The Motivated Beliefs of Financial Decision-Making Under Limited Liability*

Steffen Ahrens†
Ciril Bosch-Rosa‡

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Abstract

Using a new experimental design, we compare how subjects form beliefs about their investments under full and limited liability. Our results show that under limited liability, for the same investment, subjects invest more *and* expect higher returns. This finding suggests the existence of cognitive biases in financial decision-making and supports the recent literature on the formation of motivated beliefs under limited liability (Bénabou and Tirole, 2016; Barberis, 2015).

Keywords Moral Hazard · Experiment · Motivated Beliefs

JEL Classification C91 · D84 · G11 · G41

*Corresponding author: steffen.ahrens@tu-berlin.de. The authors would like to thank Dirk Engelmann, Jana Friedrichsen, Daniel Gietl, Anna Gumpert, Frank Heinemann, Peiran Jiao, Shyam Sunder, and Roel van Veldhuizen for their useful comments. We also thank Juan Dominguez Morán for the programming of experimental software and the testing support. Additionally, the authors gratefully acknowledge financial support from the Deutsche Forschungsgemeinschaft (DFG) though the CRC TRR 190 "Rationality and Competition." All remaining errors are ours.

†Technische Universität Berlin and University of Konstanz

‡Technische Universität Berlin

1 Introduction

Most people hold certain moral beliefs and will strive to uphold them to maintain a positive self-view (Festinger, 1962; Epley and Gilovich, 2016). Yet quite often, they are confronted with situations in which their actions are in conflict with their principles. This conflict creates a psychological discomfort that psychologists refer to as "cognitive dissonance" (Festinger, 1962). A common way to deal with such tension is to modify one's beliefs by, for example, appropriately shifting the likelihood of an outcome to justify a selfish action (Haisley and Weber, 2010; Gino et al., 2016) or by selectively overweighting certain types of information (Zimmermann, forthcoming; Eil and Rao, 2011). An example of this would be to smoke and believe that smoking is not that harmful (McMaster and Lee, 1991) or to convince oneself that those out-of-reach grapes are certainly sour (Æsop, 1914). In other words, when our actions are not aligned with our views, we might form motivated beliefs in a trade-off between holding accurate beliefs or desirable beliefs (Bénabou and Tirole, 2016).

In finance, the formation of such motivated beliefs can lead investors to stay in low-performing investments (Goetzmann and Peles, 1997; Cheng et al., 2014), induce the disposition effect (Chang et al., 2016), and give rise to excessive risk-taking under limited liability (Barberis, 2015). Concerning the latter, Barberis (2015) argues that because of limited liability and the moral hazard associated with it, investors might inadvertently bias downwards the risk perception of their investments to maintain a positive self-image while still profiting from their excessive investments.[1]

In this paper, we use experimental methods to test whether limited liability induces motivated beliefs in financial decision-making. Using a novel experimental design, we compare the risk assessment and investments that subjects make under full and limited liability. In control rounds, subjects evaluate different assets and decide how much to invest in each of them. Because there is full liability, subjects reap all gains but also absorb any losses. In treatment rounds subjects are divided into two groups and are matched in pairs. Each pair has a passive investor, who makes no investment decision,

[1]Note that while this phenomenon holds a strong resemblance to what Bénabou et al. (2018) call "absolving narratives," the motivated beliefs in Barberis (2015) and Bénabou (2015) are fundamentally different, as they are not formed after the realization of the investment but rather when making the investment. In other words, the type of motivated beliefs we are interested in are *decision related*, not *outcome related*.

and an active investor, who evaluates the different assets and decides how to invest its matched passive subject's endowment. If the investment results in gains, then the profits are split between the two investors. If there are losses, then the passive investor absorbs all of them, leaving the active investor with neither gains nor losses. Our design allows us to isolate any change in beliefs that might come from the sudden change in the trade-off between accurate beliefs and desirable beliefs arising from the limited liability.

The results are clear: for the same investment, under limited liability, subjects invest more and expect significantly higher returns than they do under full liability. Such results point toward the presence of motivated beliefs through cognitive dissonance, as predicted by Barberis (2015), Bénabou (2015), and Bénabou and Tirole (2016).

This paper is part of a trend in behavioral finance that, through the use of experiments, aims to understand belief formation and decision-making in financial markets (e.g., Nosić and Weber, 2010; Bosch-Rosa et al., 2018; Weber et al., 2018). More precisely, we are part of the literature that investigates cognitive biases in financial environments. Some previous work in this area that is close to our research are Chang et al. (2016) and Mayraz (2017). While the first investigates the effects of delegation on the disposition effect, the second studies the effects of "wishful thinking" on asset price beliefs. To our knowledge, we are the first to study the effect of limited liability on the motivated beliefs in financial decision-making. In a subsequent paper Bosch-Rosa et al. (2019) confirm our results using an alternative experimental design.[2]

Our contribution to the literature is therefore to analyze whether limited liability affects beliefs and, by extension, investment decisions. This contribution is relevant, as a) it contributes to the growing literature on "motivated beliefs" (Bénabou and Tirole, 2011, 2016; Bénabou, 2015; Gino et al., 2016) by shedding light on the effects that incentives have on the beliefs in financial decision-making, and b) it clarifies the channels through which limited liability induces excessive risk-taking.

