Who runs first in bank runs? - An experimental analysis

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Work in progress, very preliminary

Abstract

We study theoretically and experimentally how lines form endogenously in front of banks. The lines determine the sequence of decision that, in turn, may affect the emergence of bank runs. Depositors make two decisions: 1) how much to bid to arrive soon to the bank (this determines the line); 2) to withdraw or keep the funds deposited (this determines if a bank run arises or not). We study these decisions in two information settings. In the sequential / simultaneous environment the withdrawal decisions are / are not observable by subsequent depositors. Theoretically, in the sequential setup no bank run should arise in any given sequence of decision, so there are no incentives to make costly efforts (that is, a positive bid) to arrive early at the bank. In the simultaneous setting beliefs on the withdrawal decisions of the other depositors determine the optimal withdrawal decision and, in turn, the optimal amount of costly effort to arrive early to the bank. We test the theoretical predictions in the lab, where we gather extensive data on individual traits (socio-demographics, uncertainty attitudes and personality traits) to account for heterogeneity of the personal characteristics of the depositors. Surprisingly, we find no significant differences in the effort to arrive early to the bank (captured by the bids) neither across the information settings, nor according to the liquidity needs of the depositors. Even though we consider a wide range of individual traits, they do not seem to have a consistent effect on the level of the effort. The most interesting effects are related to rationality. Irrational depositors (those who choose dominated withdrawal strategies) tend to make more efforts to arrive early to the bank when withdrawal decisions are observable. We report also that some depositors seem to attempt to arrive early at the bank to make her decision of keeping the money in the bank visible to subsequent depositors.

Keywords: ambiguity / loss / risk aversion, bank run, bid for position, endogenous line formation, experiment, game theory, sequential games, simultaneous games, strategic uncertainty

JEL Class.: C91, D03, D8, G02, J16

1 Introduction

The last financial crisis has shown that bank runs are existing and important phenomena. In the first two years of the crisis only in the USA 165 banks failed, and in many cases the cause of the failure was a run on the bank. Even large financial institutions like Northern Rock, Bear Stearns, IndyMac Bank, Washington Mutual experienced runs. Governments all over the world took actions to restore the confidence in the financial sector, by increasing the deposit insurance coverage or bailing out failing banks. Understanding bank runs is of first-order importance to find the right responses and to prevent them in the future.

Since the seminal paper by Diamond and Dybvig (1983) the literature has made great advances, however, there are features missing from the model that would possibly foster our knowledge on bank runs. One of them is the endogenous timing of depositors' decisions. As Ennis and Keister (2010) point out: "In the Diamond-Dybvig tradition, the order in which agents get an opportunity to withdraw is assumed to be exogenously given (generally determined by a random draw). In other words, agents in the model are not allowed to take explicit actions to change their order of arrival. This assumption is, of course, extreme and, unfortunately, not much is known so far about the case where it is not made."

In this paper first we discuss a theoretical model that allows to study endogenous timing by using a two-stage game. In the first stage, depositors submit bids and the bids determine the sequence in which depositors get the chance to make withdrawal decisions. We interpret the bids as effort made to obtain a certain position in the line, or in other words, the willingness to run first. In the second stage, depositors decide if to withdraw or to keep their funds deposited (that we also call simply *to wait*) sequentially. We investigate two informational environments. In the first one that we call simultaneous setup, withdrawal decisions (taken in the second stage) by other depositors cannot be observed, while in the other one, labelled as sequential setup depositors can condition their withdrawal decisions on previous decisions of other depositors. We are interested if the difference in the observability of withdrawal decisions affects bidding in the first stage. Several experimental studies (e.g. Schotter and Yorulmazer, 2009; Kiss et al., 2012, 2014a; Davis and Reilly, 2016) show how differences in what may be observed about previous withdrawal decisions affects behavior before and during bank runs, but none investigated how this observability affects the forming of the queue in front of banks. We show that in the sequential setup in the second stage only customers with urgent liquidity needs (that we call *impatient* depositors following the literature) withdraw in any possible sequence of decision that may arise in the first stage, while patient depositors (those who are not hit by a liquidity shock) keep their funds deposited in the bank. Thus, no bank run is the unique Perfect Bayesian equilibrium. As a consequence, it makes no sense to make costly efforts to have an early position in the line, so the optimal bids of both patient and impatient depositors is zero. However, in the simultaneous setup where withdrawal decisions cannot be observed, expectations about how the other depositors decide in the second stage determine both the bids and the withdrawal decisions. For instance, if a depositor believes that all other depositors will withdraw in the second stage depleting the liquidity of the bank, then they may find to run as well and therefore are willing to bid a positive amount in the first stage. There are multiple equilibria: bank runs may occur in equilibrium, but no bank run is also an equilibrium.

We test these theoretical results in the lab. Importantly, the theoretical results (in line with the literature) assume homogeneous depositors apart from the liquidity types. However, real-world depositors differ in many dimensions. To account for such heterogeneity, we measure a host of individual traits of the participants in the experiment. More concretely, we collect data on the age, gender, attitude toward uncertainty (risk aversion, loss aversion, ambiguity aversion), cognitive abilities, overconfidence, income, trust in institutions, personality (Big Five) and social value orientation of the participants. Previous research (Kiss et al. 2014b, 2015) has studied - among others - the effect of gender and cognitive abilities on depositors' withdrawal decision. However, we do not know if they influence *when* depositors would like to arrive at the bank. We also collect beliefs in the simultaneous setup because bidding and withdrawal decisions theoretically are governed by beliefs. More concretely, we ask the participants' belief about own position is in the line and also what they think about how many participants in total will withdraw.

Our study builds on the canonical Diamond-Dybvig framework with two types of depositors. Types (patient vs impatient) are private information. We add to this setup a bidding stage and in the sequential setup we allow depositors to observe previous withdrawal decisions. Similarly to Diamond and Dybvig (1983), the bank does not have any fundamental problem, so bank runs may arise due to coordination problems among the depositors. It is important to understand what may cause these coordination failures since it is clearly not optimal that healthy banks suffer bank runs and the financial intermediation is disrupted. Although fundamentally weaker banks are more likely to be affected by bank runs, there is empirical evidence (e.g. Davison and Ramirez, 2014; De Graeve and Karas, 2014) that even fundamentally healthy financial intermediaries suffer bank runs.

Note that some of the factors whose effect we study is exogenously given, while others can be affected by policy, so they are in this sense endogenous. Individual traits pertain to the first group, and the endogenous factors comprise the informational environment and the beliefs. Both exogenous and endogenous factors are important in policy. Suppose that our results indicate that personality traits affect depositor behavior, for instance more risk averse depositors are more likely to withdraw. Then the policymakers should try to assess the risk attitudes of depositors and focus on those with higher levels of risk aversion. Policy can influence the endogenous factors more easily. If the environment rich in information leads to less bank runs, then policy should strive to promote such an environment. Beliefs can be affected for instance by credible policies. For example, a well-functioning deposit insurance may make depositors to believe that other depositors are not likely to withdraw. Overall, our results clearly inform policy.

Surprisingly, we do not find any significant differences in the bids neither across liquidity types, nor across information settings. This finding suggests that liquidity needs and the informational environment does not affect who runs first to the bank. Reassuringly, we observe that bids and expected positions correlate, suggesting that participants understood the underlying situation and the previous results is not just a conseqeunce of random bidding. Another sign that participants comprehended the game is that they expected less bank runs in the sequential setting which is in line with our theoretical prediction. We observe that in the sequential setup rationality has an effect on bidding in two ways. First, participants that were not fully rational (captured by the fact of choosing dominated withdrawal strategies in some information sets) submitted higher bids than rational subjects. Second, some participants doubting the rationality of other subjects seem to bid high in order to arrive first and then by waiting they attempt to induce the other patient depositor to follow suit and earn the corresponding high payoff. Other individual traits may be behind differences in the bids and then such personal characteristics may explain who runs first in a bank run. This may be the case, but among the traits that we measure we do not find any that clearly affects bidding an a consistent way.

The rest of the paper is structured as follows. Section 2 reviews the literature, then in section 3 we present the theoretical predictions. Section 4 contains the experimental design and the procedures. In section 5 we present the results. Section 6 concludes.

2 Literature review

In this section first we show that information about previous decisions matters in the emergence of bank runs suggesting that the informational setting matters. We also discuss to some length our assumptions about the informational environment. Second, we argue that individual traits are important to understand depositor behavior.

Regarding the relevance of past decisions, three types of studies (theoretical, experimental and empirical) inform our paper. On the theoretical front, Kinateder and Kiss (2014) suppose that depositors decide after each other according to a predetermined order (line) and they observe *all* previous choices before choosing if to withdraw or not. They find that even if only the previous actions are observed and liquidity needs are private information, bank runs do not occur in equilibrium. This result implies that in our sequential setup in the second stage we do not expect bank runs to arise. Experimentally, Garratt and Keister (2009) and Schotter and Yorulmazer (2009) find that allowing to observe the number of depositors that have withdrawn in some circumstances affects the emergence and the severity of bank runs. Kiss et al. (2014a) study all possible information structures in a three-depositor bank environment and document significant differences in the rate of bank runs depending both on the information structure *and* the order of decisions. Chakravarty et al. (2014) and Brown et al. (2016) show how observability of actions affects the contagion of bank runs. Importantly, in all these experimental papers the sequence of decision was exogenously determined. There are also empirical findings that suggest the importance of the information that depositors have when they decide. Kelly and O Grada (2000), Iyer and Puri (2012, 2016) and Atmaca et al. (2016) point out the importance of observing decisions in one's social network, suggesting that observed withdrawals provoke further withdrawals. Starr and Yilmaz (2007) argue that during a bank run incident in 2001 in Turkey observing decisions also played a crucial role.

Our theoretical results follow the logic of backward induction. That is, we expect depositors to bid for the position in the line anticipating the withdrawal decisions. In a similar vein, Davis and Reilly (2016) show that the stance that the policymaker adopts in terms of repayment after a liquidity suspension affects the emergence of bank runs.

In theory and in the lab we consider two information structures. The first is characterized by the lack of information about previous decisions, so depositors decide if to withdraw without knowing how the preceding depositors chose. The second information structure represents the opposite, so depositors observe all previous decisions. The first information structure can be motivated by the case of the US bank, Washington Mutual that in September 2008 experienced massive online withdrawal, a so-called "silent bank run" where decisions of other depositors could not be observed. Such episodes are best modeled in a simultaneous-move framework, as is the traditional Diamond-Dybvig setup (1983). Other runs, like the one on Northern Rock, a bank in the UK were not silent, individuals could see the long queues in front of the banks and the media covered extensively the run. Sequential move games seem to be an appropriate way to model this situation. Therefore, in the second stage of our game we study both a simultaneous and a sequential setup.

We turn now to see how individual traits affect depositor behavior. Starting with Diamond and Dybvig (1983) most of the theoretical studies on bank runs assume that depositors are homogeneous except for their liquidity needs. However, depositors in real life differ in a myriad of ways. Unfortunately, the number of empirical and experimental studies analysing this heterogeneity is rather limited. O Grada and White (2003) analyse two banking panics in New York in the XIX. century that affected the Emigrant Industrial Savings Bank (EISB). They find that in the 1854 panic (that was due to contagion) the less wealthy and less sophisticated depositors started to withdraw massively their funds. In contrast, the 1857 bank run was due to fundamentals and the more wealthy and sophisticated depositors began to withdraw their funds as they observed that the value of many banking portfolios was declining. Less sophisticated depositors joined the run later. During the first panic the share of men and women is similar, but in 1857 women panicked more. Married individuals and people with children also were more prone to panicking. In both panics unskilled workers closed more accounts than semi-skilled workers or professionals. Iyer et al. (2016) also study two runs that occurred in 2001 and 2009. One of the bank runs was due to contagion, while the other was provoked by fundamental causes. In the latter case, the following depositors were more likely to run: uninsured; those with loan linkages to the bank; those working for the bank as staff; those who had somebody in their social network who withdrew her funds from the bank and those who had a higher volume of transactions with the bank. Account age made depositors less likely to run. Regarding individual characteristics, those depositors who were more educated, were engaged in a businnes or professional occupation, were more financially literate or held more assets were more likely to run when the bank has fundamental problems. Iyer et al. (2016) then compare these results to a previous run that was not fundamentally justified. They find that bank staff and depositors with loan linkages to the bank were *less* likely to run in that case. However, uninsured depositors were more likely to run in this case also than insured depositors (but the difference this time is less pronounced). Similarly to the fundamental run depositors with longer relationship with the bank / higher volume of transactions were less / more likely to run.

While we study only bank runs due to coordination failure (and ignore fundamental runs), we investigate different individual traits (e.g. attitude to uncertainty and other personal traits) that were not studied in the previous papers, so our paper nicely complements theirs. There is a growing body of experimental research that also explores the effect of various personal characteristics on the emergence of bank runs. Kiss et al. (2014a) show that gender and risk aversion seem to play no role. Kiss et al. (2015) find that cognitive abilities affect depositors' decision if there is strategic uncertainty involved. Dijk (2017) shows that emotions also affect depositor behavior, fear increasing the probability of withdrawal. Interestingly, he also finds that fear affects more women. However, none of these studies focuses on the question who are the first depositors to run.

