 announces 2 stars and PM1 has a half chance of receiving the investment. With 12.5% chance PM2 announces 3 stars and PM1 does not receive the investment and earns 0. This lie earns him 158.125 tokens in expectation.

Future return: How much PM1 receives for the remaining periods depends on the number of points he collects relative to PM2. The number of points PM2 gets is the same as if PM1 told the truth. How many points does PM1 get?

- with 2/3 chances, PM1 receives no points.
- with 1/3 chance, PM1 receives 1 point.

PM1 has a 50% chance of being chosen for all remaining periods if he and PM2 either both have 0 points (1/6 chance) or both have 1 point (25% chance). PM1 is chosen for all remaining periods for sure if he has 1 point and PM2 has none (1/12 chances), and PM1 is not chosen if he has 0 points and PM2 has 1 (50% chance).

The overall expected return of announcing 2 stars instead of telling the truth is:

$$158.125 + \frac{7 \times 230}{24} \times (T - 1) \quad (2)$$

Is it worth it? A simple comparison of Equations (1) and (2) shows that so long as there are more than 2 periods left, PM1 is better off telling the truth than announcing 2 stars.

Suppose he lies and announces 3 stars:

Immediate return: Let's look at the benefit of this deviation. With probability 87.5% he receives the investment (87.5% is the probability that the other PM announces 0, 1 or 2 stars) today and earns 230 tokens. With 12.5% PM2 announces 3 stars too and PM1 has a half chance of receiving the investment. This lie earns him 215.625 tokens in expectation.

Future return: How much PM1 receives for the remaining periods depends on the number of points he collects relative to PM2. The number of points PM2 gets is the same as if PM1 told the truth. How many points does PM1 get?

- with 2/3 chances, PM1 receives $-\infty$ points.
- with 1/3 chance, PM1 receives 1 point.

PM1 has a 50% chance of being chosen for all remaining periods if he and PM2 either both have 1 point (25% chance). PM1 is chosen for all remaining periods for sure if he has 1 point and PM2 has none (1/12 chances), and PM1 is not chosen if he has $-\infty$ points (2/3 chance).

The overall expected return of announcing 3 stars instead of telling the truth is:

$$215.625 + \frac{5 \times 230}{24} \times (T - 1) \quad (3)$$

Is it worth is? A simple comparison if Equations (1) and (3) shows that so long as there are more than 2 periods left, PM1 is better off telling the truth than announcing 2 stars.

Given that downward lying provides no incentive in terms of immediate or future returns, we have shown that if PM1 observes 1 star, he is better off telling the truth so long as there are at least 2 periods left in the game. The proof in other scenarios (PM1 observes 0, 2 or 3 stars) follows the same logic (the details of these derivations are available upon request).

This shows how truth-telling in period 1 can be supported. It obviously follows that truth-telling in more than 1 period can be supported so long as there are enough periods left in the game so that the lure of future returns outweigh the lure of an immediate return.

□

C The Allocation Game and Summary of Sessions

Table C1: The Allocation Game

Treatments	Random and Fixed Pairs		Random and Fixed Triplets	
Decision	Option 1	Option 2	Option 1	Option 2
1	(30,100)	(100,30)	(80,100,100)	(100,100,80)
2	(0,0)	(40,30)	(0,0,0)	(40,30,30)
3	(30,30)	(60,60)	(30,30,30)	(60,60,60)
4	(80,60)	(70,100)	(80,60,60)	(70,100,100)
5	(100,30)	(30,230)	(100,30,30)	(30,230,30)
6	(70,60)	(90,80)	(70,60,60)	(90,80,80)
7	(100,30)	(300,230)	(100,30,30)	(300,230,30)
8	(70,60)	(90,50)	(70,60,60)	(90,50,50)
9	(30,30)	(30,300)	(30,30,30)	(30,300,300)
10	(60,50)	(90,40)	(60,50,50)	(90,40,40)
11	(100,30)	(30,230)	(100,30,30)	(30,230,230)
12	(230,30)	(100,230)	(230,30,30)	(100,230,230)
13	(60,60)	(50,20)	(60,60,60)	(50,30,30)
14	(230,230)	(300,230)	(230,230,230)	(300,230,230)
15	(60,70)	(50,20)	(60,70,70)	(50,20,20)
16	-	-	(60,40,30)	(90,30,30)
17	-	-	(70,50,60)	(70,50,100)
18	-	-	(60,50,50)	(100,70,60)

