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Who withdraws first? Line formation during bank runs

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ABSTRACT

We study how lines form in front of banks. In our model, depositors choose first the level of effort to arrive early at the bank and then whether or not to withdraw their deposit. We argue that the informational environment (i.e., the possibility of observing the action of others) affects the emergence of bank runs and should, therefore, influence the line formation. We test this prediction experimentally. While the informational environment has no effect on the line formation when we look at the average level of effort, our findings suggest that the reasons to arrive early at the bank varies across informational environment. Thus, expectations on the occurrence of bank run are key to explain the level of effort when depositors cannot observe the action of others. In this setting, depositors who expect a run arrive early at the bank to withdraw their funds. If actions can be observed, however, those who expect a run arrive early at the bank to keep their funds deposited. Depending on the informational environment, there are other factors (e.g., irrationality of depositors or loss aversion) that also explain the behavior of depositors.

1. Introduction

The global financial crisis that started in 2007 has shown that bank runs are existing and important phenomena. According to the Federal Deposit Insurance Corporation (FDIC), more than 300 banks failed only in the US in the first three years of the crisis.[1] In many instances, the immediate cause of the failure was a bank run. Such events did not only happen in the US, but also occurred worldwide in developed and developing countries; take, for example, the DSB Bank in the Netherlands or the Jiangsu Sheyang Rural Commercial Bank in China. Run-like phenomena have also occurred in the repo market (Gorton and Metrick, 2012) or bank lending (Ivashina and Scharfstein, 2010). These events have noteworthy economic and political consequences (Caprio and Klingebiel, 1999; Laeven and Valencia, 2013; Tooze, 2018), and they also affect individuals' well-being (Montagnoli and Moro, 2018). Governments took actions to restore the confidence in the financial sector by increasing the deposit insurance coverage or bailing out failing banks. Hence, understanding bank runs is of first-order importance to find the right policy responses to deal with them properly in the future.

Since the seminal paper by Diamond and Dybvig (1983), there is an increasing theoretical, empirical and experimental literature that has explored why and how bank runs occur and how to prevent them. Some studies highlight the role of policy tools, like suspension of convertibility (Zhu, 2005; Ennis and Keister, 2009; Davis and Reilly, 2016) or deposit insurance (Zhu, 2005; Madies, 2006; Schotter and Yorulmazer, 2009; Kiss et al., 2012; Iyer et al., 2016; Peia and Vranceanu, 2019). Other studies investigate the importance of individual characteristics on depositors' behavior (Gráda and White, 2003; Kiss et al., 2014b; 2016b; Iyer et al., 2016; Dijk, 2017; Shakina and Angerer, 2018). There is, however, a lack of explanations on how the lines form in front of the banks. More specifically, we have no evidence on what factors affect the depositors' decision on *when* to go to the bank. 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 ex-*

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[1] This is in sharp contrast with the 22 banks that failed between 2001–2006. The complete list of failed bank can be accessed at https://www.fdic.gov/bank/individual/failed/.

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ogenously 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."[2] The current paper is an attempt to fill this void in the literature.

Our study builds on the canonical Diamond–Dybvig framework with two types of depositors: impatient depositors (who are hit by a liquidity shock and need to withdraw immediately) and patient depositors (without urgent liquidity needs and who can withdraw or keep their funds deposited). In our model, there is an implicit penalty for early withdrawal because if patient depositors withdraw, they forgo the highest payoff that they would obtain if keeping their funds deposited. Thus, patient depositors can provoke a bank run if they withdraw immediately.[3] We rely on two different information environments that differ in whether or not depositors can observe the decision of others when making their decisions. The observability of actions has been shown to be crucial to depositors' behavior in theoretical models (Kinateder and Kiss, 2014; Horváth and Kiss, 2016), empirical studies (Kelly and O Grada, 2000; Starr and Yilmaz, 2007; Iyer and Puri, 2012; Bursztyn et al., 2014; Atmaca et al., 2017; Artavanis et al., 2019) and laboratory experiments (Garratt and Keister, 2009; Schotter and Yorulmazer, 2009; Kiss et al., 2014a; 2018; Bayona and Peia, 2020).[4] These papers focus on depositors' reaction when they observe the action of others, while leaving aside the question whether (and how) this affects the willingness to arrive early at the bank. This is the chief question we want to address in the current paper.[5]

Our first informational environment is characterized by the lack of information about previous decisions, so depositors decide (simultaneously) whether or not to withdraw without knowing the decision of preceding depositors, in line with Diamond and Dybvig (1983). The second informational environment represents the opposite, so depositors observe all previous decisions. These informational environments resemble conditions akin to bank run episodes that occurred during the last financial crisis. For example, the US bank Washington Mutual experienced massive online withdrawal in September 2008, a so-called "silent bank run" since the decision of other depositors could not be observed. Arguably, the run on the UK bank Northern Rock in 2007 was not silent as depositors could see the long lines in front of the banks and the media covered extensively the events. Our paper highlights that theoretically the observability of actions is key to understanding whether or not bank runs emerge as a coordination problem, and this should affect how lines of depositors are formed.

Altogether, we consider a two-stage game. In stage 1, depositors decide their effort level to arrive early at the bank simultaneously, and the line is formed accordingly: depositors who make a more costly effort to arrive early at the bank (in the form of higher bids), get a position at the beginning of the line.[6] In stage 2, depositors decide whether to keep their funds in the bank or withdraw them immediately. When decisions cannot be observed, there are multiple equilibria in stage 2. In the efficient equilibrium resulting in no bank run, patient depositors keep their funds deposited. In the inefficient symmetric equilibrium with a bank run, patient depositors withdraw their funds immediately, which is optimal if all patient depositors believe that all other patient depositors will withdraw, making the bank run a self-fulfilling prophecy.[7] When decisions in stage 2 can be observed, there is a unique equilibrium without bank runs, because the observability of actions solves the coordination problem. Thus, it is possible to coordinate on the efficient equilibrium (Kiss et al., 2012; Kinateder and Kiss, 2014). The rationale for this result is that patient depositors, by keeping their money in the bank, are able to induce other patient depositors to keep their funds deposited as well. This, in turn, implies that any observed withdrawal should be attributed to an impatient depositor who needs the funds immediately: i.e., patient depositors keep their funds deposited in equilibrium, even if they observe withdrawals from previous depositors.