The paper is organized as follows. Section 2 presents our experimental design. Section 3 presents the experiment's results. Finally, Section 4 concludes.

[2]There are several differences between Bosch-Rosa et al. (2019) and this paper. Perhaps some of the most notable are on the type of investment subjects can make and the structure of the data. For example, because Bosch-Rosa et al. (2019) look at treatments beyond the effect of limited liability on individual investors, they have a within-subject design, while we opted for a simpler between-subject design. Also important, the type of investment is quite different, as in Bosch-Rosa et al. (2019) subjects can only invest in an abstract binary asset that pays a fixed return if successful. However, in our case, we use real market data and payoffs depend not only on the asset going up on price but also by *how much*.

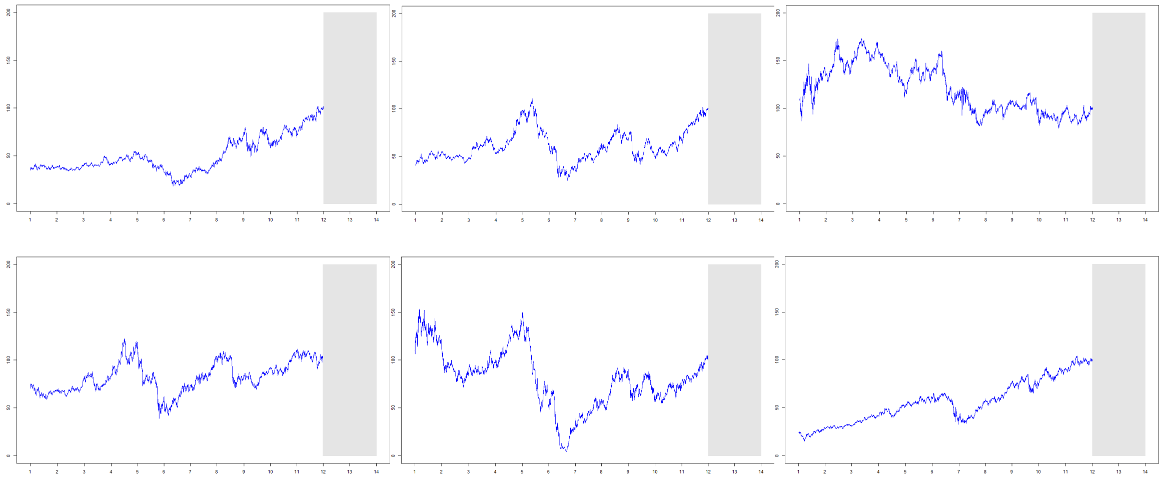


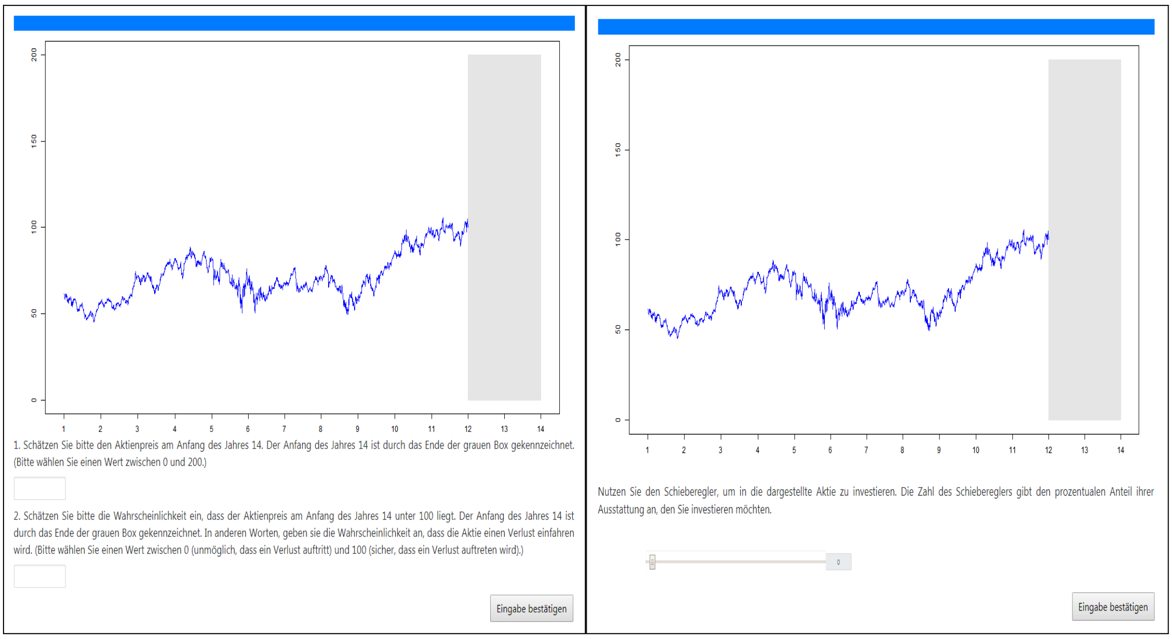
Figure 1: The six graphs presented to subjects. From left to right and from top to bottom: (1) Bayerische Motoren Werke AG, 27-Jun-03–27-Jun-16; (2) Daimler AG, 20-Jun-03—20-Jun-16; (3) Deutsche Telekom AG, 10-Sep-02—10-Sep-15; (4) Siemens AG, 05-Jan-04—05-Jan-17; (5) Infineon Technologies AG, 08-Jul-03—08-Jul-16; (6) Linde AG, 18-Dec-02—18-Dec-15. All data are downloaded from Google Finance.