3 Predictions

In this section we derive theoretical predictions on the effect of the informational environment and discuss the potential influence of individual traits. To study the effect of the information setting, we assume that depositors only differ in their liquidity needs (impatient vs patient) and investigate the effect of the observability of previous withdrawal decisions on their bidding choices. To do that, we use the three-depositor setup applied in the experiment. We show that in the sequential setup no withdrawal by a patient depositor is expected in the second stage, implying zero bids in the first stage of the game. However, in the simultaneous setup bank runs may occur in the second stage and this in turn entails potential non-zero bids in the first stage. In Appendix 8, we present a detailed theoretical model that generalize these results. Then, we discuss briefly how individual traits may affect those bids.

3.1 The bank run game

We use the bank run game of Kiss et al. (2012, 2014a) that has three periods, as detailed below.

At t=0, a bank with three depositors is formed. Each depositor is endowed with 60 ECUs. From this initial endowment 40 ECUs are automatically deposited in the bank, which therefore initially has 120 ECUs to be invested in a project. The project yields a guaranteed high return in period t=2, but the investment can be liquidated at no cost at t=1. The depositors can use the remaining 20 ECUs to bid for position at t=1. The amount not used for bidding adds to the payoff of the depositors.

Withdraw		Wait	
in position		Accompanied	Alone
1	50		
2	50	70	30
3	50 or 20		

Figure 1: Payoffs of the bank run game

At t=1, one of the depositors is hit by a liquidity shock at the beginning of the period and is forced to withdraw her funds from the bank. We follow Diamond and Dybvig (1983) and assume that there is no aggregate uncertainty about the liquidity demand; i.e., it is common knowledge that one of the three depositors will need the money and will withdraw with certainty. We refer to this depositor as the impatient depositor, whereas the depositors who can wait to withdraw their money are called patient depositors. Then the depositors first submit a bid that determines their position in the line. The amount of the bid is bounded to be between 0 and 20, both included.[1] We interpret the bid as the level of effort to arrive at the bank as soon as possible. After the bidding, the position of the depositors is determined and they must choose whether they want to withdraw their money from the bank or keep it deposited. Payoffs depend on the position in the line and the decisions of all depositors. If a depositor decides to withdraw, she immediately receives 50 ECUs as long as there is enough money in the bank to pay this amount (out of this amount, 40 ECUs correspond to the initial endowment and 10 ECUs are obtained in the form of interest). In our experiment, if depositors 1 or 2 withdraw, they definitely receive 50 ECUs. However, if depositor 3 decides to withdraw after two withdrawals, she only receives 20 ECUs (because the first two depositors who withdrew received 50 ECUs each, and the bank has only 20 ECUs to pay depositor 3). Nonetheless, if depositor 3 withdraws after less than two withdrawals, the bank pays her 50 ECUs.

At t=2, depositors who decide to wait at t=1 receive their payoff. The amount that the depositors receive in t=2 depends on the total number of depositors who decided to keep their money in the bank. If only one depositor keeps her money deposited, she receives 30 ECUs. If two depositors wait, then their payoff is 70 ECUs. Note that position in the line is only relevant if there is a run, because then arriving late yields only 20 ECUs instead of 50 ECUs.

Note that the final payoff is the payoff related to the withdrawal decision plus the amount of money not used in the bid. For example, if a patient depositor bids 15 and only the impatient

[1] This assumption imposes some form of rationality because with the upper limit depositors cannot have losses.

depositor withdraws, then she receives (20-15)+70=75 ECUs.

We focus on the situation in which observation of decisions is complete or absent, corresponding to the sequential and simultaneous setup described in the previous section. In the sequential setup previous choices (both keeping the money deposited and withdrawal) are observable and depositors decide sequentially according to their position in the line which, in turn, is determined by the bid. In the simultaneous setup previous decisions cannot be observed, patient depositors decide simultaneously whether to withdraw or to wait.

3.2 Predictions in the bank run game

Sequential setup Starting with the second stage of period 1, it is clear that the best response of a patient depositor to any information set (that is, sequence of previous decisions) that contains that somebody has kept the money in the bank is to wait as well. Let 0 denote keeping the money deposited, while 1 represents withdrawal. Then, $BR(0) = BR(0,1) = BR(1,0) = 0$. In words, if a patient depositor observes a waiting / a waiting followed by a withdrawal / a withdrawal followed by a waiting, then the best she can do is to wait as well and obtain the largest possible payoff related to the withdrawal decisions. As a consequence, a patient depositor in position 1 would always wait because then by sequential rationality she knows that the other patient depositor will wait as well, both of them enjoying the largest possible payoff. Thus, $BR(\emptyset) = 0$. Consequently, if a patient depositor in position 2 observes a withdrawal, then she knows that the withdrawal must be due to the impatient depositor and the other patient depositor is in position 3 and by waitng she can induce her to wait as well. Therefore, $BR(1) = 0$. Note that as the game unfolds, only such information sets arise in which patient depositors choose to keep their funds deposited.[2]

As a consequence, there is no point in arriving as soon as possible to the bank and depositors (the patient ones and the impatient one also) will bid zero in the bidding stage.[3]

Hypothesis 1 (Sequential setup): In the sequential setup, we expect that both patient and impatient depositors submit zero bids in the first stage of the game.

[2]To complete the analysis of all information sets, note that a patient depositor cannot observe two waitings in position 3 because the impatient depositor always withdraws. However, she can observe two withdrawals and in this case her best response is to wait given the payoffs. Notice that as the game unfolds, this information set containing two withdrawals cannot be reached.

[3]In Appendix 8, we show that this prediction can be generalized.

Simultaneous setup We start the analysis again with the second stage of period 1, that is the withdrawal decision. If a patient depositor expects that the other patient depositor will withdraw / wait, then her best response is to withdraw / wait. In the first case, all depositors would run as the impatient depositor withdraws with certainty. Hence, a patient depositor best responds by spending some amount of money in the bidding stage to get earlier to the bank than one of the other depositors, so she will bid a positive amount. The patient depositor submits the minimal amount that she considers necessary to arrive in position 1 or 2 at the bank. When a patient depositor expects the other patient depositor to keep her funds deposited, then there is no point to bid, so the optimal bid is zero.

If the impatient depositor expects 0 or 1 patient depositor to withdraw, then her best response is to bid zero in the bidding stage as she will receive 50 ECUs upon withdrawal with certainty and she will receive also the 20 ECUs not used to bid. If she expects 2 patient depositors to withdraw, then the same line of reasoning applies to her as to the patient depositor who expects the other patient depositor to withdraw. Thus, in this case she will bid a positive amount that allows her to arrive early at the bank.

Hypothesis 2 (Simultaneous setup): In the simultaneous setup, bids depend on the beliefs about withdrawal decisions. If a patient depositors expects the other patient depositor to withdraw, then she will submit a positive bid to arrive early (in position 1 or 2) at the bank. If the impatient depositor expects that both patient depositors withdraw, then she will submit a positive bid to arrive earlier at the bank than one of the other depositors.

Note that based on the theoretical predictions we may observe the same bids if in the simultaneous setup depositors believe that the (other) patient depositor(s) will wait.

3.3 Individual traits

The previous theory is silent about the magnitude of the bids. It is natural to think that the size of the bid is affected by individual traits. In this section, we present some conjectures about the effect of gender and uncertainty on the bidding behavior. For the rest of the traits, we do not have strong expectations. For example, the effect of the Big Five does not seem to be straightforward. We do not consider it problem, as we view this part of the study as an exploratory investigation to unearth potential effects. We only make some educated guesses about the effects of these traits in Appendix .

We start with gender effects. In experimental papers on bank runs, there is no consensus on if women make different withdrawal choices because while Kiss et al. (2014b) do not find gender differences in the withdrawal decisions (in information sets with or without strategic uncertainty), Dijk (2015) reports that women are more likely to withdraw when fear is induced in the participants. It is not clear if gender differences in withdrawal decisions translate into differences in the propensity to run first. Turning to experiments on bidding, many studies report gender differences. For example, Rutstrom (1998) finds that women exhibit more variance in bidding choices than men do. Casari et al. (2007) find that women without experience in auctions bid higher. It is unclear if these result hold when bidding for position in a bank-run game. Overall, there are no clear conjectures on how gender may affect bidding in our setups.

We turn to the effect of the attitude toward uncertainty. We elicit risk, loss and ambiguity aversion in the experiment.[4] The more a depositor dislikes uncertainty, the more she is willing to pay to avoid it. However, it may have different effects in the different setups. In the simultaneous setup, a way to secure a payoff is to be in position 1 or 2 and withdraw, that leads to a sure 50 ECUs instead of facing the uncertainty of the 70 / 30 ECUs. Hence, if we consider two patient or impatient depositors in the simultaneous setup, both of them expecting the other patient depositor to withdraw, then we conjecture that the one who is more averse to uncertainty will bid more. In the sequential setup, a patient depositor may want to bid high to be the first to make the withdrawal decisions and then she may choose to wait and hence induce the other patient depositor to do so as well, both of them earning 70 ECUs.[5] Thus, here the high bid to be the first would lead to a waiting, in contrast to the simultaneous case. However, in both cases, the more averse is a depositor to uncertainty, the more she would bid, *ceteris paribus*.

For the rest of the variables that we measure (cognitive abilities, income and trust, traits captured by the Big Five and Social Value orientation) we relegate our conjectures to Appendix 9. We do not have strong hypotheses and our study is rather exploratory for these variables.

[4]In our sample risk and loss aversion are negatively and significantly correlated, but none of them is correlated with ambiguity aversion on the individual level.

[5]Such reasoning also assumes that the participant believes that the other participants are rational enough to make the optimal decisions. We did not measure directly beliefs about the other participants' rationality.

4 The experiment

We recruited a total of 312 subjects (? female) with no previous experience in coordination problems or experiments on financial decisions. We ran six sessions with 24 subjects each at the Laboratory for Theoretical and Experimental Economics (LATEX) of Universidad de Alicante in October 2015 and we ran four sessions with 42 subjects each at the Laboratory for Research in Experimental and Behavioural Economics (LINEEX) of Universitat de Valencia in February 2016. Having detected no significant differences across locations, we pooled the results.

The experiment was programmed using the z-Tree software (Fischbacher, 2007). Instructions were read aloud and the bank run game was played twice. The first time it was announced as a pre-test so that participants can get familiarized with the game, and no results were communicated to the individuals, nor was there any related payment. The second try was the paid one, and was played just once. Individuals were matched in trios in order to form banks of three people. Likewise, each subject was told that she had an initial endowment of 20 ECUs destined for bidding and additionally 40 ECUs deposited in the bank. All of this information was known publicly. Appendix 10 contains the instructions.

In the experiment, we used the strategy method, and therefore individuals were asked to decide in all the possible information sets they could be in. Once the experiment finished, the computer paired participants randomly to form banks and payoffs were computed according to their bidding and withdrawal decisions. Individuals were informed of this fact.

During the game, the depositors had to make two decisions. In the first one, they participated in an auction, where they could bid any amount of the initial endowment destined for bidding (between 0 and 20 ECUs). The bids in the auction determined the position in the line, the first / second / third depositor in the line being the one with the highest / second highest / lowest bid. They were asked to bid both as patient and impatient depositors. They were informed that at the end of the experiment, the computer would select at random, with the same probability, one of the three depositors of each bank, that would be impatient. They also got to know that at the end of the experiment they received the amount not used in the bid (that is, 20-bid). We explained that bids had to be multiples of 1 ECU. By setting the maximum bid to 20 we ensure that no participant earns a negative payoff.

After the bidding decision, participants were asked to decide what they would do if they arrived to the bank and had the possibility of withdrawing or keeping their money deposited. Thus, we asked their decisions as patient depositors, because impatient depositors withdraw by definition.

Treatment 1 represented the simultaneous setup, so previous decisions were not observable and participants decided whether to withdraw or keep their funds deposited just knowing their own bid.

The sequential case was played in Treatment 2. Previous decisions were observable and participants were asked to decide in 5 different situations:

- If she arrived first to the bank and did not observe anything.
- If she arrived second and observed that the first one had kept her money deposited.
- If she arrived second and observed that the first one had withdrawn.
- If she arrived third and observed that the first one had waited and the second had withdrawn.
- If she arrived third and observed that the first one had withdrawn and the second had kept her funds deposited.
- If she arrived third and observed that the first and the second had withdrawn.

At the end of the experiment, the subjects filled out a questionnaire that was used to collect additional information about a set of socio-economic variables that we call individual traits . We announced that some questions (risk aversion, loss aversion, ambiguity aversion, cognitive abilities, overconfidence) would be incentivized. Next, we present briefly how we elicited the variables of interest. In Appendix 11 we validate our measures by comparing the data that we obtained with results from the literature.

The questionnaire started with age and gender. Then, we elicited risk attitudes using the "bomb risk elicitation test" by Crosetto and Filippin (2013). Subjects should decide how many boxes to pick from a store, numbered from 0 to 100. They were told that a bomb would be placed in one of the boxes at random, and they had to decide the number of boxes they want to collect. They would receive 0.10 euros for each box, if the bomb was not among the chosen boxes, and 0 if they had chosen the box with the bomb. Each box had uniform probability of containing the bomb and it was common knowledge. Crosetto and Filippin (2013) show that the number of boxes chosen is an appropriate measure of risk aversion.