We rely on backward induction to derive our hypotheses for stage 1 of the game, in which the line of decision is formed endogenously. If depositors cannot observe the action of others, beliefs on the occurrence of bank run determine which equilibrium is chosen in stage 2. As a result, when depositors have no information on the action of others, they should only make a costly effort to arrive early at the bank in stage 1 if they expect a bank run in stage 2, and those who run should withdraw their funds. If no bank run is anticipated, then no costly effort should be made to rush to the bank (see Hypothesis 1 in Section 2.4). If we assume that bank runs are due to coordination problems, the observability of actions leads to a unique no-run equilibrium in stage 2, so depositors should make no effort to arrive early at the bank regardless of their types (patient or impatient) if actions can be observed. Thus, if bank runs are due to coordination problems among depositors, then we expect to see that depositors make more effort to arrive early at the bank when depositors have no information on the decision of others, compared with the case in which this information exists (see Hypothesis 2 in Section 2.4). Furthermore, we expect that patient and impatient depositors will not behave differently in stage 1 in any of the informational environments, e.g., if they have the same expectations regarding bank runs in stage 2. However, the observation of withdrawals may perturb the beliefs of depositors about the occurrence of bank runs. Kiss et al. (2018) provide experimental evidence that patient depositors tend to run when withdrawals are observed because they attribute them to other patient depositors, contrary to the theoretical prediction. Kiss et al. (2018) refer to these bank runs that occur after observing previous withdrawals as *panic bank runs*. Then, if depositors expect a panic bank run in stage 2, both patient and impatient depositors have incentives to make costly efforts to arrive earlier at the bank (see Hypothesis 3 in Section 2.4).

We test these hypotheses by means of a laboratory experiment. We consider two different treatments (NoINFO vs. INFO) that differ on the information available to depositors when they have to de-

[2] Along the same lines, some theoretical models assume that positions are exogenously determined in a random manner; see, e.g., Green and Lin (2003); Andolfatto et al. (2007); Ennis et al. (2009); Kinateder and Kiss (2014).

[3] It depends on the environment how many early withdrawals the bank can serve before the payoff corresponding to keeping the funds in the bank becomes lower than the payoff related to immediate withdrawal.

[4] There is also evidence that observability of actions affects if a bank run becomes contagious (Brown et al., 2016; Chakravarty et al., 2014; Duffy et al., 2019; Trevino, 2020). For a recent literature review on contagion in financial networks see Glasserman and Young (2016). Duffy (2016), Dufwenberg (2015), Kiss et al. (2016a) and Kiss et al. (2022) also present recent advances on experimental finance, including a discussion on bank runs.

[5] Note, however, that the depositor's decision can also be useful to explain her decision to arrive early at the bank: if a depositor arrives late at the bank and withdraws, she may receive only a lower amount than her initial deposit, while arriving early would have given her a larger amount. Hence, withdrawal decision and decision *when* to contact the bank can be interrelated, as we show in the paper.

[6] We are not aware of any other paper that endogeneizes the order of decisions in a bank run model, but there have been other attempts in the literature on investments, including models of herding (Ivanov et al., 2013), war of attrition (Wagner, 2018) or global coordination games (Brindisi et al., 2014).

[7] Similarly to Diamond and Dybvig (1983), the bank in our setup does not have any fundamental problem, so bank runs arise due to coordination problems among the depositors. Although fundamentally weaker banks are more likely to be affected by bank runs, there is empirical evidence that even fundamentally healthy financial intermediaries suffer bank runs (e.g. Saunders and Wilson, 1996; Kindleberger and O'Keefe, 2003; Davison and Ramirez, 2014; De Graeve and Karas, 2014). In fact, fundamentals are important but leave unexplained part of the banking failures (e.g. Ennis, 2003; Boyd et al., 2014).

cide between withdrawing or keeping their funds deposited. In the NoINFO treatment, depositors do not observe previous decisions, while in the INFO treatment they do. When comparing the behavior in stage 1 across treatments, we find that depositors make similar efforts to arrive early at the bank in both the NoINFO and the INFO treatments. In the NoINFO treatment, the depositors' beliefs about the occurrence of bank runs predict their withdrawal decisions (i.e., depositors are more likely to withdraw when they expect a bank run). These expectations on the occurrence of bank runs also influence their decision on *when* to arrive at the bank (i.e., patient depositors who want to withdraw their funds in the NoINFO treatment arrive earlier at the bank). In addition, we do not find differences in the costly efforts to arrive early across liquidity types (patient vs. impatient) in the NoINFO treatment. These findings support our Hypotheses 1 and 2 regarding the line formation and the occurrence of bank runs when decisions cannot be observed. When actions are observable, we find that two factors can explain the costly effort made by patient depositors. On the one hand, there is evidence that some patient depositors are irrational and rush to withdraw their deposits. On the other hand, we find a substantial share of subjects that seem to anticipate that bank runs may occur because of panic. These subjects make costly efforts to arrive early at the bank and keep the funds deposited to facilitate coordination on the efficient outcome. Thus, our findings in the INFO treatment suggest that panic bank runs are a main determinant of the line formation when depositors can observe the action of others, as suggested by Hypothesis 3.

Previous empirical and experimental research has studied the effect of individual characteristics on the willingness to withdraw (Gráda and White, 2003; Trautmann and Vlahu, 2013; Kiss et al., 2016b; 2014b; Iyer et al., 2016; Dijk, 2017; Shakina and Angerer, 2018).[8] We contribute to this literature by looking at the determinants of line formation.[9] We rely on the experimental methodology to test the predictions of our model, so our approach complements other studies that employ survey data in financial economics (Graham and Harvey, 2001; Guiso et al., 2013; 2018). In these studies, participants are presented hypothetical scenarios and are asked to make a choice; e.g., Guiso et al. (2013) study strategic default on mortgages by asking participants their willingness to walk away from their mortgage depending on how the value of the mortgage exceeds the value of their houses.[10] In their survey, participants are presented with different sizes of shortfalls. The authors find that these values affect their willingness to default in a non-linear manner. They also find that a series of variables (including the cost of relocation, the stability of the financial position, or the individual characteristics) affect the willingness to default strategically. We employ the strategy method in our experiment, so participants have also been presented with a series of scenarios. One feature that makes our paper divert from survey studies is that decisions in our setting have monetary consequences for participants; i.e., one of the scenarios is paid out at the end of the experiment. This, in turn, relates our study to recent papers that employ the experimental methodology to learn about the behavior of depositors during bank run episodes (see Kiss et al. (2022) for a recent review of the experimental literature on bank runs).

To account for depositor heterogeneity, we measure some relevant individual traits of the participants in the experiment. More concretely, we collect data on gender and attitude toward uncertainty (risk aversion, loss aversion, ambiguity aversion). Moreover, we control for a wide range of other variables, like age, cognitive abilities, income, trust in institutions, or personality traits (Big Five and Social Value Orientation). Our strong interest in the attitude toward uncertainty is motivated by the fact that in many countries regulation requires banks to draw a risk profile of the customers (see, e.g., the Markets in Financial Instruments Directive (MiFID) in the EU, Article 25/2 of European Parliament (2014) or Article 30/1 of European Parliament (2016)). In our analysis, loss aversion indeed emerges as an important factor to explain line formation and the depositors' decisions. Thus, we find that loss-averse depositors are (less) more likely to arrive early at the bank when observability is (not) possible, thus when they have (no) information about the action of others, respectively. Loss-averse depositors are also more likely to panic when they observe a withdrawal. This result is in line with recent experimental findings (Haigh and List, 2005; Trautmann and Vlahu, 2013; Rau, 2014; Huber et al., 2017), pointing out that loss aversion plays an important role in financial decisions. As a result, our findings support the view that theory should incorporate loss aversion into models of bank runs.