2 Experimental Design

The core of our experiment is divided into two blocks of three rounds. In each round, we present subjects with a graph showing the daily prices of a stock from the DAX30 (Germany's prime blue chip stock market index) for 11 consecutive years (see Figure 1). Subjects know that the data come from the DAX30 but are neither told the exact years of the data nor the name of the company. Additionally, they are told that all time series have been shifted such that the price at the beginning of the 12th year is always € 100. Additionally, they know that they will not get any feedback until the end of the experiment and the specific instructions for each block will be read immediately before it starts.

2.1 Belief Elicitation and Investment

In each round, after seeing an animation representing the evolution of prices for the anonymous stock, subjects are presented with the assessment screen (see the left panel of Figure 2). In this screen, they are asked to assess the probability that the price of the stock will be below € 100 by the beginning of the 14th year (i.e., the likelihood of a loss) and to guess the price of the stock at that point. Once this is done, they move to the investment screen.



(a) Assessment Screen (b) Investment Screen

Figure 2: Screen for the belief elicitation phase. Subjects are asked for the probability that the price of this stock will be below € 100 at the beginning of the 14th year and for an exact estimate of this price. Notice that the graph presented in this screen is one of the randomly generated graphs used during practice rounds. For more details on practice rounds, see the instructions in Appendix B.

For each investment screen (see the right panel of Figure 2), subjects are endowed with € 10 and are asked to invest as much as they want of this endowment into the stock they just assessed. The return (Π_i) to the investment (I_i) of subject i will be the difference between the price at the beginning of the 12th year (€ 100) and the price at the beginning of the 14th year ($price_{t=14}$). Any amount that the subject does not invest in the stock is assumed to go into a risk-free asset with no returns. This leaves the payoff for the investment phase as

$$\Pi_i = I_i * \frac{price_{t=14}}{100} + €10 - I_i. \tag{1}$$

After making their investment decisions, subjects immediately move to the next round, where they are presented with a new assessment screen containing a different graph to assess. This process is repeated three times, after which the instructions for the second block of three rounds are read aloud.

Eliciting beliefs prior to the investment decision allows us to cleanly measure the effect of the change in the mindset on the motivated beliefs, free of other behavioral biases such as wishful thinking. This approach assumes that cognitive dissonance is an explicit contributor to the decision-making process (e.g., Rabin, 1994; Konow, 2000; Oxoby, 2004). Alternatively, cognitive dissonance may arise in retrospect to self-justify (the outcomes of) past decisions (e.g., Akerlof and Dickens, 1982; Goetzmann and Peles, 1997; Chang et al., 2016). Such a view is approximated by changing the order of belief and investment elicitation in our experimental design. Note, however, that investing first allows for wishful thinking to enter the motivated beliefs.

2.2 Control and Treatment

In each session, one of the blocks is a control block and the other is a treatment block. The difference between the treatment and control blocks is that before the start of treatment blocks, half of our subjects are assigned the role of active investors, while the other half are passive investors. Subjects are aware of their specific type before the the block starts, and they know they will keep the type for the whole block. The structure and tasks in treatment blocks are identical to those of control except for the investment component. Here active investors make investment decisions (I_i^B) not over their endowment but over the endowment of passive investors (j). So while both get € 10 in each round, active investors are assumed to invest their whole endowment in the risk-free asset while deciding how much to invest of passive investor j's endowment. If the investment is profitable (i.e., $price_{t=14} \geq 100$), then the active investor and passive investor split the gains. On the other hand, if the investment turns out sour (i.e., $price_{t=14} < 100$), then the passive investor absorbs the whole loss.[3] Therefore, the payoff for active investor i in treatment rounds is

$$\Pi_i^B = \begin{cases} \left(I_i^B * \frac{price_{t=14}}{100} - I_i^B\right) * 0.5 + €10, & \text{if } p_{t=14} \geq 100 \\ €10, & \text{if } p_{t=14} < 100. \end{cases} \tag{2}$$

Analogously, the payoffs for passive investor j, who is paired with investor i, are

$$\Pi_j^i = \begin{cases} \left(I_i^B * \frac{price_{t=14}}{100} - I_i^B\right) * 0.5 + €10, & \text{if } p_{t=14} \geq 100 \\ I_i^B * \frac{price_{t=14}}{100} + €10 - I_i^B, & \text{if } p_{t=14} < 100. \end{cases} \tag{3}$$

[3] We acknowledge that incurring losses might have a reputational cost for active investors. Yet, for the sake of simplicity, and to make moral hazard most salient, we decide that active investors incur a zero cost in the case of a failed investment.