Next, we estimated loss aversion, following Gachter et al (2007). Participants were asked to choose among 5 lotteries where they could earn or lose money depending on the result of tossing a coin. They had the opportunity of participating in the lottery if they wanted. The lotteries had always the possibility of earning 4 euros, and the five lotteries differed in the loss they could suffer, from 1 to 5 euros. The number of accepted lotteries is a meassure of loss aversion.

We elicited ambiguity aversion following Dimmock et al (2015). There were four urns, composed of a different quantity of coloured balls, and participants had to bet on the color, earning 2 euros if they guessed correctly (0 euros otherwise). Urn 1 was composed of 5 red and 5 blue balls. Urn 2 had an unknown number of red and blue balls. Urn 3 contained some number (between 0 and 10) of red balls, the rest of balls being blue; this number would be chosen from a bag with 11 balls numbered from 0 to 10. Finally, Urn 4 would be filled with 10 red and 0 blue balls, or with 0 red and 10 blue balls depending on if a 0 or a 10 was selected from a bag with these two numbers. After betting, participants had the opportunity of selling their bet, asking for a minimal price between 0 and 200 cents. Then, the computer would choose a random number between 0 and 200, and would pay it if the selling price was below. The differences in the selling price between urn 1 and the rest is a measure of ambiguity aversion, according to Dimmock et al. (2015).

The next item in our questionnaire was the Cognitive Reflection Test by Frederick (2005). We elicited overconfidence by offering money if they guessed correctly the number of questions they had answered correctly and overplacement if they guessed the number of questions answered correctly by another random participant.

Next, we asked the income level of their families and trust in several institutions (monarchy, government, army, banks, police, church and political parties). The actual questions were taken from a questionnaire of the Spanish National Statistics Institute (INE). When asking about their confidence in different institution we were especially interested in their attitude towards banks so that we can control for it in our analysis. Possibly, some participants distrust banks and that may make them more prone to withdraw and hence this negative attitude may distort the analysis if we do not take it into account. There was a 0-10 scale for family income and each point represented a range of possible income. Trust in the different institutions was expressed on a 0-10 scale as well. To sum up trust in a measure, we calculate the average of the trust scores and call it simply trust. We always report also trust in banks separately. All these measures are self-reported and were not incentivized.

We elicited personality traits using a 48-item Big Five test, and finally we measured social value orientation of our participants with the 9-Item Triple-Dominance Measure (see Van Lange et al., 1997).

At the end of the experiment we also elicited beliefs both regarding position in the line and decisions of the other depositors. More concretely, we asked in both treatments (simultaneous and sequential) and for both roles (impatient and patient depositor) what position they believed to obtain when they bid for it. There were four possible answers, 1,2 and 3 denoting the believed position and 0 representing the option of bidding without thinking about the position in the line. We also asked in both treatments from the impatient depositors what they believed how many of the other depositors chose to withdraw. The possible answers to choose from were 0, 1 and 2. In the simultaneous setup we asked a similar question from the patient depositors. The only difference was that since the impatient depositor was forced to withdraw, the possible answers were restricted to 1 and 2. In the sequential setup we also asked patient depositors upon observing a withdrawal in position 2 what they thought most probable from the following three alternatives: 1) Depositor 1 who withdrew was the one forced to withdraw., 2) Depositor 1 who withdrew was the one who could choose between keeping the money deposited and withdrawal., 3) The two previous options are equiprobable.

We made also clear that at the end of the experiment the ECUs earned during the experiment will be converted into Euros at the following rate 10 ECUs = 1 Euro.

5 Experimental results

We start with some descriptive statistics and statistical tests. At the top of Figure 2, we report the average bid for each type of depositor (patient/impatient) and for each information setting (simultaneous/sequential) separately. We find that depositors bid around 7.20 ECUs (roughly 36% of their endowment) regardless of their role or the informational environment. There is no significant difference between the bid of the patient and impatient depositor in any of the two information setting (Wilcoxon ranksum test, $p>0.26$ in each case), nor is there any significant difference between the bid of the patient / impatient depositor across information setups (Wilcoxon ranksum test, $p>0.35$ in each case).

The theoretical results predict zero bids from impatient and patient depositors in the sequential setting. Regarding the impatient depositors we observe that 92.9% submitted a positive bid in the simultaneous setup, while only 87.8% did so in the sequential setting. For patient depositors the corresponding numbers are 87.8% for both informational environment. The Wilcoxon ranksum test fails to detect significant difference between the treatments. Moreover, the Wilcoxon signed rank test rejects that bids in the sequential treatment are zero for impatient and patient depositors.

	Simultaneous		Sequential	
	Patient	Impatient	Patient	Impatient
Average bid	7.25 (4.87)	7.526 (5.31)	7.147 (5.37)	6.961 (5.21)
Believed position				
1	13.682 (4.41)	12.731 (4.44)	11.120 (6.11)	12.786 (5.12)
2	8.833 (3.37)	7.971 (2.28)	8.027 (3.80)	7.094 (2.94)
3	1.483 (1.66)	3.444 (4.32)	2.055 (4.68)	2.059 (2.88)

Figure 2: Average bid (std. dev.), unconditional and conditional on the depositors' belief about their position

These results suggest that neither the type, nor the informational environment affects the bids.

Finding 1: Contrary to the theoretical prediction, both patient and impatient depositors bid, on average, a positive amount in the sequentialtreatment. Depositors of the same liquidity type do not bid differently in any of the two informational conditions (simultaneous and the sequential setup). The bids of patient and impatient depositors are undistinguishable across information conditions.

Next, we look at the bids in each information setting and investigate whether the depositors' beliefs about their position are consistent with their bids.[6] We summarize our findings at the bottom of in Figure 2. At the bottom panel we observe that depositors who believe that they will arrive first to the bank tend to bid more on average than depositors who believe they will arrive second or third. There is indeed a significant correlation between the depositors' bid and their expected position in the line (p-value < 0.0001).

Finding 2: Bids and expected positions correlate significantly.

The correlation between bids and expected position suggests that participants understood the underlying situation and those who wanted to achieve a better position indeed submitted higher bids. However, interestingly and in contrast to the theoretical prediction we do not see any difference in bids across informational environments.

[6] At the end of the experiment, we reminded subjects their bids as patient and impatient depositors and ask them to predict their position in the line. Only 5% of the subjects reported that they did not think about their position when submitting their bids.

	Simultaneous	Sequential
None of the patient depositors will withdraw	36.90%	44.05%
Only one of the patient depositors will withdraw	45.24%	50.00%
Both of the patient depositors will withdraw	17.86%	5.95%

Figure 3: Beliefs about the behavior of the patient depositors in each setting

While our model is silent about whether patient or impatient depositors should bid more, patient depositors should bid nothing if they are going to keep their funds deposited in the simultaneous setting, according to the Homo Oeconomicus prediction. We find, however, that bids of those who keep the money deposited (7.54 ECUs) and withdraw (7.42 ECUs) are indistinguishable from each other in the simultaneous setting (p = 0.966). Further, we expect to observe no bids in the sequential setup, but this is not what we observe in our data.

What may explain positive bids in the sequential setup? Depositors might bid positive amounts in the sequential setting because they do not anticipate that there will be no bank runs in equilibrium; i.e., depositors may believe that the observability of actions will not foster coordination. We asked impatient depositors to predict how many patient depositors will withdraw their money from the bank in each of the settings. Our results are summarized in Figure 3. We find that roughly 37% (44%) of depositors expect to see no withdrawals in the simultaneous (sequential) setting, while 18% (6%) of depositors expect that both patient depositors will withdraw in the simultaneous (sequential) setting, respectively. This, in turn, seems to indicate that depositors expect coordination to be more successful in the sequential than in the simultaneous setting. The Kruskal-Wallis equality-of-populations rank test rejects the null hypothesis that depositors expect the same behavior in the two settings (p = 0.049).[7]

We summarize these results as follows:

Finding 3: Depositors believe that bank runs will be less likely in the sequential setting. However, they expect there to have coordination problems as well.

The first part of the finding is in line with our theoretical prediction that we expect less withdrawals by patient depositors in the sequential setup. However, according to the theoretical prediction it should be zero, while participants in the experiment expected a significantly higher number.

[7] Unless otherwise noted, we consider in this section a one-tailed analysis when there is a clear ex ante hypothesis.

Note that Finding 3 indicates that depositors recognize the importance of observability. But then, why did participants expect coordination to be more difficult than theory predicts in the sequential setup?

We have two plausible explanations related to rationality that may affect bidding behavior in the sequential setting. First, if subjects are rational they should understand that it is optimal to bid nothing and wait. But subjects may not be rational. There is a very natural way to measure rationality in our game: at position 3 keeping the money deposited is a dominant strategy. While the majority of the subjects (129 out of 158, 83%) are rational according to this criterion and wait in position 3, 27 out of the 158 subjects (17%) decided to withdraw (at least once) in the last position. Our data suggest that these irrational subjects bid more than rational subjects (8.815 vs 6.798, p = 0.029), indicating that higher than predicted bids may be partly due to the irrationality of the participants.[8]

Second, subjects might be rational but believe that others will be irrational. Assume that a patient depositor withdraws upon observing a withdrawal from the first depositor even if she knows that a withdrawal must be due to the impatient depositor if everybody is completely rational. However, such a patient depositor may believe that other depositors may be irrational. A way to counteract such supposed irrationality is to bid high in order to be the first in the sequence of decisions and then wait so as to induce the other patient depositor to do so as well (and hope that the other patient depositor recognizes that her best response upon observing a waiting is to wait). Alternatively, they can also bid and withdraw in the first position to make sure they receive the 50 ECUs. In our data, we observe that subjects who decided to wait in the first position bid higher than those who decided to withdraw in the first position (7.541 vs 5.735, p = 0.045), thus there is some evidence for signaling in the sequential setting. This result suggests that the higher than predicted bids may be partially due to the fact that participants did not trust the rationality of other participants.

We summarize these results as follows:

Finding 4: Positive bids in the sequential setup are partly due to two reasons related to (ir)rationality.

[8]We can also classify as irrational depositors those who withdraw in position 2 after observing a waiting. Under this definition, 122 out of 158 (77%) are rational, and 36 out of the 158 subjects (23%) are irrational. Our previous result that irrational subjects bid more in the sequential setting is robust under this classification (8.912 ECUs vs 6.656 ECUs, p = 0.013).

1. Some participants were not fully rational.

2. Some participants may have doubted the rationality of the other participants and bid high to be the first in the sequence of decisions so that by keeping her funds deposited she could induce the other patient depositor to do so as well.

Such behavior of inducing subsequent patient depositors to wait has been observed also by Kinateder et al. (2017) in a somewhat similar experimental setting. It suggests that depositors appreciate the possibilities to show / communicate to subsequent depositors that they keep their funds deposited.

We move now to see how individual traits affect the size of the bid. We begin with Figure 4 that shows raw correlations between individual traits and bids in the different informational environments as impatient and patient depositors.[9]

		Impatient		Patient	
		Simultaneous	Sequential	Simultaneous	Sequential
Demographics	Age	-0.0560	0.2530***	0.1525*	0.1941**
	Female	-0.1687**	-0.1465*	-0.0456	-0.0984
Uncertainty attitudes	Risk aversion	0.1260	-0.0237	0.0913	0.0031
	Loss aversion	-0.1696**	-0.1495*	-0.1384*	-0.1175
	Ambiguity aversion	0.0268	-0.0741	0.1083	-0.0328
Other factors	Cognitive abilities	0.0585	0.2019**	-0.1670**	-0.0033
	Overconfidence	-0.0217	-0.2332***	0.1396*	-0.1622**
	Income	0.0909	0.0620	0.0171	-0.0828
	Trust in banks	0.1134	-0.0284	0.0152	-0.0422
Big Five categories	Openness to experience	0.0452	-0.1181	-0.0052	0.0152
	Conscientiousness	-0.0364	0.0279	0.0079	0.0000
	Extraversion	0.0679	-0.0723	0.0128	-0.0638
	Agreeableness	-0.0638	0.0633	-0.0157	0.0476
	Neuroticism	-0.0661	-0.0697	-0.0998	-0.0500
Social value orientation	Individualistic	-0.0068	-0.0315	-0.0318	-0.0406
	Competitive	-	-0.0303	-	-0.0622
	Prosocial	0.0752	0.1025	0.0539	0.0555

Figure 4: Raw correlations between individual traits and bidding as impatient / patient depositors in different information setups (*/**/*** denotes significance at the 10/5/1% level.)

Starting from the bottom of Figure 4, we can observe that in case of Social Value Orientation

[9]We do not correct here for multiple testing because we just wish to have a first look at the data and we do not want to draw too far-fetched conclusions.

and the Big Five personality traits the (absolute value of the) correlations is rather low and none is significant at conventional significance levels. Therefore, it seems that the individual traits captured by these measures are not related to the bids submitted either as an impatient or a patient depositor in the simultaneous or sequential setup.

The same is true about family income and trust in banks (and in general in institutions). Interestingly, uncertainty attitudes measured by our risk and ambiguity aversion measures show no significant correlation with the bids in any role and in any informational environment.

The rest of the variables exhibits at least some significant correlation with the bids in some cases. Age is positively correlated with bids in 3 out of 4 cases, indicating that older depositors tend to bid higher amounts (mostly in the sequential setup).[10] As impatient depositors females tend to submit significantly lower bids. Loss aversion is weakly negatively correlated with bids, suggesting that more loss-averse depositors tend to bid less, contrary to our conjecture. Cognitive abilities correlate positively / negatively with bids submitted as the impatient / patient depositor, and in two cases these correlations are significant. We have no good story why the effect of cognitive abilities should vary with the type of the depositor. The effect of overconfidence is also somewhat ambiguous, though it seems to reduce bids in the sequential setup.