Our study considers factors that can be affected by policy (e.g., the informational environment), while others cannot (e.g., individual characteristics). Policymakers should try to assess how all these factors affect the willingness to arrive early at the bank to design optimal policies that can prevent bank runs, e.g., setting up deposit insurance depending on the risk attitude of depositors or promoting the informational environment leading to less runs. Importantly, we show that depositors' expectations are crucial to explaining their behavior, and we think that expectations can be affected by credible policies, e.g., a well-functioning deposit insurance may make depositors believe that other depositors are not likely to withdraw.

The rest of the paper is structured as follows. Section 2 presents our theoretical model for three depositors and the testable hypotheses. Section 3 contains the experimental design and the procedures. In Section 4, we present the results. Section 5 concludes. We relegate to the Appendix the general theoretical model and the instructions of the experiment. The Appendix also contains further empirical analysis.

2. Model and hypotheses

We present a basic theoretical model of endogenous line formation in Section 2.1. Then, we describe our experimental model, a small-scale theoretical framework with three depositors, in Section 2.2. This is the simplest setting to study the coordination problem embedded in Diamond and Dybvig (1983). In Section 2.3, we discuss the underlying assumptions of the model before deriving the hypotheses for each informational environment in Section 2.4. Section 2.5 discusses the potential influence of individual traits on depositors' behavior.

2.1. Theoretical bank-run game with line formation

We study a situation where depositors contact the bank and form a line, and then they decide whether to withdraw or keep their funds deposited, following the spirit of Diamond and Dybvig (1983). Importantly, the position in the line is determined by the depositor's effort that we capture in the form of a bid.

2.1.1. Timing

There are three time periods denoted by $t = 0, 1, 2$. In period $t = 0$, depositors deposit their funds in the bank. At the begin-

[8] Starting with Diamond and Dybvig (1983) most of the theoretical studies on bank runs assume that depositors are homogeneous, except for their liquidity needs (Green and Lin, 2000; Zhu, 2005; Ennis and Keister, 2009). However, depositors in real life differ in a myriad of ways.

[9] There has been other approaches that give depositors multiple opportunities to withdraw, thus allowing depositors to decide when to withdraw (Gu, 2011; Garratt and Keister, 2009; Schotter and Yorulmazer, 2009; Shakina and Angerer, 2018).

[10] There is strategic default on mortgages when homeowners decide to walk away from their mortgages, even if they could afford to pay them.

ning of $t = 1$, some depositors are hit by a liquidity shock and become impatient. The rest of the depositors are of the patient type who derive utility from consumption in periods 1 and 2. In period 1, depositors make the following decisions: i) first they decide the effort level they exert in order to arrive at the bank as fast as possible, a process that determines the sequence of withdrawal decisions (bidding stage); ii) and then they decide whether to withdraw or to keep their money deposited (withdrawal decision). Then the bank pays according to the withdrawal decisions in periods 1 and 2.

2.1.2. Depositors

There is a finite set of depositors denoted by $I = \{1, \ldots, N\}$, 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 random variable with support given by the set of liquidity types $\Theta = \{0, 1\}$. If $\theta_i = 1$, depositor i is called *impatient*, so she only cares about consumption at $t = 1$. If $\theta_i = 0$, depositor i is called *patient*. While the type of each depositor is private information, the number of patient depositors is assumed to be constant, given by $p \in \{1, \ldots, N-1\}$ and common knowledge. The remaining depositors $(N - p)$ are impatient. A type liquidity vector $\theta \in \Theta^N : \sum_{\theta_i \in \Theta} \theta_i = p$ indicates the type of each depositor. Thus, there is no aggregate uncertainty regarding the liquidity preference of the depositors.[11]

Depositors face a cost when they go to the bank, b_i, which represents the effort level they make to arrive early at the bank.[12] Depositors are expected utility maximizers, and we consider preferences that are quasilinear with respect to the cost associated with contacting the bank. Therefore, for a given consumption level in each of the two periods and a chosen effort level, depositor i's utility is given by:

$$\bar{u}_i(c_{1,i}, c_{2,i}, \theta_i) = u_i(c_{1,i} + (1 - \theta_i)c_{2,i}) - b_i(\theta_i). \tag{1}$$

with u_i strictly increasing, strictly concave, twice continuosly differentiable and satisfying the Inada conditions. Without loss of generality, we assume that $u_i(0) = 0$. Note that for the overall utility (including consumption and the effort) we use the notation $\bar{u}$ to separate it from the utility derived from consumption (u).

2.1.3. The bank

At $t = 0$, each depositor $i \in I$ has one unit of a homogeneous good which she deposits in the bank.[13] The bank invests the deposits in a safe technology that pays a unit gross return after each unit of investment liquidated at $t = 1$ and $R > 1$ after each unit of investment at $t = 2$. The long-term return, R, is constant. Therefore, the bank is fundamentally in good condition, and there is no uncertainty in this regard.

The bank offers a simple demand deposit contract to the depositors. The contract stipulates that upon withdrawal in period 1 depositors receive $c_1 > 1$, unless the available funds decrease to very low levels or zero. More concretely, we assume that the bank pays c_1 to the first $\bar{\tau} \geq N - \phi$ withdrawing depositors (to be derived later). For simplicity, we assume that an optimization exercise in the spirit of Diamond and Dybvig (1983) determines c_1. The first best allocation solves

$$\begin{aligned} &\max_{c_1, c_2} (N - p)u(c_1) + pu(c_2) \\ &\text{s. t. } (N - p)c_1 + \tfrac{p}{R}c_2 = N. \end{aligned} \tag{2}$$

We omit the subscript i from the optimization as depositors have identical utility functions. The solution to this problem is

$$u'(c_1^*) = Ru'(c_2^*), \tag{3}$$

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 $\eta \in \{0, \ldots, p\}$ be the number of depositors who keep their funds deposited at $t = 1$.[14] Following the Diamond–Dybvig model, we assume that all players who keep their money in the bank at $t = 1$ obtain the same consumption at $t = 2$, namely,

$$c_2(\eta) = \max\{0, \frac{R(N - (N - \eta)c_1^*)}{\eta}\}. \tag{4}$$

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 keep their funds deposited so that it is an optimal strategy for each of them. Period-2 consumption is higher than consumption received after withdrawing at $t = 1$ if the following holds

$$\frac{R(N - (N - \eta)c_1^*)}{\eta} > c_1^*. \tag{5}$$

This condition is equivalent to

$$\eta > \frac{RN(c_1^* - 1)}{c_1^*(R - 1)}. \tag{6}$$

Since η is a natural number, so the previous condition becomes

$$\eta \geq int\left[\frac{RN(c_1^* - 1)}{c_1^*(R - 1)}\right] + 1, \tag{7}$$

where *int* denotes the integer part. 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 keeps the funds deposited receives $c_2(\eta) \leq c_1^*$, for all $\eta \leq \bar{\eta}$, and $c_2(\eta) > c_1^*$, for all $\eta > \bar{\eta}$.