Notes: In parentheses, the first number is the payoff of X, the second number the payoff of Y and the third number the payoff of Z. The first two columns display the pairs of options used in the Random and Fixed Pairs treatments; the last two columns display the pairs of options used in the Random and Fixed Triplets treatments. Decisions 1 and 2 correspond to the payoffs of the decisions made in the Investment Game in Part 2. All decisions except the 5th can help identify concerns for efficiency. Specific decisions can also help identify other types of social preferences, including concerns for advantageous inequity aversion (decisions 3 and 6), spitefulness (decision 14), preference for being ahead (decision 15). Some other decisions are simple sanity checks for understanding (decisions 7 and 10).

Table C2: Summary of Sessions

Session Number	Treatment	Nb Participants	Percentage of Females
1	Fixed Pairs	24	75.00%
2	Random Triplets	24	50.00%
3	Random Triplets	27	55.56%
4	Random Triplets	18	55.56%
5	Random Triplets	18	44.44%
6	Random Triplets	30	66.67%
7	Random Pairs	22	63.64%
8	Fixed Pairs	10	40.00%
9	Random Pairs	18	38.89%
10	Random Pairs	26	57.69%
11	Fixed Pairs	26	61.54%
12	Fixed Pairs	18	44.44%
13	Fixed Triplets	18	50.00%
14	Fixed Triplets	24	54.17%
15	Fixed Triplets	30	46.67%
16	Fixed Triplets	24	45.83%
17	Fixed Triplets	21	57.14%
18	Random Pairs	18	44.44%
19	Fixed Pairs No Info	28	71.43%
20	Fixed Triplets Infinite	24	70.83%
21	Fixed Pairs No Info	10	80.00%
22	Fixed Triplets Infinite	15	60.00%
23	Fixed Pairs No Info	16	50.00%
24	Fixed Triplets Infinite	18	44.44%
25	Fixed Triplets Infinite	12	66.67%
26	Fixed Triplets Infinite	24	54.17%
27	Fixed Triplets Infinite	18	66.67%
28	Fixed Pairs No Info	18	61.11%
Total	-	579	56.65%

Notes: The table reports the treatment, the number of participants, and the percentage of females, per session.

D Regression Analyses

The regressions in Table D1 confirm the results from the non-parametric tests we conduct in the main body of the paper about PMs' behavior. This Table reports the estimates of coefficients from Probit models with standard errors clustered at the individual level. In models (1) and (2) the dependent variable is making a detectable lie (Extreme, High Risk and Low(er) Risk lies). In models (3) and (4) the dependent variable is making a deniable lie. The independent variables include the various treatments, with the Random Pairs treatment as the omitted category, as well as a what period subjects are in. Models (1) and (3) also control for individual characteristics (number of efficient choices in the Allocation Game, the Machiavellian measures and gender). These regressions confirm that detectable lies are less frequent in the presence of reputation (regressions 1 and 2), but there are no treatment differences when it comes to Deniable lies (models 3 and 4). This is the case whether or not we use controls. While not reported in detail here, none of the controls are significant.

Table D1: Treatment Differences in the Likelihood of Making Detectable and Deniable Lies.

	(1)	(2)	(3)	(4)
Fixed Pairs	-0.960 (0.264)***	-0.971 (0.266)***	0.129 (0.153)	0.147 (0.153)
Random Triplets	0.436 (0.225)*	0.436 (0.221)**	0.107 (0.154)	0.123 (0.153)
Fixed Triplets	-0.884 (0.230)***	-0.891 (0.230)***	0.189 (0.146)	0.193 (0.149)
Period	0.008 (0.005)*	0.008 (0.005)*	0.010 (0.002)***	0.010 (0.003)***
Constant	-1.734 (0.492)***	-1.101 (0.206)***	-1.658 (0.345)***	-1.126 (0.141)***
Controls	Yes	No	Yes	No
Number of observations	6,399	6,399	6,399	6,399
Number of groups	237	237	237	237

Notes: This Table presents the coefficients from panel Probit regressions of making a detectable lie (models 1 and 3) or a deniable one (models 2 and 4) on treatment dummies. The omitted dummy is the Random Pairs treatment. In models 2 and 4 controls include the number of efficient choices in the Allocation Game, the Machiavellian measures as well as gender. Standard errors are clustered at the individual level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