The previous correlations can be misleading as we do not control for many factors that may be correlated with the variable under study. Hence, now we attempt to show the determinants of bidding behavior using an econometric analysis. Figure 1 and 2 report the results of a Tobit regression on the amount that depositors bid in each of the settings, depending on their roles as patient or impatient depositors. In each case, our first regression controls for risk preferences, loss aversion and ambiguity. We include the demographic variables (Age and Gender) in our second regression. Our third regression controls for income, trust in institutions, cognitive abilities and personality traits; i.e., BIG5 and SVO. In each of the regressions, we consider a dummy variable that takes the value 1 if patient depositors decided to withdraw their money from the bank. In the simultaneous setting, this variable determines whether depositors who withdrew arrived earlier to the bank. In the sequential setting, we also use the decision of depositors in the first position (variable called Decision) to determine whether depositors were interested in showing their decision to other depositors. To control for the possibility of irrational subjects in the sequential setting, we also include a dummy variable that takes the value 1 for subjects who decided to withdraw in

[10] Age in our sample ranges from 18 to 63, with an average of 22.7, so we have a rather young pool with some older participants, so this result should be taken with a pinch of salt.

	Patient depositor allowed to wait or withdraw				Impatient depositor forced to withdraw			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Constant	8.162***	4.583	5.721*	13.68*	8.316***	11.63***	12.34***	9.854*
	(1.400)	(3.552)	(3.060)	(7.914)	(1.448)	(2.720)	(3.584)	(5.862)
Decision	-0.098	-0.263	-0.402	0.078				
	(1.238)	(1.217)	(1.198)	(1.972)				
Risk aversion	1.058	0.970	1.273	1.164	0.990	0.984	0.925	0.903
	(1.576)	(1.484)	(1.497)	(1.622)	(1.008)	(1.014)	(1.078)	(1.200)
Loss aversion	-2.086**	-2.189***	-2.637***	-3.127**	-2.572**	-2.115*	-2.182**	-2.447*
	(0.814)	(0.819)	(0.951)	(1.227)	(1.283)	(1.075)	(1.093)	(1.375)
Ambiguity aversion	0.021**	0.020**	0.011	0.009	0.001	0.002	0.002	0.004
	(0.009)	(0.009)	(0.010)	(0.012)	(0.007)	(0.007)	(0.010)	(0.006)
Age		0.166	0.146*	0.168		-0.124*	-0.140**	-0.137**
		(0.102)	(0.081)	(0.114)		(0.064)	(0.058)	(0.066)
Gender (=1 if female)		0.184	-0.354	0.509		-1.585	-1.632	-1.438
		(1.008)	(1.142)	(0.890)		(1.228)	(1.444)	(1.315)
Controls (income, confidence, CRT)			Yes	Yes			Yes	Yes
Personality (BIG5 and SVO)			No	Yes			No	Yes

Notes. We have a total of 131 observations in the simultaneous setting (10 left-censored, 117 uncensored, and 4 right-censored observations). In the sequential setting, we have 144 observations (19 left-censored, 118 uncensored, and 7 right-censored observations). Robust standard errors in parentheses are clustered at the session level. Significance at the *** p<0.01, ** p<0.05, * p<0.1.

Table 1: Bidding behavior in the simultaneous setting

position 3.

Consider first the simultaneous setting in Table 1. When depositors are in the role of patient depositors, bids are not driven by whether or not subjects want to withdraw their money from the bank as the variable Decision is not significant in any of the specifications. Arguably, loss aversion seems to be the main determinant of their bids. Although this effect was expected, the negative sign of loss aversion indicates that loss-averse subjects tend to bid *less* than those who are not loss-averse. One possible reason is that subjects perceive that bidding in the simultaneous setting (where they cannot make visible their decision to subsequent participants) will not help to foster coordination, thus loss-averse subjects prefer to focus on keeping their initial endowment of 20 ECUs rather than bidding to decide when to go to the bank.[11] When we consider the decision of impatient depositors (who are forced to withdraw) we confirm that loss aversion has a negative and significant effect on the bidding behavior. The effect of loss aversion for patient and impatient depositor is not statistically different.

Next, in Table 2 we look at the sequential setting. Recall that subjects should bid zero in this setting, but we observe positive bids when decisions are sequential and these bids are not statistically different from the ones in the simultaneous setting (Figure 2). In line with our previous discussion on the role of showing subsequent depositors the decision, our econometric analysis suggests that

[11] We also find an effect of ambiguity aversion on bidding behavior, but the effect vanishes when we include additional controls. Among them, the only one that is significant is cognitive reflection; in fact subjects with higher score in the CRT tend to bid less ($p = 0.047$).

subjects who withdraw in position 1 tend to bid significantly less, thus there is an incentive for subjects who want to wait to bid and then make visible the decision to the other patient depositor. There is also a significant effect of rationality in that those who are irrational tend to bid more.[12] Finally, we find that loss-averse subjects tend to bid more. This is in line with the idea that subjects in the sequential setting want to avoid a bank run and prefer to bid to show their choice to other depositors. We indeed observe that loss-averse subjects withdraw less in position 1 (21.13% vs 31.25%), but differences are not statistically significant. If depositors are forced to withdraw, loss aversion has no effect.

	Patient depositor allowed to wait or withdraw				Impatient depositor forced to withdraw			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Constant	7.969***	5.799***	6.171***	8.687*	7.286***	4.788*	3.266	8.402**
	(1.084)	(1.542)	(1.692)	(4.513)	(1.759)	(2.633)	(2.700)	(3.959)
Decision (=1 if withdraw)	-2.035*	-1.814	-2.023**	-2.020*				
	(1.120)	(1.097)	(1.007)	(1.183)				
Irrational subjects	3.621***	3.375***	3.313***	3.744***	2.200*	1.789	2.290*	2.124
	(1.101)	(1.112)	(1.035)	(0.934)	(1.120)	(1.125)	(1.236)	(1.325)
Risk aversion	-0.250	-0.546	-0.432	-0.497	-0.590	-1.069*	-0.772*	-0.435
	(1.118)	(1.083)	(1.196)	(1.249)	(0.683)	(0.613)	(0.464)	(0.644)
Loss aversion	2.558***	2.663***	2.803***	2.899***	1.507	1.603	1.746	1.747
	(0.746)	(0.905)	(0.897)	(0.905)	(1.460)	(1.342)	(1.445)	(1.362)
Ambiguity aversion	-0.009	-0.010	-0.012	-0.009	-0.015***	-0.017**	-0.013*	-0.0148
	(0.011)	(0.013)	(0.012)	(0.010)	(0.006)	(0.008)	(0.007)	(0.00893)
Age		0.118*	0.120**	0.126*		0.161**	0.139**	0.137*
		(0.063)	(0.058)	(0.071)		(0.066)	(0.067)	(0.0786)
Gender (=1 if female)		-0.985	-0.858	-0.862		-1.909***	-0.862*	-0.867
		(1.057)	(0.713)	(0.565)		(0.622)	(0.464)	(0.732)
Controls (income, confidence, CRT)			Yes	Yes			Yes	Yes
Personality (BIG5 and SVO)			No	Yes			No	Yes

Notes. We have a total of 131 observations in the simultaneous setting (10 left-censored, 117 uncensored, and 4 right-censored observations). In the sequential setting, we have 144 observations (19 left-censored, 118 uncensored, and 7 right-censored observations). Robust standard errors in parentheses are clustered at the session level. Significance at the *** p<0.01, ** p<0.05, * p<0.1.

Table 2: Bidding behavior in the sequential setting

For sake of completeness, we report in Table 3 the withdrawal rates of patient depositors in the information sets for both information setups.

In the simultaneous setting the withdrawal rate is slightly over 15% which lower than in other papers on bank runs with a similar setup (e.g. Kiss et al. (2014). Note that beliefs determine the best response in this setting, so this low percentage reflects that patient depositors expected that other patient depositors would not withdraw. The policy governing financial stability has an important role in affecting these beliefs, because if depositors believe that others will not withdraw their funds, then there is no need to do it. For instance, a credible deposit insurance scheme may

[12] The differences in the withdrawal rates of rational (21.70%) and irrational (22.22%) subjects is not statistically significant (p = 0.953), thus we can conclude that irrational subjects do not tend to bid more because they are more likely to withdraw in position 1.

	Information set	Withdrawal rate
	Simultaneous setup	15.4%
Sequential setup	Observes nothing	21.8%
	Observes withdrawal	57.7%
	Observes waiting	5.1%
	Observes withdrawal, waiting	9%
	Observes waiting, withdrawal	8.3%
	Observes two withdrawals	9%

Table 3: Withdrawal rates of patient depositors

prevent inefficient bank runs even if decisions of other depositors is not observable. In the sequential setting, participants were quite rational because the withdrawal rate was rather low in information sets in which withdrawal was a dominated strategy (the last 4 information sets). Interestingly, in the other information sets the withdrawal rate was higher, than in the simultaneous setting, although theoretically the opposite should occur. Notably, observing a withdrawal triggered a very high rate of withdrawal (57.7%). While theoretically an environment that allows to observe what other depositors decide should yield no bank runs due to coordination failure, the experimental evidence provides a warning that observing withdrawals at the beginning of the queue actually can lead to massive withdrawals.[13]

6 Discussion and conclusion

This study was motivated by the relative lack of theoretical and experimental evidence about how queues of depositors form in front of banks. We aimed at complementing the scarce empirical evidence to understand better who runs to the bank in a bank run. Gaining insight to this issue would inform theory and policy as well. Theoretical papers generally assume that the aforementioned queues form randomly, reflecting the lack of knowledge about who rushes to the banks. Policy would benefit from knowing how informational environments and individual traits affect the emergence of bank runs as it could focus better on the identified factors.

To achieve our objective we build a theoretical model that yields useful predictions about the formation of lines and we also posit some conjectures about how individual characteristics may

[13]In a companion paper we argue that it is due to panic driven by unreasonable beliefs about the behavior of other depositors, see Kiss et al. (2018).

affect this process. A basic assumption behind the model is that the willingness to pay for position in the line in the form of a bid is a good a proxy for the effort that an individual would make to arrive early at the bank. Theory predicts that when decisions of withdrawing or keeping the money deposited are observable, then we should not observe any bank runs for any line that may arise and as a consequence no effort is needed to achieve the individual optimum that also leads to the social optimum. In contrast, when these decisons cannot be observed, then beliefs about the decision of other depositors determines both the bids and also the subsequent decisions.

We designed an experiment to investigate both the effect of the information setting and also how individual traits affect who runs to the bank. Interestingly, the descriptive statistics show no significant differences between the bids (and hence in our interpretation the efforts to arrive early at the bank) neither across liquidity types (patient vs. impatient), nor across information settings (simultaneous vs. sequential). Beliefs reveal that participants expected less bank runs in the sequential setup, but they did not believe that no coordination failure would arise there. We show that rationality and belief about the rationality of other depositors plays an important role. More precisely, some participants were not fully rational (as they did not recognize dominant strategies in some information sets) and irrationality led to higher bids, *ceteris paribus*. Moreover, we document that some participants in the role of the patient depositor seemed to bid high to be the first in the sequence of decision to keep her funds deposited, thus inducing the other patient depositor to do the same (and prevent a bank run). This behavior may be explained by the doubt about the rationality of the co-players. Possibly, this wish to coordinate with other depositors by making visible the decision to keep the funds deposited could be harnessed by banks or regulators.

When considering a wide range of individual traits, we do not find any that affects in a consistent manner the bids, suggesting that sociodemographic factors, uncertainty attitudes and personalit traits do not have a crucial influence on whether a depositor rushes to the bank or not. In the sequential setting, patient depositors who are loss-averse and irrational tend to submit higher bids, *ceteris paribus*.

Even though we did not identify clear factors or individual traits that affect clearly who runs in a bank run, this seeming non-result is a contribution to the literature. On the theoretical front, our results suggests that the assumption that lines form randomly in front of banks is not wrong, at least it does not contradict our results. Regarding policy recommendation, our findings indicate that neither information about other depositors decisions, nor individual traits seem to affect the emergence of bank runs.

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8 Appendix: Theoretical prediction - The role of observability of withdrawal decisions

We modify the workhorse Diamond and Dybvig (1983) modell by adding a bidding stage before the withdrawal decisions and allowing observability of previous withdrawal decisions in the sequential setup.

8.1 Depositors

There are three time periods denoted by $t = 0, 1, 2$. Period 1 is divided into subperiods as will be detailed later. There is a finite set of depositors denoted by $I = \{1, ..., N\}$, where $N > 2$. The consumption of depositor $i \in I$ in period $t = 1, 2$ is denoted by $c_{t,i} \in \mathbb{R}^0_+$, and her liquidity type by θ_i. It is a binomial random variable with support given by the set of liquidity types $\Theta = \{0, 1\}$. If $\theta_i = 0$, depositor i is called *patient*, that is, she only cares about consumption at $t = 1$. If $\theta_i = 0$, depositor i is called *patient*. Depositor i's utility function is given by

$$u_i(c_{1,i}, c_{2,i}, \theta_i) = u_i(c_{1,i} + (1 - \theta_i)c_{2,i}).$$

The number of patient depositors is assumed to be constant and given by $p \in \{1, ..., N\}$ and the remaining depositors are impatient. The number of patient and impatient depositors is common knowledge. The liquidity type is private information.