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 can be 0 or a positive amount, but 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, as well as those who keep the money deposited, receive zero consumption.

2.1.4. The bank-run game with line formation

In period 1, the bank-run game with line formation takes place. At the beginning of period 1, nature assigns liquidity types to the depositors by choosing any (liquidity) type vector θ with equal probability (i.e., each depositor has the same probability of being patient or impatient).

In the first stage of period 1, once liquidity type is (privately) revealed, depositors choose the effort to arrive at the bank, and the line is formed. Positions in the line are determined according to the effort level chosen by the depositor. Higher effort increases the probability of obtaining an early position. We assume that efforts are not publicly observable.

In the second stage of period 1, depositors decide sequentially whether to keep their money in the bank or withdraw their funds. Regarding the information that depositors have in the second stage, we consider two setups: i) no information (NoINFO) and

[11] Following Diamond and Dybvig (1983) this is the most frequent assumption in the literature, though there are papers that apply fundamental uncertainty, e.g. Green and Lin (2003).

[12] In real life, the costly effort need not be monetary, it may involve for instance the opportunity cost related to spending time and effort on withdrawing early from the bank.

[13] We disregard the pre-deposit game described by Peck and Shell (2003).

[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 will keep their funds deposited.

ii) information (INFO). In the NoINFO setup, depositors decide in sequence according to their efforts, but neither the own position nor the other depositors' actions are observed. In the INFO setup, previous decisions are observed (and hence the position is also known).

$b_i \in [0, b_{\max}]$ denotes depositor i's effort in the first stage. The ranking of efforts determines the sequence of decisions. If more than one depositor exerts the same level of effort, then each of them has the same probability of being in the given position. Let $b = (b_1, \dots b_i, \dots b_N)$ be the vector of the chosen efforts. Function $r(b_i, b) : b_i \times b \to [1, N]$ ranks the efforts and determines the sequence. We denote by r_i the position of depositor i.

The decision of an impatient depositor in the withdrawal decision stage is always to withdraw ($s = 1$). In the NoINFO setup, the decision of a patient depositor in the withdrawal decision stage is binary, $s_i \in \{0, 1\}$ where 0 denotes keeping the money in the bank, while 1 stands for withdrawal. In the INFO setup, the patient depositor has a binary decision in each of the possible information sets she may be in, which are determined by the sequence of previous decisions of each type up to the point when the depositor decides, $s_{i,\psi} \in \{0, 1\}, \psi \in \{0, 1\}^k, k \in [0, N-1], \sum \psi > (k - p - 1)$. Note that information sets are defined as sequences of 0 and 1, since in the INFO setup, a depositor in position $k+1$ observes the k previous decisions. Note that in each information set, there is uncertainty about the observed withdrawals in the sense that it is not clear if they were due to a patient or to an impatient depositor.

The payment obtained by each depositor from the bank is $c_{t,i}$, where $t \in \{1, 2\}$ depending on the withdrawal decision of the depositor. The payments are as follows:

$$c_{1,i} = \begin{cases} c_1^*, & \text{if } s_i = 1 \text{ and } \sum_{j=1}^{r_i - 1} s_j < int\left[\frac{N}{c_1^*}\right], \\ c_1^{low}, & \text{if } s_i = 1 \text{ and } \sum_{j=1}^{r_i - 1} s_j = int\left[\frac{N}{c_1^*}\right], \\ 0, \text{ if } s_i = 1 \text{ and } \sum_{j=1}^{r_i - 1} s_j > int\left[\frac{N}{c_1^*}\right] \end{cases} \quad (8)$$
$$c_{2,i} = \left\{ c_2(\eta), \quad \text{if } s_i = 0 \right.$$

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. If a depositor who attempts to withdraw comes too late, then she receives zero consumption. The last line describes period-2 consumption for those who keep their funds deposited, $c_2(\eta)$ is given by (4).

2.1.5. NoINFO setup

A (pure) strategy of a depositor is given by her bid when acting as impatient, her bid when acting as patient depositor, and her choice to keep the money deposited or withdraw. Thus, in the NoINFO setup, we define the strategy of depositor j as $\sigma_j = (b_j^{imp}, b_j^{pat}, s_j) \in ([0, b_{\max}] \times [0, b_{\max}] \times 0, 1)$. Let $\sigma = (\sigma_1, \sigma_2, \dots \sigma_N)$ be a profile of strategies for each depositor. Note that given σ, each depositor i has an (expected) position in the line and this position plus the strategy determines the payments that the bank will make. Each depositor will be of a given type according to the (liquidity) type vector selected by nature, θ. Since all type vectors are equiprobable, each depositor is patient with probability $\frac{p}{N}$ or impatient with probability $\frac{(N-p)}{N}$. Thus, the expected payoff for each depositor i is

$$\begin{aligned} \pi_i(\sigma) = \frac{(N-p)}{N} \sum_{c_{1,i}} \mathbb{E}[u(c_{1,i}) P(c_{1,i} \mid \sigma, \theta, \theta_i = 0) P(\theta)] \\ + \frac{p}{N} \left[\sum_{c_{2,i}} \mathbb{E}[u(c_{2,i}) P(c_{2,i} \mid \sigma, \theta, \theta_i = 1) P(\theta)] \right] \\ + \left[\sum_{c_{1,i}} \mathbb{E}[u(c_{1,i}) P(c_{1,i} \mid \sigma, \theta, \theta_i = 1) P(\theta)] \right], \end{aligned} \quad (9)$$

where $P(c_{t,i} \mid \sigma, \theta, \theta_i)$ denotes the probability that depositor i receives consumption $c_{t,i}$ given the strategy profile of depositors, the type vector and her liquidity type, while $P(\theta)$ denotes the probability of a given type vector.

In the NoINFO setup, we use the notion of symmetric Bayesian Equilibrium in pure strategies (which is equivalent to PBE given that all the decisions occur simultaneously, and which is the concept that we apply in the INFO setup).