The regressions in Table D2 also confirm the results from the non-parametric tests we conduct in the main body of the paper about investors' behavior. This Table reports the estimates of coefficients from Probit models with standard errors clustered at the individual level. The dependent variable is the binary decision of the investor to invest. The independent variables include the various treatments, with the Random Pairs treatment as the omitted category, having detected a lie in the previous period and the announcement in the current period. Model (1) also controls for individual characteristics (number of efficient choices in the Allocation Game, the Machiavellian measures and gender). These regressions show that the Fixed Triplets treatment sees higher investment than the others. Indeed, relative to Random Pairs, the likelihood of investing is higher in Fixed Triplets, while compared with the control, investment is no different in Fixed Pairs and is actually lower in Random Triplets (although the significance of this last comparison is marginal and sensitive to the inclusion of controls). Not surprisingly, the likelihood of investing is significantly higher when the announcement is higher, and it is lower after a detected lie.

Table D2: Treatment Differences in the Likelihood of Investing.

	(1)	(2)
Fixed Pairs	0.124 (0.199)	0.183 (0.192)
Random Triplets	-0.454 (0.256)*	-0.427 (0.264)
Fixed Triplets	0.456 (0.219)**	0.534 (0.211)**
Period	-0.029 (0.004)***	-0.029 (0.004)***
Detected lie in $t - 1$	-0.453 (0.081)***	-0.454 (0.081)***
Announcement	1.237 (0.082)***	1.20 (0.078)***
Constant	-1.587 (0.572)***	-1.818 (0.206)***
Controls	Yes	No
Number of observations	4,134	4,134
Number of groups	159	159

Notes: This Table presents the coefficients from panel Probit regressions of investing. In the Triplets treatments, “Announcement” corresponds to the highest announcement. In model (1) controls include the number of efficient choices in the Allocation Game, the Machiavellian measures as well as gender. Standard errors are clustered at the individual level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

The regressions in Table D3 report the estimates of coefficients from Probit models with standard errors clustered at the individual level. The dependent variable is having lied at least once in the Investment Game. The regressions in Table D4 report the estimates of coefficients from OLS models with standard errors clustered at the individual level. The dependent variable is the number of lies made by the PM in the Investment Game. Finally, the regressions in Table D5 report the estimates of coefficients from Probit models with standard errors clustered at the session level. The dependent variable is having lied at least once when observing 0 stars in the Investment Game. In the three tables, the independent variable is the number of efficient choices made in the Allocation Game.

Table D3: Predicting Having Lied At Least Once.

	Random Pairs	Fixed Pairs	Randon Triplets	Fixed Triplets
Number of efficient choices	0.126 (0.134)	0.027 (0.025)	0.048 (0.084)	-0.143 (0.102)
Constant	-0.519 (1.585)	0.654 (0.322)	0.757 (1.188)	3.558 (1.552)**
Number of observations	42	39	78	78

Notes: This Table presents Probit regressions of having lied at least once on the number of efficient choices in the Allocation Game. Standard errors are clustered at the individual level. In the Fixed Pairs treatment, the independent variable is omitted as a number of efficient choices not equal to 8 predicts success perfectly - we therefore present the results of the OLS regression instead. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table D4: Predicting the Number of Lies.

Treatments	Random Pairs	Fixed Pairs	Randon Triplets	Fixed Triplets
Number of efficient choices	0.860 (0.607)	-0.173 (0.400)	-0.058 (0.335)	0.071 (0.269)
Constant	3.300 (7.485)	10.254 (5.107)*	17.058 (4.907)***	7.934 (4.230)*
Number of observations	42	39	78	78
R ²	0.038	0.005	0.001	0.001

Notes: This Table presents OLS regressions of the number of lies a PM makes on the number of efficient choices in the Allocation Game. Standard errors are clustered at the subject level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table D5: Predicting Having Lied At Least Once When Observing 0 Stars.

Treatments	Random Pairs	Fixed Pairs	Randon Triplets	Fixed Triplets
Number of efficient choices	0.048 (0.129)	-0.058 (0.118)	-0.044 (0.074)	0.093 (0.072)
Constant	0.146 (1.556)	0.986 (0.402)	1.421 (1.074)	-0.867 (1.050)
Number of of observations	38	37	75	76

Notes: This Table presents Probit regressions of having lied at least once when seeing 0 stars on the number of efficient choices in the Allocation Game. Standard errors are clustered at the individual level. Not all subjects observed 0 stars at least once, which explains the small difference in the number of observations with respect to the other regressions. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$