The payoff structure and investment opportunities in our experiment seem well suited to study the effects of cognitive dissonance in financial markets. To see this, consider the example used by Barberis (2015) of traders on bank mortgage desks: because subprime products were usually complex, there was scope for traders to manipulate their beliefs (as a self-justification for excessive risk-taking), as it would be hard to argue against any assessment they had made. Similarly, the ambiguity of the products offered to active investors in our experiment lends itself particularly well to belief manipulation, allowing us to study the effects of limited liability on the risk assessment of active investors.

2.3 Details on Payoffs

In total, across both blocks, we elicit the probability that the stock will suffer a loss, the expected price, and the investment decision six times for each subject. To incentivize the choices in the assessment screen, we use the binarized scoring rule (Hossain and Okui, 2013), where subjects' payoff is either € 0 or € 5. The binarized scoring rule is incentive compatible and is robust to any risk preferences subjects might have. Additionally, to avoid any hedging, subjects were paid for only one of their six choices for the loss assessments, price predictions, and investment (be it in the control or treatment block).[4] The payoff-relevant decisions were randomly and independently chosen by the computer, so a subject might get paid for her price prediction in round three, her investment in round four, and the accuracy of the assessed loss likelihood in round six. This payoff structure makes the moral hazard effect even more salient since the (unique) payoff for the investment decision was equally likely to come from the control or treatment block.

2.4 Session Types

We run three types of sessions: type 1 sessions run first the control block presenting subjects with graphs 1–3 and then the treatment block using graphs 4–6. Type 2 sessions start with the treatment block using graphs 4–6, followed by the control block using graphs 1–3. This allows us to control for the ordering effects of each block. Type 3 sessions, on the other hand, have the same ordering as type 1 sessions (control then treatment) but with inverted graph order, so in the control block, subjects are presented with graphs 4–6 and in treatment graphs 1–3. To account for order effects of belief elicitation and

[4] See Blanco et al. (2010) for a discussion on how to avoid hedging in belief elicitation contexts.

investment decision, we additionally run sessions like type 1 and type 2 but with flipped screen order, shown in Figure 2.

2.5 Personality Traits

Finally, subjects take part in a third block in which we elicit their personality traits. This block includes tests for risk, ambiguity, and loss aversion through a modification of the multiple price lists used in Rubin et al. (2017). Additionally, to measure their cognitive ability, subjects answer CRT (Frederick, 2005), CRT2 (Thomson and Oppenheimer, 2016), and eCRT (Toplak et al., 2014) questions. Subjects also answer the short version of the Big Five personality traits suggested by Rammstedt and John (2007) as well as the three questions on financial literacy that we borrow from Lusardi and Mitchell (2011). At the end of the block, they are asked to state their gender, field of study, and age.

3 Results

A total of 218 subjects were recruited through the Online Recruitment System for Economic Experiments (ORSEE) (Greiner, 2015). All sessions lasted two hours and were run at the Experimental Economics Laboratory of the Technische Universität Berlin. Subjects made, on average, € 23.04, and the experiment was programmed and conducted using O-Tree (Chen et al., 2016).

Table 1 presents the median value across all subjects for the expected price (PriceExp), the expected probability of a loss (ProbLoss), and the share of the endowment invested in the stock (Investment). The table is divided by types of session (rows) and graph (columns). Note that across all three session types, control always has twice as many observations as treatment does. This is because we use only the data of active investors in treatment blocks (109 observations), while for control blocks, we use the data of all participants (218 observations).

It is clear from Table 1 that beliefs and investment decisions differ substantially across graphs. These differences are (in most cases) statistically significant (see Table 3 in Appendix A for pairwise comparisons) and go in the direction one would expect from looking at the graphs. For example, subjects expect graph 1, with a clear upward trend, to be (almost) half as likely to result in losses than graph 2, which has a less clear upward trend. Additionally, there is a clear correlation between the expected price and