Definition σ^* is a symmetric Bayesian equilibrium in pure strategies in the simultaneous setup if it is a pure strategy and $\pi_i(\sigma_i = \sigma^*; \sigma_k = \sigma^*, \forall k \in I) \geq \pi_i(\sigma_i'; \sigma_k = \sigma^*, \forall k \in I), \forall \sigma_i'$.

Proposition 1. *There is always an equilibrium where patient depositors keep their money deposited, and in this equilibrium nobody makes any effort to go to the bank. Additionally, there is a bank-run equilibrium where depositors make a positive effort to arrive early at the bank if and only if the highest possible effort is bounded and the bound is sufficiently low.*

The proof is relegated to Appendix A.

Proposition 1 shows that an equilibrium with positive effort requires that the maximum effort is bounded below. We discuss here briefly why it is the case. Note that an equilibrium with positive efforts requires that nobody has any incentive to deviate. Focus on the depositors who are exerting the highest effort in equilibrium. There are two possibilities: they are obtaining the highest payoff from the bank with probability 1 (if the bank has enough funds to pay to all depositors exerting the highest effort) or with probability < 1 (if the bank has not enough funds to pay every depositor exerting the highest effort). The first case cannot be an equilibrium because then the depositor could exert an effort slightly lower, and still receive the same payoff. In the second case, if she receives the highest payoff with probability < 1, she could increase her payoff by slightly increasing the effort and receiving the maximum payment from the bank with probability 1. It implies that, in order to have such an equilibrium, the maximum effort must be bounded. In Appendix A, we prove this result formally.

2.1.6. INFO setup

We turn now to the INFO setup. We define the strategy of depositor j as $\sigma_j = (b_j^{imp}, b_j^{pat}, s_j \mid \varphi), \forall \varphi$, where φ is each of the information sets that may occur in the INFO setup (that is, all the possible sequences of withdrawals and keeping the money deposited). When all the previous actions are observed, depositors must form a belief about the sequence that has been selected (the sequence of patient and impatient depositors). Therefore, beliefs in a particular information set define a probability distribution about the possible sequences that may have occurred. This can also be understood as beliefs on the possible efforts exerted by the different depositors. Beliefs are assumed to be homogeneous for all depositors.

In the INFO setup, we use the notion of Perfect Bayesian Equilibrium (PBE).

Definition In the symmetric setup, a strategy $\sigma^* = (b^{imp,*}, b^{pat,*}, s^* \mid \varphi), \forall \varphi$ and a belief system about the type sequence $\mu(\{\theta\}^N \mid \varphi), \forall \varphi$ represent a symmetric Perfect Bayesian equilibrium in pure strategies if i) σ^* is a pure strategy chosen by all depositors, ii) in each information set there is no profitable deviation conditional on μ, and iii) $\mu(\{\theta\}^N \mid \varphi), \forall\varphi$ is consistent with σ^* applying the Bayes' rule whenever possible.

Proposition 2. *In the INFO setup, in the unique PBE, patient and impatient depositors do not exert any effort to arrive at the bank, and patient depositors keep the money deposited on the equilibrium path.*

Proof. In a symmetric equilibrium, there can be three cases: 1) $b^{imp,*} > b^{pat,*}$, which implies that impatient depositors arrive first; 2) $b^{pat,*} > b^{imp,*}$, entailing that patient depositors arrive first; and 3) $b^{pat,*} = b^{imp,*}$, so all the possible type sequences are equiprobable.

Note that in cases 1) and 2), consistent beliefs about the type sequence require considering with probability 1 that the depositors of each type are first or second. This implies that the situation is equivalent to a game of perfect information. Proposition 1 in Kinateder and Kiss (2014) uses backward induction to show that in a bank-run game of this type with perfect information patient depositors keep the money deposited in any equilibrium. Note that it implies a symmetric strategy.

In case 3), consistent beliefs about the type sequence imply that all sequences are equiprobable. Proposition 3 in Kinateder and Kiss (2014) shows that in a bank-run game of this type with equiprobable sequences, patient depositors keep the money deposited in any equilibrium. Note that it implies a symmetric strategy.

Therefore, we have proved that in any continuation game after the formation of the line, patient depositors keep the money deposited in any PBE. Note that if a PBE includes a strictly positive effort to arrive at the bank, there is a profitable deviation for the depositor because exerting a lower effort would not change the payment received from the bank. Therefore, in a PBE, depositors do not exert any effort and patient depositors keep the money deposited. □

2.2. The experimental model

Our experimental model is a particular reduced version of the general model in which decisions and efforts are studied with a quasi-linear utility function. In our experimental model, we separate the two decisions and assign an independent budget to choose the effort level. Such a model extends the bank-run game in Kiss et al. (2014a) to incorporate a stage in which depositors can make costly efforts (in the form of a bid) to obtain a position in the line. The timeline is slightly different from the general model to make it easier to understand for experimental subjects. In our experimental model, three depositors are endowed with 40 ECUs, automatically deposited in a common bank at $t = 0$, and with 20 ECUs, used to choose the effort level. The bank will invest the total endowment (120 ECUs) in a risk-free project that yields a guaranteed positive net return after $t = 2$. The bank, however, can liquidate any fraction of the investment before the project is carried out.

Depositors learn their liquidity needs after depositing their endowment in the bank. In particular, one of the depositors is hit by a liquidity shock, and is forced to withdraw her funds from the bank. 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 choose to keep their funds deposited or withdraw are called patient depositors.

At $t = 1$, first depositors learn their liquidity needs (patient or impatient), then they bid (simultaneously) for a position in the line (bidding stage). We interpret the bid as the level of costly effort to arrive early at the bank that depositors are willing to exert. Once the line is formed, depositors choose at $t = 2$ according to the order determined by the bids between withdrawing their funds from the bank or keeping them deposited (withdrawal decision). We hereafter refer to depositor i as the one in position $i = \{1, 2, 3\}$.

The bank cannot condition the payoffs on the liquidity needs of depositors, which is not observable. Payoffs depend on the position in the line and the decisions of depositors at $t = 2$ (see Table 1). 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 depositor 1 or 2 withdraws, she definitely receives 50 ECUs. However, if depositor 3 decides to withdraw after two withdrawals, she only receives 20 ECUs (the bank has only 20 ECUs left to pay depositor 3, because the first two depositors who withdrew received 50 ECUs each). Nonetheless, if depositor 3 withdraws after less than two withdrawals, the bank pays her 50 ECUs.

While impatient depositors are forced to withdraw at $t = 2$, patient depositors can decide to keep their funds deposited. If they do, they are paid at $t = 3$ once the bank carries out the project (see Fig. 1). The amount that patient depositors receive at $t = 3$ depends on the total number of depositors who keep their money in the bank at $t = 2$. If only one depositor keeps her money deposited, she receives 30 ECUs. If two depositors do so, then their payoff is 70 ECUs. This payoff structure implies that early withdrawals from patient depositors carry an implicit penalty if the other patient depositor decides to keep her funds deposited at $t = 2$, because a patient depositor who withdraws in this case obtains 50 ECUs at $t = 2$ instead of 70 ECUs at $t = 3$. Note also that position in the line is only relevant if there is a run (i.e., when patient depositors withdraw at $t = 2$), because then arriving late (that is, in position 3) yields only 20 ECUs instead of 50 ECUs.