8.2 The bank

At $t = 0$, each depositor $i \in I$ has one unit of a homogeneous good which she deposits in the bank. The bank offers a simple demand deposit contract to the depositors that stipulates that upon withdrawal in period 1 depositors receive $c_1 > 1$ unless the funds available to pay that amount decrease to very low levels or zero. We assume that an optimization exercise in the spirit of Diamond and Dybvig (1983) determines c_1. The first best allocation solves

$$\max_{c_1, c_2} (N - p)u_i(c_{1,i}) + pu_i(c_{2,i})$$

$$\text{s. t. } (N - p)c_1 + \tfrac{p}{R}c_2 = N.$$

The solution to this problem is

$$u'(c_1^*) = Ru'(c_2^*),$$

which, as in Diamond and Dybvig (1983), implies that $R > c_2^* > c_1^* > 1$. In the first best allocation, all impatient depositors consume c_1^* at $t = 1$, and all patient ones c_2^* at $t = 2$. Hence, patient depositors receive a higher consumption than impatient ones.

Let $\eta \in \{0, ..., p\}$ be the number of depositors who keep their money deposited at $t = 1$.[14]

[14]Note that η is restricted to be equal to p or smaller since an impatient depositor has a dominant strategy to withdraw, and thus, not more than p depositors keep their funds deposited.

Following the Diamond-Dybvig model it is assumed that all players who keep their money in the bank at $t = 1$, obtain the same consumption at $t = 2$, namely,

$$c_2(\eta) = \max\{0, \frac{R(N-(N-\eta)c_1^*)}{\eta}\}.$$

If $\eta = p$, only impatient depositors withdraw at $t = 1$, and $c_2(\eta) = c_2^* > c_1^*$. Then, patient depositors enjoy a higher consumption than impatient ones. Given p, N and c_1^*, it is possible to determine how many patient depositors have to wait in order for waiting to be an optimal strategy for each of them. Second-period consumption is higher than consumption received after withdrawing at $t = 1$ if the following holds

$$\frac{R(N-(N-\eta)c_1^*)}{\eta} > c_1^*.$$

This condition is equivalent to

$$\eta > \frac{RN(c_1^*-1)}{c_1^*(R-1)}.$$

Since η is a natural number so the previous condition becomes

$$\eta \geq int\left[\frac{RN(c_1^*-1)}{c_1^*(R-1)}\right]+1.$$

Given p, N and c_1^*, there is a unique $\bar{\eta}$ such that $1 \leq \bar{\eta} \leq p$, and for every patient depositor i who waits receives $c_2(\eta) \leq c_1^*$, for all $\eta \leq \bar{\eta}$, and $c_2(\eta) > c_1^*$, for all $\eta > \bar{\eta}$.[15]

The bank is able to pay c_1^* to $int\left[\frac{N}{c_1^*}\right]$ depositors. After $int\left[\frac{N}{c_1^*}\right]$ withdrawals the bank has possibly some funds left over (it is strictly less than c_1^*) that it can pay to the next withdrawing depositor. We denote this sum c_1^{low}. All subsequent depositors who want to withdraw receive zero.

8.3 Strategies and equilibrium

Period 1 is divided in two parts in which the two stages of the underlying game are played. In the first one, depositors submit a bid that determines their position in the sequence of decision. In the second stage, depositors decide sequentially whether to wait or to withdraw their funds from the bank. We assume that bids are not publicly observable. Regarding the information that depositors have in the second stage, we consider two setups: i) simultaneous and ii) sequential. In the simultaneous setup depositors know their position in the sequence, but actions of other depositors are not observed. In the sequential setup, previous decisions are observed.

[15] We use "wait" and "keep the money deposited / in the bank" in an interchangeable manner.

We assume that bids are bounded from above, so nobody can bid more than a certain amount that we denote by b_{max}. For simplicity, we assume that every depositor has an endowment b_{max} that can be used for bidding. We denote by $b_i \in [0, b_{max}]$ the amount submitted by depositor i in the first stage. The ranking of bids determines the sequence of decision, so for instance the depositor who submitted the highest bid is the first to decide in the second stage. If more than one depositor submits the same bid, then each has the same probability of being the first to act. Let $b = (b_1, ..b_i, ..b_N)$ be the vector of all bids. Function $r(b_i, b) : b_i \times b \to [1, N]$ ranks the bids and determines the sequence. We denote by r_i the position of depositor i.

The decision in the second stage is binary, $s_i \in \{0, 1\}$ where 0 denotes keeping the money deposited, while 1 represents withdrawal. Impatient depositors' decision in stage 2 is always to withdraw ($s = 1$), but it depends on their bids when they get the chance to do so. The strategy of a patient depositor i is $(b_i; s_i)$. Any depositor's final payoff is the consumption received from the bank (which depends on whether the depositor withdraws and on the other depositors' choices) plus the endowment for bidding minus the actual bid. To sum up, the final payoffs are as follows:

$$c_{1,i} = \begin{cases} c_1^* - (b_{\max} - b_i), & \text{if } s_i = 1 \text{ and } \sum_{j=1}^{r_i - 1} s_j < int\left[\frac{N}{c_1^*}\right], \\ c_1^{low} - (b_{\max} - b_i), & \text{if } s_i = 1 \text{ and } \sum_{j=1}^{r_i - 1} s_j = int\left[\frac{N}{c_1^*}\right], \\ 0 - (b_{\max} - b_i), & \text{if } s_i = 1 \text{ and } \sum_{j=1}^{r_i - 1} s_j > int\left[\frac{N}{c_1^*}\right] \end{cases}$$

$$c_{2,i} = \left\{ \; c_2(\eta) - (b_{\max} - b_i), \quad \text{if } s_i = 0 \right.$$

The first row says that if the bank has enough funds (that is, the number of previous withdrawals is sufficiently low) and depositor i decides to withdraw, then she receives c_1^*. However, if previous withdrawals depleted the funds of the bank in such a way that it has less than c_1^*, then the bank pays whatever is left to the withdrawing depositor (c_1^{low} in the second row). And if a depositor who attempts to withdraw comes too late, then she receives zero. For simplicity, we assume that $c_1^{low} = 0$. In the last line that describes second-period consumption for those who keep their funds deposited, $c_2(\eta)$ is given by (8.2).

8.4 Equilibrium

We solve the game using backward induction. Thus, first we determine how depositors decide in the second stage given the available information. Then, we see how the optimal bids are in the first stage. In equilibrium, nobody would like to deviate unilaterally, that is given the bid and the decision of others nobody would like to change her bid and decision.

8.4.1 Sequential setup

We begin with the second stage that is complicated since decisions can be based now also on what is observed. Hence, a strategy for a patient depositor specifies what the depositor should do at any position and given any sequence of previous decisions that she might observe. Kinateder and Kiss (2014) show in an equivalent setup that for any possible sequence of decisions patient depositors do not withdraw. This result applies to our paper as well. Given the unique equilibrium in the subgame played in the second stage no depositor has incentives to submit a positive bid.

Proposition1Given the payoffs, depositors submit zero bids in stage 1 and in stage 2 patient depositors wait and impatient depositors withdraw.

8.4.2 Simultaneous setup

Again we start with the second stage. Since previous decisions cannot be observed, decisions can be conditioned only on type (patient vs. impatient), position and the belief about the other depositors' decisions. The important thing is what a patient depositor believes about the number of patient depositors (other than her) who choose to wait. We denote the belief of depositor i by β_i. Clearly, if $\beta_i \geq \bar{\eta}$, then her optimal decision is to wait also. Otherwise, the optimal decision given the payoffs is to withdraw.

$$BR_i(\beta_i) = \begin{cases} 1 & \text{if } \beta_i < \bar{\eta}, \\ 0 & \text{otherwise} \end{cases}$$

Note that we do not impose that these beliefs cannot depend on position.

Theoretically, if there is a mechanism that coordinates beliefs of the depositors (as the sunspots in Diamond and Dybvig(1983)), then there should be two equilibria for any given sequence of decision: either a full-fledged bank run or an equilibrium in which no patient depositor withdraws.

Given these best responses, how should a depositor bid in the first stage? If depositors are rational and take into account the structure of the game, then their bidding depends on what they expect to happen in stage 2. If any depositor (patient or impatient) believes that at most $N - \bar{\eta}$ depositors withdraw, then there is no point in bidding any positive amount in order to be at the beginning of the line. Otherwise, if a depositor believes that there will be a bank run in stage 2, then it pays off to submit a positive bid if in expected terms it yields a higher utility than bidding zero. That is,

$$\Pr{}_i(b_i) * u_i(c_1^* - b_i) + (1 - \Pr(b_i))u_i(0 - b_i) > u(0),$$

where $\Pr_i(b_i)$ is a function that maps b_i into a subjective probability of being among the first $int\left[\frac{N}{c_1^*}\right]$ according to the bidden amount. Thus, $\Pr_i(x) = 0.8$ means that individual i believes that if she bids x, then with 80% probability she will be among the first $int\left[\frac{N}{c_1^*}\right]$ depositors and receives c_1^*.

What is the optimal amount to bid if a depositor believes that there will be a run? It solves the following optimization problem

$$\max_{b_i} \Pr{}_i(b_i)u_i(c_1^* - b_i) + (1 - \Pr{}_i(b_i))u_i(0 - b_i)$$

$$s.t.$$

$$\Pr{}_i(b_i) * u_i(c_1^* - b_i) + (1 - \Pr{}_i(b_i))u_i(0 - b_i) > u(0)$$

$$b_i \leq b_{\max}$$

Notice that we deliberately denote the utility function as u_i attempting to express that the way depositors value the utility derived from consumption may vary from individual to individual according to individual traits.

Unless we impose a specific functional form the utility we cannot solve the problem. It is not important for us to derive an exact solution. We are satisfied with more general predictions that rely on the beliefs of the depositors.

Proposition2If a patient depositor believes that the number of withdrawals in stage 2 of period 1 will be less or equal to $\bar{\eta}$, then she bids zero in stage 1. If a patient depositor believes that the number of withdrawals in stage 2 of period 1 will be more than $\bar{\eta}$, then she bids a positive amount up to $b_{\max}$. If an impatient depositor believes that the number of withdrawals in stage 2 of period 1 will be less or equal to $int\left[\frac{N}{c_1^*}\right]$ depositors, then she bids zero in stage 1. If an impatient depositor believes that the number of withdrawals in stage 2 of period 1 will be more than $int\left[\frac{N}{c_1^*}\right]$, then she bids a positive amount up to $b_{\max}$.

- *Proof.* If a patient depositor expects the number of total withdrawals to be less than $\bar{\eta}$, then she expects the bank to have enough funds in period 2 so that her consumption will be larger than c_1^*. In this case, she does not want to waste resources on bidding. In the opposite case, it does not pay off to wait until period 2, as the payoff will be lower, than the payoff in period 1 if she obtains a sufficiently good position in the line. The amount to bid depends on how many other patient depositor she expects to withdraw. In the worst case, she may expect all other patient depositor to withdraw also. In this case, she may bid a high amount, but never higher than $b_{\max}$.

If an impatient depositor expects the number of total withdrawals to be less than or equal to $int\left[\frac{N}{c_1^*}\right]$, then she believes that by withdrawing she will receive c_1^*, so there is no point in spending resources on bidding. If she believes the number of withdrawals to be higher, then she bids what she deems necessary to have a positive utility, her maximum bid being $b_{\max}$. □

Note that the previous proposition is not about equilibrium, but individual decisions. Clearly, if many depositors hold pessimistic beliefs (that may be affected by individual traits) about decisions in stage 2, then a bank run occurs. In the opposite case, bank run may not occur. However, it is possible that more depositors withdraw than the number of impatient depositors. Since there are no coordination devices (as the sunspots in the original Diamond-Dybvig study), it is possible that miscoordination happens. Beliefs govern what happens in this setup. In the experiment we control for beliefs as we ask the participants what they think how many of the other depositors chose to withdraw.

9 Appendix: Conjectures on the effects of individual traits

In this Appendix we formulate some conjectures on the potential effect of some variables that we measure in the experiment on the bidding of the participants.

We start with cognitive abilities. In Kiss et al. (2016) we investigated to some extent the effect of cognitive abilities (measured by the cognitive reflection test) on decisions in some information sets with dominant strategies in a bank run experiment. We found that individuals with better cognitive abilities chose the dominant strategy more often in the presence of strategic uncertainty. In general, we may expect individuals with better cognitive abilities to make better choices. Regarding withdrawal decisions, it implies that in the sequential setup they would wait if being the first to decide or if observing that somebody has already waited. In the simultaneous setup, beliefs determine what is the best response. Turning to bidding choices, note that in the simultaneous setup it is a dominated strategy to bid high and then keep the funds deposited. Hence, we expect a participant with a high CRT score either in the role of a patient or impatient depositor to bid high and then to withdraw. Things are less clear in the sequential setup, because participants as patient depositor may want to bid high to arrive early to the bank and then by keeping their money deposited they could try to induce the other patient depositor to follow suit. This signaling behavior has been observed by Kinateder et al. (2015). However, in the case of the impatient depositor who lacks any incentive to show others that she does not withdraw we expect that individuals with better cognitive abilities will bid low. Note that these conjectures are often complex as they relate bidding and withdrawal decisions or are dependent on the information setting and / or the liquidity type of the depositor.