	Control			Treatment		
	Graph 1	Graph 2	Graph 3	Graph 4	Graph 5	Graph 6
Session Type 1 (N=86):						
PriceExp	120.0	89.5	107.0	105.0	117.5	116.0
ProbLoss	35.0	60.0	50	50.0	40.0	35.0
Investment	40.0	17.5	25.0	47.5	60.0	73.0
Session Type 2 (N=88):						
PriceExp	119.0	90.0	100.0	95.0	110.5	110.0
ProbLoss	35.0	60.0	50.0	56.5	40.0	40.0
Investment	55.0	24.5	50.0	30.0	50.0	60.0
	Treatment			Control		
	Graph 1	Graph 2	Graph 3	Graph 4	Graph 5	Graph 6
Session Type 3 (N=44):						
PriceExp	120.0	90.0	105.0	100.0	116.0	115.0
ProbLoss	30.0	56	50.0	50.0	45.0	35.0
Investment	71.5	30.0	46.0	16.5	30.0	39.5

Table 1: Descriptive statistics. The upper part of the table shows the median values of price expectation, loss probability, and investment for each of the six graphs in each of the three session types. For treatment cases, only the data of active investors is taken into consideration considered. Since we do not see significant differences across any of the three measures depending on the screen order, we pool together the data of both orders.

the probability of losses: the more likely a loss is, the lower the expected price will be. All of this leads us to believe that our graphical interface is understood by our subjects and their beliefs respond to the graphs we present to them.

3.1 The Effects of Limited Liability on Beliefs and Investment Behavior

In this section, we analyze a between-subject design (i.e., for each graph, we compare the beliefs (investment) of active investors in treatment sessions to the beliefs (investment) of all subjects in control sessions). The left (right) panel of Figure 3 presents the expected price (probabilities that subjects assign to a loss) for each of the six graphs presented to subjects. The light-shaded columns are the elicited beliefs of all subjects in control, while the dark-shaded columns only include the beliefs of active investors in treatment. Analogously, Figure 4 presents the investment decisions of all subjects in control (light-shaded bar) and active investors in treatment (dark-shaded bar) for each of the six graphs.

Figure 3 shows that, in general, subjects in treatment blocks hold higher expected