Overall, these payoffs follow Diamond and Dybvig (1983) in that i) if all patient depositors keep their money in the bank, then they receive the highest payoff (70 ECUs in our case); ii) if there are too many withdrawals, notably due to withdrawing patient depositors, then the payoff of patient depositors who keep their funds deposited may be lower than the payoff related to immediate withdrawal (receiving 50 ECUs upon withdrawal vs. 30 ECUs if keeping the money in the bank in our case); and iii) early withdrawal yields a higher payoff than the initial deposit (50 ECUs vs. 40 ECUs in our case).

The sequence of events is presented in Fig. 1.

2.3. Underlying assumptions and parametrization

Before discussing our hypotheses, there are some aspects of our model that are worth mentioning. First, we constrain the bid at $t = 1$ to be an integer number between 0 and 20, both included. This assumption implies that depositors can only bid the part of their endowment that was not deposited in the bank and imposes some form of rationality because depositors cannot have losses in the experiment. Further, the amount not used for bidding adds to the final payoff of the depositor. For example, if a patient depositor bids 15 and only the impatient depositor withdraws, she receives $(20 - 15) + 70 = 75$ ECUs.

Second, our model assumes that depositors who withdraw receive their money immediately, while those who keep their funds deposited receive the money once the bank carries out the project. This is important for the return on investment (ROI) and the liquidation costs. When only the impatient depositor withdraws, she receives 50 ECUs immediately, and 70 ECUs are invested into the project, so the patient depositors who keep their funds deposited receive 70 ECUs each (i.e., 140 ECUs in total). This corresponds to a ROI equal to $(140 - 70)/70 = 100\%$. However, if one of the patient depositors withdraws early, the one who keeps her funds de-

Table 1
Payoffs of the bank run game depending on the position of depositors and their choices.

Your position in the line	If you withdraw (only possible action if impatient)	If you keep the funds deposited and...	
		another depositor keeps the fund in the bank	you are the only one who keeps the fund deposited
1°	50		
2°	50		
3°	20 or 50	70	30

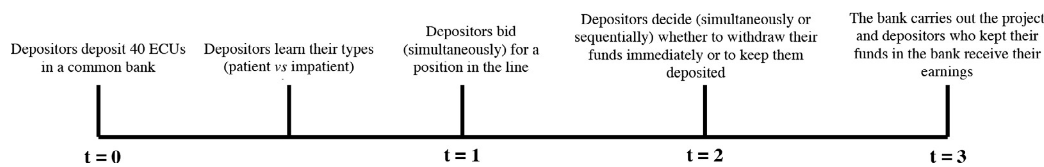

Fig. 1. Sequence of events in the game.

posited receives 30 ECUs (after an investment of 20 ECUs). This amount corresponds to a ROI equal to $(30-20)/20 = 50\%$. As a result, we (implicitly) assume that there is a liquidation cost for the bank if patient depositors withdraw early, similar to other bank run studies (Cooper and Ross, 1998; Ennis and Keister, 2009).

We want to study the behavior of depositors in two different informational environments, depending on whether or not they can observe the action of other depositors. The fact that *all* decisions can be observed in our INFO environment implies that depositors do not only observe the withdrawal decision of others, but also know whether others have kept their funds deposited. This assumption is part of recent theoretical models (Green and Lin, 2003; Kinateder and Kiss, 2014) and supported by empirical studies that show that in many instances depositors observe the decision of others in their social network or neighbourhood (Kelly and O Grada, 2000; Starr and Yilmaz, 2007; Iyer and Puri, 2012; Iyer et al., 2016; Atmaca et al., 2017; Artavanis et al., 2019). Experimental studies have also incorporated this feature; see, among others, Kiss et al. (2014a, 2018) or Shakina and Angerer (2018).[15]

Finally, it is worth noting that patient depositors in position 3 should always keep their funds deposited, regardless of what they observe (if anything). This is the case because keeping the funds deposited always entails higher payoffs to a patient depositor 3 than withdrawing for any possible history of decisions; i.e., after two withdrawals, depositor 3 receives 30 ECUs if she keeps her funds deposited and 20 ECUs if she withdraws. If a depositor keeps her money in the bank and only the impatient depositor withdraws, then in position 3 it is better to keep the funds deposited and earn the highest payoff (70 ECUs vs. 50 ECUs). This feature of our model is also present in Green and Lin (2003) or Ennis and Keister (2010).[16] In fact, this will help us identify irrational depositors in our experiment to test whether irrationality affects behavior.[17]

2.4. Hypotheses

We focus on the polar situations in which observation of decisions is either absent or complete. The former case corresponds to the NoINFO environment (previous decisions cannot be observed), while the latter is represented by the INFO environment (both keeping the money deposited and withdrawal are observable, and depositors decide sequentially according to their position in the line). Next, we derive theoretical predictions for the NoINFO and the INFO treatments (Hypotheses 1 and 2) and formulate a behavioral conjecture (Hypothesis 3) based on the literature.[18]

2.4.1. NoINFO treatment

When depositors cannot observe the action of others, they play a minimal version of the (simultaneous) coordination problem embedded in Diamond and Dybvig (1983). We made this setup as close as possible to Diamond and Dybvig (1983), so depositors do not know neither their position in the line, nor the decisions of the other depositors when deciding whether to withdraw in $t = 2$. There are two equilibria in pure strategies for any possible line, one where both patient depositors keep their money in the bank (the efficient equilibrium) and one where both patient depositors withdraw (the bank run equilibrium).

If patient depositors expect to choose the efficient outcome in $t = 2$ (in other words, both patient depositors believe that the other patient depositor keeps her funds deposited), there is no incentive to make a costly effort to arrive early, so a bid of 0 is the optimal strategy in $t = 1$. If the bank-run equilibrium is expected to be played in $t = 2$ (that is, a patient depositor believes that the other patient depositor withdraws), a patient depositor best responds by spending some amount of money in the bidding stage in $t = 1$ to get earlier to the bank than one of the other depositors, so she will bid a positive amount. More precisely, the patient depositor submits the minimal amount that she considers necessary to arrive in position 1 or 2 at the bank and to receive 50 ECUs.

The impatient depositor has no incentive to make costly efforts to arrive early at the bank if she expects no withdrawals or only one withdrawal from the patient depositors. If she expects that both patient depositors withdraw, then the same line of reasoning applies to her as to the patient depositor who wants to withdraw and expects the other patient depositor to withdraw as well. Thus, in this case, she will bid the conjectured minimum positive amount that allows her to arrive early at the bank. In fact, both the patient and the impatient depositors have the same incentives to

[15] As we discuss in Section 5 one relevant situation would be to study behavior when actions cannot be observed at the individual level, but at the aggregate level.