We consider next the effect of income and the trust in institutions. As seen in the literature review, more wealthy individuals tend to be more sophisticated, so they usually make better decisions. In this sense, the predictions for higher income correlate with those related to better cognitive abilities. Trust in institutions and especially in banks implies that a participant who trusts institutions is less likely to withdraw in the second stage in both setups. Therefore, she is less worried about arriving early at the bank, so she would bid lower, *ceteris paribus*.

To measure personality traits we use the Big Five. *Openness to experience* that reflects intellectual curiosity and creativity *a priori* does not seem to be related to bidding behavior in our experiment. Individuals are described by *conscientiousness* if - among others - they prefer planned rather than spontaneous behavior. These planning may be related to bidding decisions that correspond to the theoretical predictions. *Extraversion* reflects energy, positive emotions, assertiveness and sociability, traits that do not seem to imply a clear bidding behavior. *Agreeableness* expresses the tendency to be compassionate and cooperative, and is also a measure of trusting and helpful behavior. It may affect the beliefs an individual has about the other patient depositor's decision. The less agreeable a participant is, the more she may believe that there will be a bank run that in turn implies higher bids in the simultaneous setup. Individuals exhibiting *neuroticism* tend to experience unpleasant emotions (such as anger, anxiety and depression) easily. Related to bidding behavior in our experiment, the more neurotic a participant is, the more she may want to avoid having to be concerned about the other patient depositor's decision and may submit a higher bid.

Related to personality traits we also measured social preferences that were elicited using the 9-Item Triple-Dominance Measure of a Social Value Orientation (SVO)(see Van Lange et al., 1997) that is widely used to measure such preferences in social psychology (see Murphy and Ackermann, 2011). More concretely, the test classifies individuals as *prosocial*, *individualistic* or *competitive* if she makes at least 6 choices that correspond to that category in 9 allocation tasks.[16] Since receiving the highest payoff depends on the choice of the other patient depositor, so it requires coordination,

[16]Note that an individual is not classified if her choices do not correspond consistently with one of the categories.

we expect that individuals classified as prosocial tend to attempt to achieve those payoffs by waiting in the second stage. That in turn implies that in the simultaneous setup these individuals would bid lower, *ceteris paribus*. In the sequential setup, their behavior is less clear as they may bid high to be the first to decide and then keep the money in the bank and induce the subsequent patient depositor to do so as well. Following similar arguments, individualistic participants may tend to care only for themselves and try to receive the sure payoff related to withdrawal. Therefore, in both treatments we expect them to bid high and withdraw, *ceteris paribus*.

10 Appendix: Instructions

Here we reproduce the instructions, translated from Spanish.

Simultaneous treatment

Welcome to this experiment!

In this experiment, we study how individuals solve decision-making problems, and we are not interested in your particular decision, but in the average behavior of individuals. That is why you will be treated anonymously during the experiment and nobody in this room will ever know the decisions that you make.

Next, you will see the instructions that explain how the experiment goes. These instructions are the same for all participants and it is of utmost importance that you understand them well because your earnings will depend to a large extent on your decisions.

At the end of the experiment we will ask you to complete a long questionnaire that contains several games that allow you to earn extra money. The objective of the questionnaire is to get to know your tastes and preferences (that are not obviously the same as those of the rest of the participants) and for this reason there are no correct answers to the questions that we raise. During the questionnaire it is important that you state your preferred option in each case because your earnings from the questionnaire depend to a large degree of your decisions.

Remember that all the decisions that you make during the experiment are anonymous and will not be linked to you. If you have any doubt or question during the experiment, raise your hand and we will come to you. Remember also that you are not allowed to speak during the experiment.

What is the experiment about?

At the beginning of the experiment you will receive 60 ECUs:

- Part of the money (**20 ECUs**) is your **initial endowment**.
- The rest of the money (**40 ECUs**) is **deposited in a bank**.

The bank where your money is deposited is composed of three depositors who are in the lab. Thus, the bank has a total capital of 120 ECUs (40 ECUs from each depositor).

How can you earn money in this experiment?

In each bank, one of the depositors is chosen randomly and she will be forced to withdraw her deposit. The rest of the depositors may decide if they **withdraw their funds** from the bank or **keep them deposited** until the bank carries out a project. In any case, your earnings will depend not only on your decision, but also on how the other depositors of your bank have decided. Moreover, the position in the line may affect your earnings as we explain next.

Position in the line

To determine the sequence in which depositors make their decision, we carry out an auction. Each depositor of the bank (the one that will be forced to withdraw or those who can choose if to keep their money deposited or withdraw it) can submit a bid from her initial endowment (0, 1, 2, â¦, 20 ECUs) that determines her position in the line. The depositor with the highest bid will be the first in the line, the one with the intermediate bid will be the second, and the depositor with the lowest bid will be the third. If there is a tie in the bids the positions will be determined randomly. The amount of money used for bidding is deducted from her initial endowment of 20 ECUs. The depositor will receieve the amount not used for bidding at the end of the experiment as part of her earnings.

What happens if you withdraw your deposit?

The depositor who is forced to withdraw or any other depositor who chooses to withdraw will receive 50 ECUs whenever the bank has enough funds to pay that amount. Therefore, if you are the first or the second depositor in the sequence of decision and you choose to withdraw (or you are forced to do so), then you earn 50 ECUs (this amount corresponds to your initial deposit of 40 ECUs + 10 ECUs in form of interests earned). If you are the third depositor in the line and you choose to withdraw (or you are forced to do so), then your earnings depend on what the other two depositors before you have decided:

- If only one of the previous two depositors (or none of them) chose to withdraw, then you also receive 50 ECUs, because the bank has no problems to pay that amount.
- If both of the depositors who have decided before you chose to withdraw, then your earnings amount to 20 ECUs (the amount of money that the bank has after two withdrawals).

To sum up,

Your position in the line	Your earnings if you withdraw
1.	50 ECUs
2.	50 ECUs
3.	20 ECUs (if the first and the second have withdrawn) 50 ECUs (if only one or none of the previous depositors has withdrawn)

What happens if you keep your money deposited?

After paying the depositors who chose to withdraw, the bank carries out a project and pays dividend to those depositors who decided to keep their funds in the bank.

- If two depositors choose to keep their funds deposited, then each of them earns 70 ECUs, independently of their position in the line.
- If one depositor chooses to keep her funds deposited, then she earns 30 ECUs, independently of her position in the line.

To sum up,

As you see, it is not possible that all three depositors of the same bank decide to keep their funds deposited. This is the case because in each bank there will be a depositor who will be forced to withdraw her funds. This depositor (as the others) can submit her bid that determines her position in the line, but she cannot choose between keeping the money deposited or to withdraw.

How many decisions do I have to make in this experiment?

Your position in the line	Your earnings if you keep your money in the bank
1.	70 ECUs (if the other depositor keeps her funds deposited) 30 ECUs (if you are the only depositor who keeps the money deposited)
2.	70 ECUs (if the other depositor keeps her funds deposited) 30 ECUs (if you are the only depositor who keeps the money deposited)
3.	70 ECUs (if the other depositor keeps her funds deposited) 30 ECUs (if you are the only depositor who keeps the money deposited)

In this experiment we ask you to submit a bid as a depositor forced to withdraw and also as one who can choose between keep her funds deposited or withdraw. In both cases, you may submit a bid form your initial endowment (between 0 and 20 ECUs). Furthermore, we ask you to tell us what decisions (to withdraw or to keep your funds deposited) you would make as a depositor who can decide if to withdraw or keep her money in the bank.

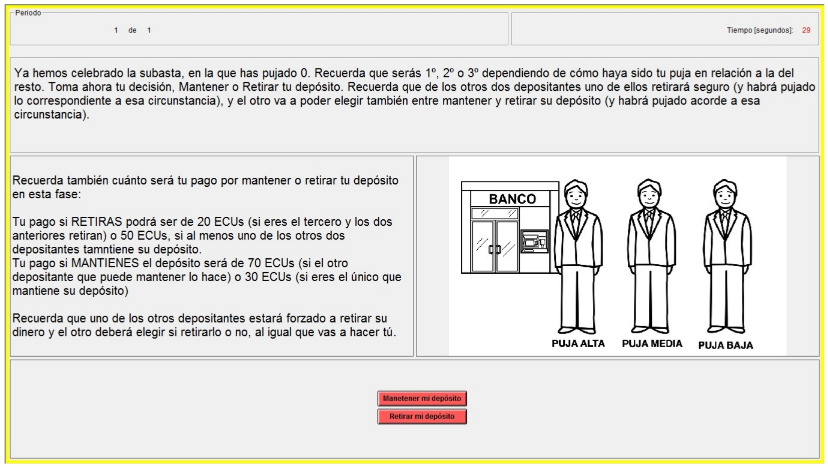
In this experiment you do not know anything about the bids and the decisions (to withdraw or to keep the funds deposited) of the other depositors of your bank. You do not even know your position in the line (which depends on your bid and on the bids of the other depositors of your bank). Having in mind this information, we ask you what you would do with your deposit (keep it in the bank or withdraw it).

What information will I have in this experiment?

Next we show you one of the screens of the experiment so that you can see the way that we provide you the information.

(The Spanish text is the following: Period 1 of 1, Time (seconds):

We completed the auction, your bid was 0. Remember that you will be the first, the second or the third in the line depending on how your bid was relative to the bids of the others. Please, decide now if you want to keep your money in the bank or you want to withdraw. We remind you that one of the other two depositors will surely withdraw (and she submitted her bid knowing this), and the other one will choose between keeping her money in the bank and withdrawing (and she submitted her bid knowing this).



Remember also your payoff related to keeping your funds deposited and to withdrawal in this stage:

- If you withdraw, then your payoff may be 20 ECUs (if you are the third depositor in the line and the previous two depositors have withdrawn) or 50 ECUs if at least one of the other depositors keeps her funds deposited.
- If you keep your money deposited, then your payoff will be 70 ECUs (if the other depositor who can also keep her funds deposited does so) or 30 ECUs (if you are the only one who keeps her funds deposited).

Remember that one of the other depositors will be forced to withdraw and the other one has to choose if to withdraw her money or not, like you.

(Red buttons:) Keep the deposit in the bank

Withdraw the deposit from the bank

(In the Picture the text below the first / second / third person is High / Intermediate / Low bid.))

Note that in the upper pane we remind you of your bid and we tell you that you are one of the depositors who can choose between keeping her funds in the bank and withdrawing. On the right-hand side, in the picture you see the three depositors of the bank, ranked according to their bids (that you do not know). On the left-hand side we remind you your payoffs related to withdrawal and keeping the money deposited. Your decision can be made by clicking the corresponding button in the lower pane.

What determines your final earnings?

At the end of the experiment, the computer will choose randomly one of the three depositors of the bank to be the depositor forced to withdraw. The other two will be the depositors who can choose between keeping their funds in the bank and withdrawing. All depositors have the same probability of being chosen as the depositor forced to withdraw.

Once the depositor forced to withdraw is selected, the computer uses the submitted bids to determine the sequence of decision and deducts the bids from the initial endowments of 20 ECUs. Next, the computer tells the decision of each depositor in function of the decisions given for all possibilities.

If you are the depositor forced to withdraw, then we deduct from your initial endowment of 20 ECUs your bid submitted as the forced depositor. And you will earn a payoff in function of your position in the line and the decision of the other depositors:

Your position in the line	Earnings
1°	50
2°	50
3°	20 or 50

In case that you are a depositor who can choose between keeping her funds in the bank and withdrawing, we deduct from your initial endowment of 20 ECUs your bid submitted as a depositor who can choose between keeping the money in the bank and withdrawal. And you will earn a payoff in function of your position in the line and the decision of the other depositors:

<table>
<tr><th rowspan="2">Your position in the line</th><th rowspan="2">If you withdraw</th><th colspan="2">If you keep your money deposited and …</th></tr>
<tr><th>another depositor keeps her funds in the bank</th><th>you are the only one who keeps the money deposited</th></tr>
<tr><td>1°</td><td>50</td><td rowspan="3">70</td><td rowspan="3">30</td></tr>
<tr><td>2°</td><td>50</td></tr>
<tr><td>3°</td><td>20 or 50</td></tr>
</table>

At the end of the experiment you will receive your earnings in Euros (10 ECUs = 1 Euro).

Next, we provide some examples so that you can see how the payoffs are calculated. Before starting the experiment, there will be a trial round where you will be able to see the decision screens for the bidding and the decision if to withdraw or keep the money deposited. This trial round will not affect your final payoff. We will call your attention when the phase that determines your payoff begins.

Thanks for participating!

Example 1

Imagine depositors A, B and C and assume that the computer selects B as the depositor forced to withdraw. Here are the bids:

	Bid if you are forced to withdraw	Bid if you can choose between keeping the money or withdrawing
Depositor A	8	5
Depositor B	6	2
Depositor C	0	10

These are then the bids that determine the position:

Bid of depositor A: 5 ECUs

Bid of depositor B: 6 ECUs

Bid of depositor C: 10 ECUs

Therefore, depositor C will be the first, depositor B the second and depositor A the third in the line. These bids will be deducted from the initial endowment, so from there depositor A will receive 15 ECUs, depositor B will receive 14 ECUs and depositor C will have 10 ECUs. This amount will add to the earnings related to withdrawing or keeping the funds deposited.