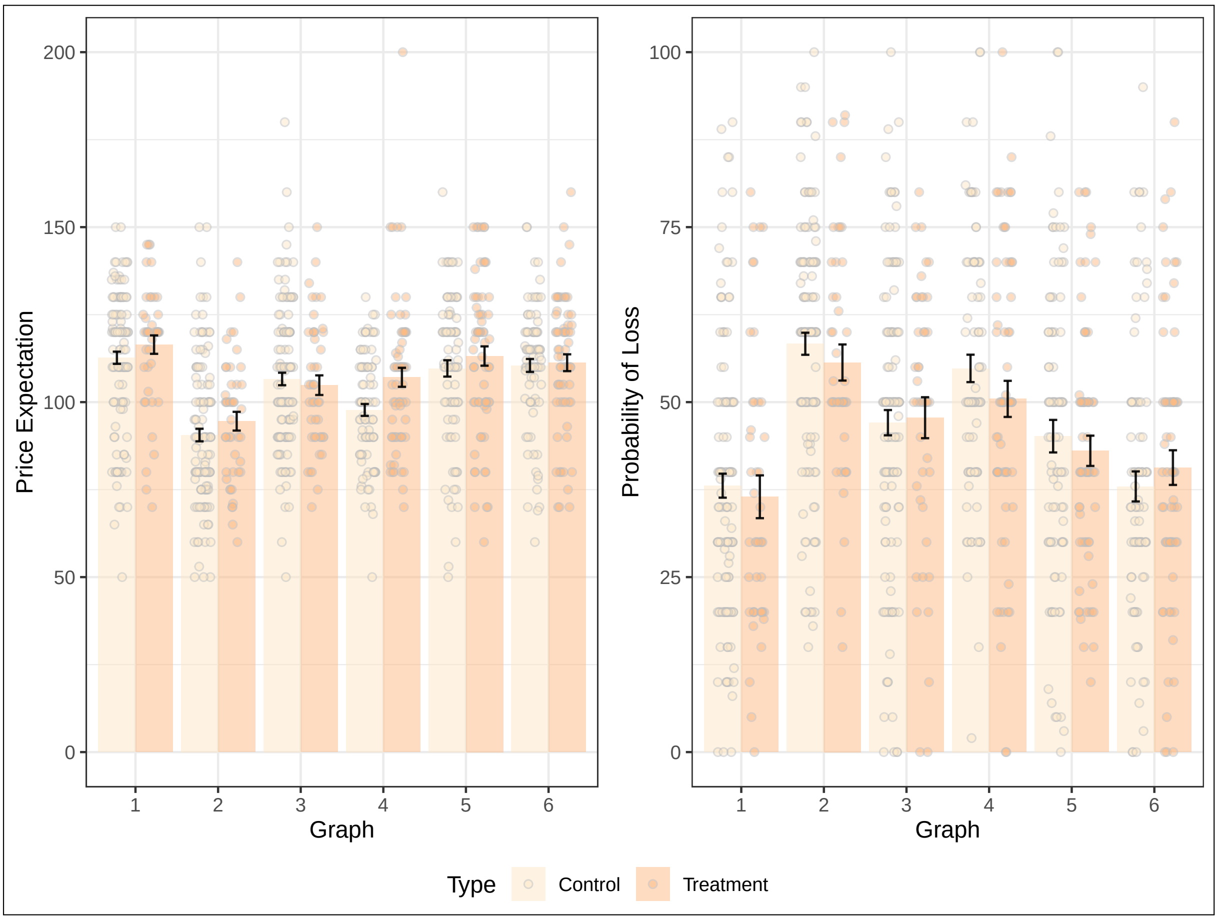


Figure 3: Beliefs. In the vertical axis, we plot the subjects' stated price expectations (left panel) and loss probabilities (right panel). In the horizontal axis, we separate by graph. The bars represent the average belief; the black error bar represents the standard error. Each dot is an individual belief. Light-shaded columns collect beliefs of all subjects in control blocks, and dark-shaded columns collect beliefs of active investors only in treatment blocks.

prices than those in control and assign lower loss probabilities in treatment than in control blocks. At the same time, Figure 4 shows that, for the same graph, subjects invest substantially more in treatment blocks than in control blocks. Using a series of Wilcoxon rank-sum tests, the differences in investment are highly significant, whereas the differences in beliefs are not (see Table 4 in Appendix A).

The previous results change once we control for personal traits and order effects. To do so, in Table 2, we run a series of linear models where the dependent variable is either (1) the expected stock price (ExpPrice), (2) the probability that subjects assign to a loss (ProbLoss), or (3) the investment share in the stock (Investment). Our main explanatory variable is "Treatment," which takes value unity if the observation is from an active investor in a treatment round or zero if it comes from a control round. Additionally, we control for graph, screen, and treatment order; risk, ambiguity, and loss aversion; and

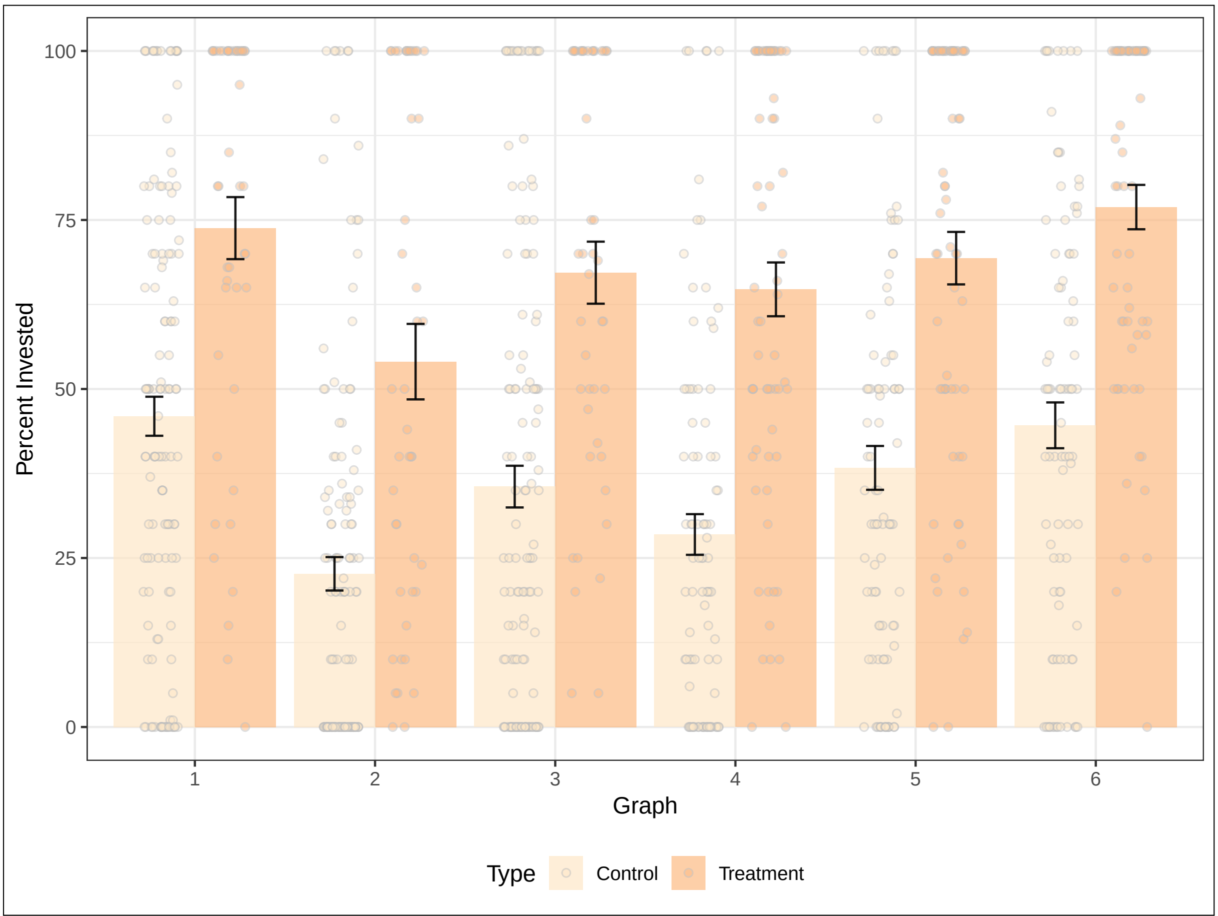


Figure 4: Investments. In the vertical axis, we plot the percent of endowment invested. In the horizontal axis, we separate by graph. The bars represent the average investment; the black error bar represents the standard error. Each dot is an individual investment decision. Light-shaded columns collect investments of all subjects in control blocks, and dark-shaded columns collect investments of active investors only in treatment blocks. The vertical black bars report the standard errors.

gender, cognitive ability, and various personality traits. All standard errors are clustered at the subject level.