[16] In their literature review, Ennis and Keister (2010) describe this feature as follows: *"Suppose, for example, that all of these agents have chosen to withdraw early. Then this last agent knows that if she chooses to withdraw early, she will receive whatever resources are left in the bank. If she chooses to wait, however, she will receive the matured value of these assets in the later period, which is larger. Hence, if she is patient, she is strictly better off waiting to withdraw."*

[17] Our definition of irrational behavior follows from subjects who do not recognize their dominant strategy in position 3 but we cannot discard the possibility that other features affect their willingness to withdraw; e.g., subjects can be confused or make errors when making their choices as depositor 3 in the experiment.

[18] For other studies that consider simultaneous or fully sequential decisions see, among others, Schotter and Yorulmazer (2009) or Kiss et al. (2012, 2018, 2021)

arrive early at the bank if they want to withdraw and expect the other two depositors to withdraw. Thus, we expect them to bid equally. Therefore, the efforts are zero or positive depending on the expectations about which equilibrium is played, the efficient equilibrium or the bank-run equilibrium.

Hypothesis 1 (NoINFO treatment)**.** In the NoINFO treatment, the effort to arrive early at the bank (i.e., the bids) depends on the expectations about the occurrence of bank runs. If a patient depositor expects the other patient depositor to withdraw, then she submits a positive bid to arrive early (in position 1 or 2) at the bank. If the impatient depositor expects both patient depositors to withdraw, then she submits a positive bid to arrive early at the bank. If no bank run is expected, then depositors submit a zero bid. Conditional on their expectations on the occurrence of bank runs, patient and impatient depositors do not bid differently.

2.4.2. INFO treatment

As in the general model, there is a unique perfect Bayesian equilibrium without bank run in $t = 2$ in the three-depositor experimental model, when depositors have information about the decision of other depositors (Kinateder and Kiss, 2014; Kiss et al., 2014a). The observability of previous decisions solves the coordination problem. Depositors have no incentives to make any costly effort to arrive early at the bank; i.e., depositors should bid nothing in the bidding stage, regardless of their liquidity needs.

Hypothesis 2 (INFO treatment and bank runs due to coordination problems)**.** In the INFO treatment, bank runs do not occur due to a coordination problem among depositors, so both patient and impatient depositors make no effort to arrive early at the bank (i.e. submit a zero bid).

Although having information on the action of others solves the coordination problem theoretically, Kiss et al. (2018) show that the observation of withdrawals distorts depositors' beliefs that a bank run is underway. More concretely, they find that patient depositors tend to attribute an observed withdrawal to the other patient depositor instead of the impatient one. As a result, depositors who observe a withdrawal are likely to withdraw as well (Garratt and Keister, 2009; Schotter and Yorulmazer, 2009; Kiss et al., 2014a; 2021). Kiss et al. (2018) refer to these bank runs that occur neither because of fundamental problems nor a coordination issue as *panic bank runs*. This behavioral finding suggests a different hypothesis than the previous one. If depositors believe that a panic bank run can occur in stage 2, then depositors may make a costly effort in stage 1 to arrive early at the bank.

Hypothesis 3 (INFO treatment and bank runs due to panic behavior)**.** In the INFO treatment, depositors may submit positive bids in stage 1 of the game to arrive early at the bank if they believe that there will be a panic bank run.

In principle, the reason for patient depositors to bid in the INFO treatment when a panic bank run is underway is twofold. On the one hand, patient depositors have incentives to make a costly effort to arrive early at the bank to keep the money deposited. This way, the other patient depositor will observe her decision, and this will facilitate the coordination on the efficient outcome. Remember that if the first depositor who acts is impatient, the observation of withdrawal may result in a (panic) bank run. This idea is somewhat reminiscent of what Choi et al. (2011) call strategic commitment. Recent experimental findings show that subjects may be willing to pay to reveal their types and facilitate coordination on the efficient equilibrium or outcome (Steiger and Zultan, 2014; Masiliunas, 2017; Kinateder et al., 2020). A second possibility is to bid and withdraw. This decision is reasonable if the patient depositor thinks that the other patient depositor will withdraw for sure, so the patient depositor receives a guaranteed payoff of 50 ECUs, rather than 30 ECUs corresponding to keeping the funds deposited alone. When assessing both options, the patient depositor should find it optimal to keep her funds deposited whenever she believes that the other patient depositor is rational enough and chooses the efficient outcome upon observing that somebody has already kept her money in the bank. Otherwise, if she believes that the other patient depositor is not rational and withdraws even upon observing that somebody kept her funds deposited, then she is better off if she withdraws. As for the behavior of the impatient depositors, her expectation regarding the occurrence of (panic) bank runs is also key to determining whether or not she should make any costly effort to arrive early at the bank. If the impatient depositor believes that there will be no coordination problems (i.e., both patient depositors will keep their funds deposited), then she should make no costly effort to arrive early at the bank. If the impatient depositor expects a (panic) bank run, then she has incentives to bid a positive amount to arrive early at the bank.

2.5. Individual traits

The previous theory is silent about the magnitude of the bids, but it is natural to think that the size of the bid is affected by individual traits. In our experiment, we use a questionnaire to elicit a series of variables that we believe to be important for bidding behavior.

There is no consensus in the experimental literature on bank runs, on whether women make different choices than men. Kiss et al. (2014b) and Shakina (2019) do not find gender differences in the withdrawal decisions, while Dijk (2017) reports that women are more likely to withdraw when fear is induced in participants. On the contrary, the experimental evidence on bidding behavior seems to support the hypothesis that men and women bid differently; e.g., Rutström (1998) finds that women exhibit more variance in bidding choices than men do, and Ham and Kagel (2006); Casari et al. (2007); Chen et al. (2015); Price and Sheremeta (2015), among others, find that women tend to bid higher in auctions. It is unclear if these results hold when bidding for a position in a bank-run game, so we test whether gender affects bidding behavior in our informational environments.

In our experiment, we also elicit risk, loss and ambiguity aversion (see Appendix C for further details). We expect that the more a depositor dislikes uncertainty or loss, the more she is willing to pay to avoid it. However, it may have different effects in the different treatments. In the NoINFO treatment, a way to secure a payoff is to be in position 1 or 2 and to withdraw. This leads to a sure 50 ECUs instead of facing i) the uncertainty of the 70 / 30 ECUs, or ii) a potential loss if she receives only 30 ECUs and the initial endowment of 40 ECUs is assumed to be a reference point. Hence, if we consider two depositors in the NoINFO treatment, both of them expecting that at least one of the patient depositors withdraws, we conjecture that the one who is more averse to uncertainty or loss will bid more. As commented before, in the INFO treatment a patient depositor may want to bid high to be the first to decide in stage 2 and she may choose to keep her funds deposited. Hence, she can induce the other patient depositor to do so as well, both of them earning 70 ECUs (a potential reference point). Thus, here the high bid to be the first would lead to keeping the money in the bank, in contrast to the NoINFO treatment. However, in both cases, the more averse a depositor to uncertainty or loss, the more she bids, *ceteris paribus*.