For instance, assume the following decisions (ranked according to the sequence of decision)

1. - Depositor C: Keep the money deposited
2. - Depositor B: Withdraw (Forced)
3. - Depositor A: Keep the money deposited

Depositor C and A will receive 70 ECUs and depositor B receives 50 ECUs for their decisions.

These earnings add to the earnings resulting from the bid, so depositor A receives a total of 85 ECUs (15 initial endowment + 70 decision), depositor B receives a total of 64 ECUs (14 initial endowment + 50 decision), depositor C receives a total of 80 ECUs (10 initial endowment + 70 decision).

Now *assume the following decisions*:

1. - Depositor C: Withdraw
2. - Depositor B: Withdraw (Forced)
3. - Depositor A: Keep the money deposited

Then depositor C and B will receive 50 ECUs and depositor A receives 30 ECUs for their decisions.

These earnings add to the earnings resulting from the bid, so depositor A receives a total of 45 ECUs (15 initial endowment + 30 decision), depositor B receives a total of 64 ECUs (14 initial endowment + 50 decision), depositor C receives a total of 60 ECUs (10 initial endowment + 50 decision).

Assume the following decisions:

1. - Depositor C: Withdraw
2. - Depositor B: Withdraw (Forced)
3. - Depositor A: Withdraw

Then depositor C and B will receive 50 ECUs and depositor A receives 20 ECUs for their decisions.

These earnings add to the earnings resulting from the bid, so depositor A receives a total of 35 ECUs (15 initial endowment + 20 decision), depositor B receives a total of 64 ECUs (14 initial endowment + 50 decision), depositor C receives a total of 60 ECUs (10 initial endowment + 50 decision).

Example 2

Imagine depositors A, B and C and assume that the computer selects C as the depositor forced to withdraw. Here are the bids:

	Bid if you are forced to withdraw	Bid if you can choose between keeping the money or withdrawing
Depositor A	15	5
Depositor B	7	3
Depositor C	1	3

These are then the bids that determine the position:

Bid of depositor A: 5 ECUs

Bid of depositor B: 3 ECUs

Bid of depositor C: 1 ECUs

Therefore, depositor A will be the first, depositor B the second and depositor A the third in the line. These bids will be deducted from the initial endowment, so from there depositor A will receive 15 ECUs, depositor B will receive 17 ECUs and depositor C will have 19 ECUs. This amount will add to the earnings related to withdrawing or keeping the funds deposited.

For instance, assume the following decisions (ranked according to the sequence of decision)

1. - Depositor A: Keep the money deposited
2. - Depositor B: Withdraw
3. - Depositor C: Withdraw (Forced)

Then depositor B and C will receive 50 ECUs and depositor A receives 30 ECUs for their decisions. These earnings add to the earnings resulting from the bid, so depositor A receives a total of 45 ECUs (15 initial endowment + 30 decision), depositor B receives a total of 67 ECUs (17 initial endowment + 50 decision), depositor C receives a total of 69 ECUs (19 initial endowment + 50 decision).

Assume the following decisions

1. - Depositor A: Keep the money deposited
2. - Depositor B: Keep the money deposited

3. - Depositor C: Withdraw (Forced)

Then depositor A and B will receive 70 ECUs and depositor C receives 50 ECUs for their decisions. These earnings add to the earnings resulting from the bid, so depositor A receives a total of 85 ECUs (15 initial endowment + 70 decision), depositor B receives a total of 87 ECUs (17 initial endowment + 70 decision), depositor C receives a total of 69 ECUs (19 initial endowment + 50 decision).

Assume the following decisions

1. - Depositor A: Withdraw
2. - Depositor B: Withdraw
3. - Depositor C: Withdraw (Forced)

Then depositor A and B will receive 50 ECUs and depositor C receives 20 ECUs for their decisions. These earnings add to the earnings resulting from the bid, so depositor A receives a total of 65 ECUs (15 initial endowment + 50 decision), depositor B receives a total of 67 ECUs (17 initial endowment + 50 decision), depositor C receives a total of 39 ECUs (19 initial endowment + 20 decision).

Sequential treatment

Welcome to this experiment!

In this experiment, we study how individuals solve decision-making problems, and we are not interested in your particular decision, but in the average behavior of individuals. That is why you will be treated anonymously during the experiment and nobody in this room will ever know the decisions that you make.

Next, you will see the instructions that explain how the experiment goes. These instructions are the same for all participants and it is of utmost importance that you understand them well because your earnings will depend to a large extent on your decisions.

At the end of the experiment we will ask you to complete a long questionnaire that contains several games that allow you to earn extra money. The objective of the questionnaire is to get to know your tastes and preferences (that are not obviously the same as those of the rest of the participants) and for this reason there are no correct answers to the questions that we raise. During the questionnaire it is important that you state your preferred option in each case because your earnings from the questionnaire depend to a large degree of your decisions.

Remember that all the decisions that you make during the experiment are anonymous and will not be linked to you. If you have any doubt or question during the experiment, raise your hand and we will come to you. Remember also that you are not allowed to speak during the experiment.

What is the experiment about?

At the beginning of the experiment you will receive 60 ECUs:

- Part of the money (**20 ECUs**) is your **initial endowment**.
- The rest of the money (**40 ECUs**) is **deposited in a bank**.

The bank where your money is deposited is composed of three depositors who are in the lab. Thus, the bank has a total capital of 120 ECUs (40 ECUs from each depositor).

How can you earn money in this experiment?

In each bank, one of the depositors is chosen randomly and she will be forced to withdraw her deposit. The rest of the depositors may decide if they **withdraw their funds** from the bank or **keep them deposited** until the bank carries out a project. In any case, your earnings will depend not only on your decision, but also on how the other depositors of your bank have decided. Moreover, the position in the line may affect your earnings as we explain next.

Position in the line

To determine the sequence in which depositors make their decision, we carry out an auction. Each depositor of the bank (the one that will be forced to withdraw or those who can choose if to keep their money deposited or withdraw it) can submit a bid from her initial endowment (0, 1, 2, â¦, 20 ECUs) that determines her position in the line. The depositor with the highest bid will be the first in the line, the one with the intermediate bid will be the second, and the depositor with the lowest bid will be the third. If there is a tie in the bids the positions will be determined randomly. The amount of money used for bidding is deducted from her initial endowment of 20 ECUs. The depositor will receieve the amount not used for bidding at the end of the experiment as part of her earnings.

What happens if you withdraw your deposit?

The depositor who is forced to withdraw or any other depositor who chooses to withdraw will receive 50 ECUs whenever the bank has enough funds to pay that amount. Therefore, if you are the first or the second depositor in the sequence of decision and you choose to withdraw (or you are forced to do so), then you earn 50 ECUs (this amount corresponds to your initial deposit of 40 ECUs + 10 ECUs in form of interests earned). If you are the third depositor in the line and you choose to withdraw (or you are forced to do so), then your earnings depend on what the other two depositors before you have decided:

- If only one of the previous two depositors (or none of them) chose to withdraw, then you also receive 50 ECUs, because the bank has no problems to pay that amount.
- If both of the depositors who have decided before you chose to withdraw, then your earnings amount to 20 ECUs (the amount of money that the bank has after two withdrawals).

To sum up,

Your position in the line	Your earnings if you withdraw
1.	50 ECUs
2.	50 ECUs
3.	20 ECUs (if the first and the second have withdrawn) 50 ECUs (if only one or none of the previous depositors has withdrawn)

What happens if you keep your money deposited?

After paying the depositors who chose to withdraw, the bank carries out a project and pays dividend to those depositors who decided to keep their funds in the bank.

- If two depositors choose to keep their funds deposited, then each of them earns 70 ECUs, independently of their position in the line.
- If one depositor chooses to keep her funds deposited, then she earns 30 ECUs, independently of her position in the line.

Your position in the line	Your earnings if you keep your money in the bank
1.	70 ECUs (if the other depositor keeps her funds deposited) 30 ECUs (if you are the only depositor who keeps the money deposited)
2.	70 ECUs (if the other depositor keeps her funds deposited) 30 ECUs (if you are the only depositor who keeps the money deposited)
3.	70 ECUs (if the other depositor keeps her funds deposited) 30 ECUs (if you are the only depositor who keeps the money deposited)

To sum up,

As you see, it is not possible that all three depositors of the same bank decide to keep their funds deposited. This is the case because in each bank there will be a depositor who will be forced to withdraw her funds. This depositor (as the others) can submit her bid that determines her position in the line, but she cannot choose between keeping the money deposited or to withdraw.

How many decisions do I have to make in this experiment?

In this experiment we ask you to submit a bid as a depositor forced to withdraw and also as one who can choose between keep her funds deposited or withdraw. In both cases, you may submit a bid form your initial endowment (between 0 and 20 ECUs).

In this experiment, you do not know anything about the bids submitted by the other depositors, but you can condition your decision of withdrawing or keeping the money in the bank on what the other depositors decided to do with their deposits, if they decided before you. Thus, we ask you to tell us what you would like to do with your deposit (keep it deposited or withdraw it) if after the auction you are in the first, second or third position of the sequence of decision. Since you can condition your choice on the decisions of the other depositors of your bank, you have to make a decision in six potential scenarios:

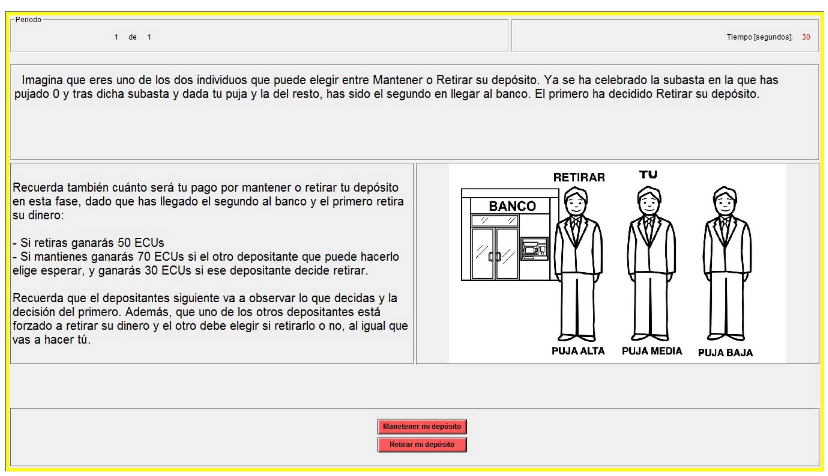
- What do you do with your deposit if you are the first in the line
- What do you do with your deposit if you are the second in the line and the first depositor chose to keep her money in the bank
- What do you do with your deposit if you are the second in the line and the first depositor chose to withdraw her funds

- What do you do with your deposit if you are the third in the line and the first depositor chose to withdraw her funds and the second chose to keep them deposited
- What do you do with your deposit if you are the third in the line and the first depositor chose to keep her funds in the bank and the second chose to withdraw them
- What do you do with your deposit if you are the third in the line and the two previous depositors chose to withdraw their funds

Keep in mind when submitting your bid and making your decision, that the other depositors of your bank can also condition their decision on what you decided. That is, if you are the first in the line and decide to keep your money deposited or to withdraw it, the other depositors of your bank may condition their decision on what they observe.

What information will I have in this experiment?

Next we show you one of the screens of the experiment so that you can see the way that we provide you the information.



(The Spanish text is the following: Period 1 of 1, Time (seconds):

Suppose that you are one of the depositors who may choose between keeping her funds deposited or withdrawing them. We have completed already the auction, your bid was 0 and after the auction given your bid and those of the rest you are the second to arrive at the bank. The first depositor decided to withdraw her deposit.

Remember also your payoff related to keeping your funds deposited and to withdrawal in this stage given that you are the second in the line and the first withdrew her deposit:

- If you withdraw, then you earn 50 ECUs.
- If you keep your money deposited, then your payoff will be 70 ECUs if the other depositor who can also keep her funds deposited does so or 30 ECUs if that depositor decides to withdraw.

Remember that the next depositor will observe your decision and also the decision of the first depositor. Remember also that one of the other depositors is forced to withdraw and the other one has to choose if to withdraw her money or not, like you.

(Red buttons:) Keep the deposit in the bank

Withdraw the deposit from the bank

(In the Picture the text below the first / second / third person is High / Intermediate / Low bid, and the text above the first / second person is Withdraw / You.))

Note that in the upper pane we tell you that you are one of the depositors who can choose between keeping her funds in the bank and withdrawing. We also tell you your position in the line and the decisions of the previous depositor. You can see it also on the right-hand side in the picture where you can see that you are the second in the line and that the first one has decided to withdraw. On the left-hand side we remind you your payoffs related to withdrawal and keeping the money deposited. Your decision can be made by clicking the corresponding button in the lower pane.

What determines your final earnings?

At the end of the experiment, the computer will choose randomly one of the three depositors of the bank to be the depositor forced to withdraw. The other two will be the depositors who can choose between keeping their funds in the bank and withdrawing. All depositors have the same probability of being chosen as the depositor forced to withdraw.

Once the depositor forced to withdraw is selected, the computer uses the submitted bids to determine the sequence of decision and deducts the bids from the initial endowments of 20 ECUs. Next, the computer tells the decision of each depositor in function of the decisions given for all possibilities.