Columns [1]–[3] have as the dependent variable the expected price at $t = 14$, while columns [4]–[6] have the expected probability of a loss, respectively. Table 2 shows a strong effect of limited liability on the price expectations of the subjects: subjects investing under limited liability form significantly higher return expectations. This result is robust to the introduction of ProbLoss as an explanatory variable (column [3]). Therefore, it is clear from Table 2 that once we control for personality traits, we observe how active investors form motivated beliefs to self-justify their excessive risk-taking.

Result 1: *In the presence of limited liability, subjects modify their beliefs. For the same investment opportunity, subjects investing third-party funds under limited liability report* *higher expected returns.*

Notice that we detect motivated beliefs only on price expectations and not on the probability of losses (Columns [4]–[6]). Stating the probability that a stock holds losses in the future might be a harder concept to grasp for subjects than stating a future price expectation. This results in a very noisy estimate for loss probabilities but not for price expectations, as is clear in Figure 3. There we can see how, for each investment, the individual dots for beliefs span the whole support, while those for price expectations are concentrated around the median (also see Table 5 in Appendix A for interquartile distances for each graph).

It is also clear that our treatment has a large effect on the investment decision of active investors (columns [7]–[10] in Table 2). These differences are also obvious in Figure 4, where we see that the mean investment is clearly higher under treatment than under control. In fact, many active investors invest all of the passive investor's endowment to take full advantage of the limited liability. Again, the result is robust to the introduction of regressors with high explanatory power such as ExpPrice or ProbLoss.

Result 2: *For the same investment opportunity, active investors make significantly larger investment under limited liability than under full liability.*

Interestingly, the investment decision is also affected by the order in which the screens are shown. Subjects who first saw the investment screen (i.e., "screen order" takes value unity) invest significantly more than subjects who first saw the belief elicitation screen. This result is in line with our prior: if subjects are asked to think about the losses of an investment, then they are more conservative in their investments. By contrast, the screen order has no effect on beliefs. Intuitively, this means that there is no effect of wishful thinking (after the investment has taken place) on the subjects' beliefs. Such a result is in line with the experimental evidence of Mayraz (2017) and Sun (2018).

Finally, note that with the exception of a weak, negative effect of loss aversion on the subjects' investment decisions, personality traits have no significant effects on neither subjects' beliefs nor on their behavior.

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
		ExpPrice			ProbLoss			Investment		
Treatment	3.320***	3.344***	2.469**	-1.228	-1.250	1.001	31.89***	31.85***	29.48***	31.04***
	(1.268)	(1.269)	(0.984)	(1.154)	(1.158)	(0.908)	(2.814)	(2.815)	(2.798)	(2.813)
Female	-1.223	-1.125	-0.0300	1.653	1.564	0.806	-2.163	-2.292	-1.494	-1.270
	(1.971)	(1.934)	(1.534)	(1.876)	(1.853)	(1.468)	(3.305)	(3.286)	(3.052)	(3.079)
Ambiguity Aversion	-0.380	-0.386	-0.0311	0.501*	0.507*	0.247	-0.850	-0.841	-0.567	-0.510
	(0.258)	(0.254)	(0.221)	(0.275)	(0.280)	(0.239)	(0.598)	(0.590)	(0.580)	(0.575)
Risk Aversion	-0.238	-0.255	-0.304	-0.0858	-0.0695	-0.241	-1.084	-1.061	-0.880	-1.106
	(0.287)	(0.286)	(0.253)	(0.293)	(0.300)	(0.260)	(0.819)	(0.796)	(0.802)	(0.756)
Loss Aversion	0.0625	0.115	0.0886	0.0104	-0.0378	0.0396	-1.235*	-1.304*	-1.386**	-1.329**
	(0.283)	(0.280)	(0.239)	(0.257)	(0.248)	(0.219)	(0.720)	(0.708)	(0.659)	(0.651)
Correct CRT	0.375	0.418	-0.0406	-0.615*	-0.656*	-0.374	0.313	0.256	-0.0409	-0.173
	(0.379)	(0.372)	(0.288)	(0.336)	(0.339)	(0.268)	(0.670)	(0.663)	(0.619)	(0.611)
Screen Order		-3.314**	-1.186		3.040*	0.809		4.365	6.713**	6.351*
		(1.582)	(1.325)		(1.644)	(1.326)		(3.436)	(3.077)	(3.240)
ExpPrice						-0.673***			0.709***	
						(0.0303)			(0.0512)	
ProbLoss			-0.700***							-0.654***
			(0.0398)							(0.0542)
Constant	112.2***	111.9***	137.2***	35.79***	36.02***	111.4***	76.77***	77.09***	-2.228	100.6***
	(8.261)	(8.196)	(6.434)	(6.264)	(6.239)	(6.370)	(17.51)	(17.32)	(17.34)	(16.29)
N	981	981	981	981	981	981	981	981	981	981
Adj. R^2	0.131	0.135	0.542	0.135	0.138	0.544	0.272	0.274	0.426	0.398
Big Five	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Order Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Graph Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Graph Joint Significance	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 2: Three linear models and ten specifications. The first two columns study the effect of limited liability on expected prices and the probability of the stock having a loss, respectively. The third and fourth columns study the effect of limited liability on investment decisions.

4 Conclusion

Cognitive dissonance is the psychological discomfort that arises when one cannot rationalize two conflicting views or actions. A common way to deal with this tension is to form motivated beliefs (Festinger, 1962). For instance, in finance, investors (inadvertently) bias downwards their risk perception to maintain a positive self-image while profiting from their excessive risk-taking (Barberis, 2015; Bénabou, 2015; Bénabou et al., 2018).

To study the formation of such motivated beliefs, we run an experiment in which subjects make investment decisions under both full and limited liability. Under full liability, investors respond for all of their losses, while under limited liability, a neutral party (a passive investor) absorbs any losses derived from the investment. Because we elicit the risk assessment of investors for the same investment under full and limited liability, our design allows us to detect if limited liability leads to excessive risk-taking and motivated results.

The results are clear: for the same investment, limited liability leads subjects to invest more while simultaneously expecting higher returns. Because beliefs are elicited in an incentive compatible way, any increase in expected gains can be interpreted as an indication of motivated beliefs, where the desirability of beliefs takes over.

One of the implications of our results is that limited liability not only causes investors to take excessive risk through the abuse of moral hazard (Gropp et al., 2013) but also causes investors to (inadvertently) upwardly bias their expected profits. Such bias can be extremely costly for both individual investors and firms (Bénabou, 2015) but is especially dangerous if it is collectively shared by the financial sector, as these biased beliefs might reinforce bubble formation or trigger a new crisis (Bénabou and Tirole, 2016).

Finally, it is important to keep in mind that our experiment uses a pool of undergraduate students, meaning our results do not automatically imply the presence of motivated beliefs in professional financial investors. However, given the recent literature that lab and field results are both qualitatively and quantitatively similar (e.g., Herbst and Mas, 2015; Fréchette, 2015), and given the robustness of our results, we believe that our results are strong enough to raise some concern about the effects of motivated beliefs in the financial industry, highlighting the need to incorporate behavioral insight into financial regulation.

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A Additional Tables

	1 = 2	1 = 3	2 = 3	4 = 5	4 = 6	5 = 6
Session type 1:	Control	Control	Control	Treatment	Treatment	Treatment
ExpPrice	<0.001	0.089	<0.001	0.442	0.308	0.851
ProbLoss	<0.001	0.009	<0.001	0.531	0.009	0.330
Investment	<0.001	0.007	0.005	0.894	<0.001	0.015
Session type 2:	Control	Control	Control	Treatment	Treatment	Treatment
ExpPrice	<0.001	0.007	<0.001	<0.001	0.020	0.263
ProbLoss	<0.001	<0.001	0.004	<0.001	<0.001	0.448
Investment	<0.001	0.036	<0.001	0.028	0.001	0.047
Session type 3:	Treatment	Treatment	Treatment	Control	Control	Control
ExpPrice	<0.001	0.030	0.021	0.018	<0.001	0.389
ProbLoss	0.021	0.143	0.039	0.203	<0.001	0.094
Investment	0.001	0.357	0.009	0.027	<0.001	0.228

Table 3: p-values of Wilcoxon matched-pairs signed-ranks test for pairwise comparisons across graphs (from Table 1).

Treatment = Control	Graph 1	Graph 2	Graph 3	Graph 4	Graph 5	Graph 6
ExpPrice	0.377	0.183	0.598	0.015	0.449	0.683
ProbLoss	0.486	0.220	0.556	0.247	0.498	0.243
Investment	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

Table 4: p-values resulting from Wilcoxon rank-sum tests comparing Treatment and Control decisions.

	Graph 1	Graph 2	Graph 3	Graph 4	Graph 5	Graph 6
ExpPrice	0.075	0.125	0.15	0.15	0.135	0.11
ProbLoss	0.3	0.175	0.255	0.25	0.2	0.2

Table 5: Interquartile range for the elicited beliefs (ExpPrice and ProbLoss) for each graph under treatment. Both measures have been normalized to 1.