If you are the depositor forced to withdraw, then we deduct from your initial endowment of 20 ECUs your bid submitted as the forced depositor. And you will earn a payoff in function of your position in the line and the decision of the other depositors:

Your position in the line	Earnings
1°	50
2°	50
3°	20 or 50

In case that you are a depositor who can choose between keeping her funds in the bank and withdrawing, we deduct from your initial endowment of 20 ECUs your bid submitted as a depositor who can choose between keeping the money in the bank and withdrawal. And you will earn a payoff in function of your position in the line and the decision of the other depositors:

<table>
<tr><th rowspan="2">Your position in the line</th><th rowspan="2">If you withdraw</th><th colspan="2">If you keep your money deposited and …</th></tr>
<tr><th>another depositor keeps her funds in the bank</th><th>you are the only one who keeps the money deposited</th></tr>
<tr><td>1°</td><td>50</td><td rowspan="3">70</td><td rowspan="3">30</td></tr>
<tr><td>2°</td><td>50</td></tr>
<tr><td>3°</td><td>20 or 50</td></tr>
</table>

At the end of the experiment you will receive your earnings in Euros (10 ECUs = 1 Euro).

Next, we provide some examples so that you can see how the payoffs are calculated. Before starting the experiment, there will be a trial round where you will be able to see the decision screens for the bidding and the decision if to withdraw or keep the money deposited. This trial round will not affect your final payoff. We will call your attention when the phase that determines your payoff begins.

Thanks for participating!

Example 1

Imagine depositors A, B and C and assume that the computer selects B as the depositor forced to withdraw. Here are the bids:

	Bid if you are forced to withdraw	Bid if you can choose between keeping the money or withdrawing
Depositor A	8	5
Depositor B	6	2
Depositor C	0	10

These are then the bids that determine the position:

Bid of depositor A: 5 ECUs

Bid of depositor B: 6 ECUs

Bid of depositor C: 10 ECUs

Therefore, depositor C will be the first, depositor B the second and depositor A the third in the line. Remember that when depositor B decides (the second in the line), she will observe the decision of depositor C (who decides first) and depositor A (the last one to decide) observes both the decision of depositor C and thet of depositor B. The bids will be deducted from the initial endowment, so from there depositor A will receive 15 ECUs, depositor B will receive 14 ECUs and depositor C will have 10 ECUs. This amount will add to the earnings related to withdrawing or keeping the funds deposited.

For instance, assume the following decisions (ranked according to the sequence of decision)

1. - Depositor C: Keep the money deposited

2. - Depositor B: Withdraw (Forced)

3. - Depositor A (after observing that the first one keeps the money in the bank and the second withdraws): Keep the money deposited

Depositor C and A will receive 70 ECUs and depositor B receives 50 ECUs for their decisions.

These earnings add to the earnings resulting from the bid, so depositor A receives a total of 85 ECUs (15 initial endowment + 70 decision), depositor B receives a total of 64 ECUs (14 initial endowment + 50 decision), depositor C receives a total of 80 ECUs (10 initial endowment + 70 decision).

Now *assume the following decisions*:

1. - Depositor C: Withdraw

2. - Depositor B: Withdraw (Forced)
3. - Depositor A (after observing two withdrawals): Keep the money deposited

Then depositor C and B will receive 50 ECUs and depositor A receives 30 ECUs for their decisions.

These earnings add to the earnings resulting from the bid, so depositor A receives a total of 45 ECUs (15 initial endowment + 30 decision), depositor B receives a total of 64 ECUs (14 initial endowment + 50 decision), depositor C receives a total of 60 ECUs (10 initial endowment + 50 decision).

Assume the following decisions:

1. - Depositor C: Withdraw
2. - Depositor B: Withdraw (Forced)
3. - Depositor A (after observing two withdrawals): Withdraw

Then depositor C and B will receive 50 ECUs and depositor A receives 20 ECUs for their decisions.

These earnings add to the earnings resulting from the bid, so depositor A receives a total of 35 ECUs (15 initial endowment + 20 decision), depositor B receives a total of 64 ECUs (14 initial endowment + 50 decision), depositor C receives a total of 60 ECUs (10 initial endowment + 50 decision).

Example 2

Imagine depositors A, B and C and assume that the computer selects C as the depositor forced to withdraw. Here are the bids:

	Bid if you are forced to withdraw	Bid if you can choose between keeping the money or withdrawing
Depositor A	15	5
Depositor B	7	3
Depositor C	1	3

These are then the bids that determine the position:

Bid of depositor A: 5 ECUs

Bid of depositor B: 3 ECUs

Bid of depositor C: 1 ECUs

Therefore, depositor A will be the first, depositor B the second and depositor A the third in the line. These bids will be deducted from the initial endowment, so from there depositor A will receive 15 ECUs, depositor B will receive 17 ECUs and depositor C will have 19 ECUs. This amount will add to the earnings related to withdrawing or keeping the funds deposited.

For instance, assume the following decisions (ranked according to the sequence of decision)

1. - Depositor A: Keep the money deposited
2. - Depositor B (after observing that the first kept her funds deposited): Withdraw
3. - Depositor C: Withdraw (Forced)

Then depositor B and C will receive 50 ECUs and depositor A receives 30 ECUs for their decisions. These earnings add to the earnings resulting from the bid, so depositor A receives a total of 45 ECUs (15 initial endowment + 30 decision), depositor B receives a total of 67 ECUs (17 initial endowment + 50 decision), depositor C receives a total of 69 ECUs (19 initial endowment + 50 decision).

Assume the following decisions

1. - Depositor A: Withdraw
2. - Depositor B (after observing that the first withdrew): Withdraw
3. - Depositor C: Withdraw (Forced)

Then depositor A and B will receive 50 ECUs and depositor C receives 20 ECUs for their decisions. These earnings add to the earnings resulting from the bid, so depositor A receives a total of 65 ECUs (15 initial endowment + 50 decision), depositor B receives a total of 67 ECUs (17 initial endowment + 50 decision), depositor C receives a total of 39 ECUs (19 initial endowment + 20 decision).

Assume the following decisions

1. - Depositor A: Keep the money deposited

2. - Depositor B (after observing that the first kept her funds deposited): Keep the money deposited

3. - Depositor C: Withdraw (Forced)

Then depositor A and B will receive 70 ECUs and depositor C receives 50 ECUs for their decisions. These earnings add to the earnings resulting from the bid, so depositor A receives a total of 85 ECUs (15 initial endowment + 70 decision), depositor B receives a total of 87 ECUs (17 initial endowment + 70 decision), depositor C receives a total of 69 ECUs (19 initial endowment + 50 decision).

11 Appendix: Validation of the trait measures

We elicited risk aversion using the Bomb Risk Elicitation Task (BRET) in Crosetto and Filippin (2013). Subjects were informed that there were 100 numbered boxes in a warehouse, one of which contained a bomb. Subjects had to decide how many boxes to collect $n_b \in [0, 100]$. Boxes were collected in order; i.e., box 1 is collected first, then box 2, box 3, etc... Once subjects made their choices, a random number determined the location of the bomb, $b \in [0, 100]$. If the bomb was collected (i.e., $n_b \geq b$), subjects received nothing. If the bomb was not collected (i.e., $n_b < b$), then subjects received 10 Euro cents for every box they have collected (i.e., earnings would be Euro $0.1n_b$). If we assume the classic (CRRA) power utility function $u(x) = x^r$, a risk averse (risk neutral) [risk lover] subject will collect less than (exactly) [more than] 50 boxes. Crosetto and Filippin (2013) show that he number of collected boxes in the BRET can indeed be used to estimate an interval for the degree of risk aversion $r \in [0, 68.275]$.

Figure 5 shows the distribution of the boxes collected in our data. On average, subjects collected 42.25 boxes ($SD = 14.21$, Min = 7, Max = 80, Median = 40). We observe that roughly 65% of the subjects are risk averse, 13% are risk neutral and 22% are risk seeking. We reject null hypothesis of risk neutrality according to the non-parametric Wilcoxon test or the t-test ($p < 0.001$).[17] We also find gender differences in risk aversion. The Mann-Whitney and the Kolmogorov-Smirnov tests suggest that men are found to be less risk averse than women (44.48 *vs* 40.88, $p < 0.040$) that is in

[17] The cumulative distribution of choices in Crosetto and Filippin (2013) yields similar results, with 52% of risk averse subjects, 15% risk neutral subjects and 33% risk seekers. They also reject the null hypothesis of risk neutrality in their data

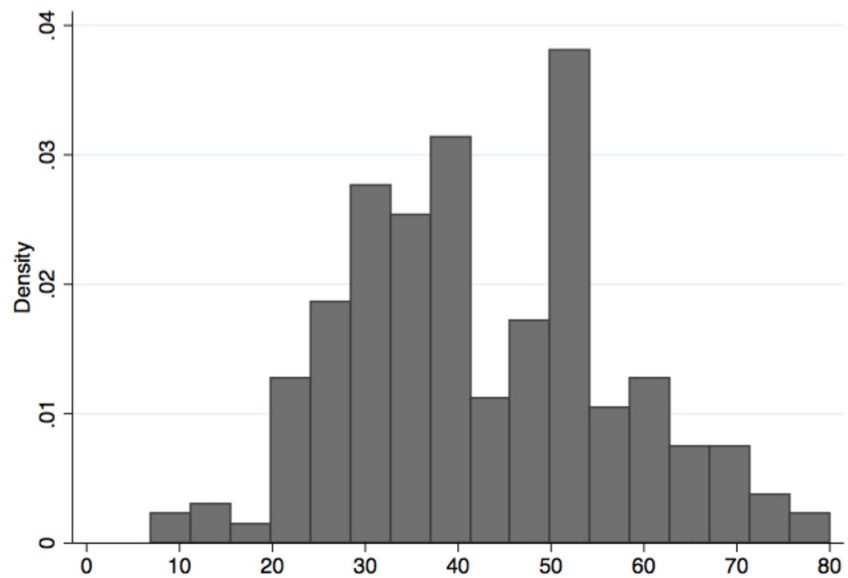


Figure 5: Number of boxes collected in the BRET

line with the literature (see for instance Croson and Gneezy, 2009 or Niederle, 2016).

We adapt GÃ¤chter, Johnson and Herrmann (2007) to measure loss aversion. In our task, subjects face a set of binary choices with a winning price of 4 Euros, and a losing price that varies between 1 and 5 Euros (see Table 4). In each lottery, subjects indicate whether or not they will be willing to accept the lottery.

Table 4: Elicitation of loss aversion

	Accept	**Reject**
L1. If the coin turns up heads, then you lose €1; if the coin turns up tails, you win €4	○	○
L2. If the coin turns up heads, then you lose €2; if the coin turns up tails, you win €4	○	○
L3. If the coin turns up heads, then you lose €3; if the coin turns up tails, you win €4	○	○
L4. If the coin turns up heads, then you lose €4; if the coin turns up tails, you win €4	○	○
L5. If the coin turns up heads, then you lose €5; if the coin turns up tails, you win €4	○	○

Note: The modal value was 5 in every single condition.

If we apply cumulative prospect theory (Tversky and Kahneman 1992) and assume that subjects give the same probability weights to the 0.5-chance of gaining and losing, the coefficient of loss aversion λ is given by the ratio between the utility of the winning price and the losing price, where $\lambda = u(G/L)^r$ under CRRA utility function and the degree of risk aversion r can be obtained from the BRET task. In our data, the median value of λ is 1.42. We estimate that 235 out of

275 subjects (85%) are loss averse; i.e., $\lambda > 1$.[18] We find a negative correlation between the risk aversion parameter (r) and being classified as loss averse ($\rho = -0.12, p = 0.057$), therefore risk averse subjects according to the BRET task are more likely to be loss averse according to the loss aversion task.

FALTA AMBIGUITY AVERSION, COGNITIVE ABILITIES, OVERCONFIDENCE, BIG FIVE, SOCIAL VALUE ORIENTATION

Frederick (2005) reports CRT scores for several locations, ranging from 2.18 (MIT) to 0.57 (University of Toledo) and the average being 1.24. Our results of an average of 0.88 are most similar to those at Bowling Green University.

Hoppe and Kusterer (2011) study how CRT scores and overconfidence are related in a similar manner as we do.[19] They report that around 60% (depending on the CRT score) are overconfident and that individuals with higher CRT are less overconfident. Our data reveals that around 88% are overconfident and we find also a negative and significant correlation (-0.37, p-value=0) between CRT and overconfidence.

Schmitt et al. (2007) present the geographic distribution of the Big Five in 56 nations. Their table 5 contains data for the categories in different countries. Our results ....

Van Lange et al. (1997) have data on the distribution of types in different experiments. Approximately 60% of the individuals can be classified as prosocial, about 25% are individualistic and the rest ($\sim$ 15%) are competitive. We find that 63% are prosocial, 24% are individualistic, but only 0.03% can be classified as competitive.

[18] We have 275 subjects because 37 out of 312 subjects (roughly 12%) make inconsistent choices in this task; e.g., they accept Li but reject Lj, where $i, j \in [0, 6], i > j$. Our frequency of inconsistent choices and our classification is very much in line with GÃ¤chter et al. (2007). See **APPENDIX**.

[19] They asked five questions related to general knowledge and participants had to guess how many of these questions they answered correctly.