We measure the rest of the variables (cognitive abilities, income, trust, or personality traits) mainly to control for them in the analysis and avoid confounds.

3. The experiment

3.1. Experimental design and procedures

The experiment consisted of two treatments and ten sessions executed in a between-subject design. We recruited a total of 312 subjects (156 for the NoINFO and 156 for the INFO treatment) with no previous experience in coordination problems or experiments on financial decisions. Each subject participated in only one treatment. We ran six sessions with 24 subjects each at the Laboratory for Theoretical and Experimental Economics (LATEX) of Universidad de Alicante and four sessions with 42 subjects each at the Laboratory for Research in Experimental and Behavioural Economics (LINEEX) of Universitat de Valencia between October 2015 and February 2016.[19]

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 served as a trial so that participants could get familiarized with the game and the software. No results were communicated to the subjects after this trial, nor was there any related payment. The second play was relevant for the final payment (section Appendix B contains the instructions).

We employed the strategy method (Brandts and Charness, 2011) and asked participants to make two different types of choices. The first one concerned an auction, in which subjects decided what amount of their endowment not deposited in the bank (between 0 and 20 ECUs) to bid for a position in the line. Subjects were asked to bid both as patient and impatient depositors. It was common information that banks would be formed by one impatient and two patient depositors, and the first / second / third depositor in the line would be the depositor who submitted the highest / second highest / lowest bid.

After their bidding decision, participants were asked to decide what to do if they arrived at the bank and had the possibility of withdrawing or keeping their money deposited. Recall that impatient depositors are forced to withdraw, so we were only interested in the decision of participants in the role of the patient depositor. In the NoINFO treatment, participants made their choices without any further information apart from knowing their own bids as patient depositors. In the INFO treatment, participants were asked to make a choice in six different scenarios:

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

By using the strategy method, we obtain a sufficiently large and balanced number of observations across treatments and positions in the line.[20] One advantage of our design is that we elicit the beliefs of participants regarding their position in the line, as detailed in Section 3.2. This allows us to condition their choices on their believed position to examine whether the use of the strategy method has any effect on their decision to withdraw or keep the funds deposited. By asking participants for decisions in all the information sets that they could face, we also try to uncover their reasoning and identify their behavioral type. For example, we know that no depositor 3 would withdraw if patient because this is a dominated strategy. If a patient depositor in position 3 withdraws, we can classify that subject as irrational and then examine whether the bidding behavior of irrational depositors for a position in the line is different from the behavior of rational depositors who keep their funds deposited in position 3.

After subjects made their choices in the bank-run game, they filled out a questionnaire that was used to collect additional information about a set of socio-economic variables (see Appendix B). In the sessions run in Valencia, we elicited the participants' beliefs about their position in the line and the decision of other depositors, as detailed below. To avoid any wealth effect that may distort the subjects' behavior in these subsequent phases, the formation of banks and the realization of payoffs in the bank-run game were postponed to the end of the experiment.

3.2. Elicitation of beliefs

When subjects completed the questionnaire in our experimental sessions in Valencia ($N = 168$ subjects), we elicited their beliefs regarding position in the line and decisions of the other depositors. More concretely, we asked in both informational environments (NoINFO and INFO) and for both roles (impatient and patient depositor) what position they believed to obtain when they submitted their bids.[21]

We also elicited subjects' expectations regarding the occurrence of bank runs in each of the informational environments. To do so, we asked impatient depositors' belief regarding the behavior of the patient depositors. More specifically, we asked impatient depositors what they believed about how many of the other depositors (0, 1 or 2) chose to withdraw. In the NoINFO treatment, we also asked this question when in the role of the patient depositor. Since the impatient depositor was forced to withdraw, the possible answers were restricted to 1 and 2. The answer to these questions allows us to determine whether or not depositors expect a bank run to occur.

Finally, in the INFO treatment we elicited patient depositors' belief upon observing a withdrawal in position 2. More concretely, subjects had to decide which of the following three alternatives was most likely:

1. Depositor 1 who withdrew was the impatient depositor (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 equally likely.

Thus, we can assess whether participants attribute an observed withdrawal to the impatient depositor (as predicted by rationality and the coordination explanation of bank runs) or the patient depositor (as suggested by panic bank runs).[22]

[19] We have balanced observations across locations. In particular, we have 72 participants from Alicante and 84 from Valencia in each treatment. Having detected no significant differences across locations, we pool the observations.

[20] Although we cannot rule out that the use of this method influences behavior, findings from a meta-study by Brandts and Charness (2011) suggest that the likelihood for this is small, as the results may not differ significantly from using the direct-response method, where participants would be revealed their roles (as patient or impatient depositors) and then would make one decision depending on their actual position in the line (observing the action of others in the INFO treatment).

[21] In principle, subjects could bid without thinking about the position in the line. At the end of the experiment, only 5% of the subjects reported that they did not think about their position when submitting their bids. We perform a robustness analysis in D.2, where we show that our results are robust if we exclude these subjects from the analysis.

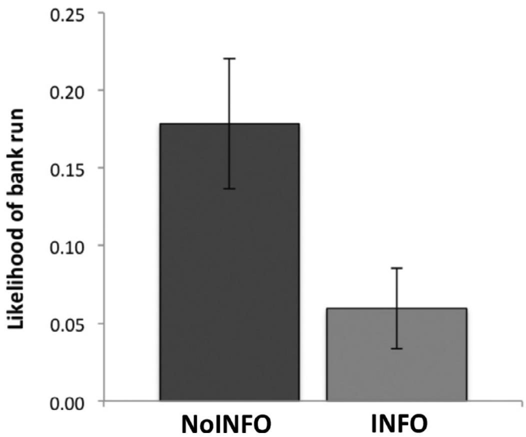

Fig. 2. Beliefs on the likelihood of a bank run in each informational environment. The vertical lines plot the standard errors of each mean.

3.3. Payment to participants

We follow the experimental methodology and pay participants depending on their actual choices in the experiment. Once the experiment finished, the computer paired participants randomly to form banks of three depositors and assigned the role of patient and impatient depositors at random. Payoffs were computed according to the bidding behavior and the withdrawal decisions of subjects in the bank-run game (given their role).

Subjects were also paid for their choices in the questionnaire. In particular, we randomly selected one of the three tasks that were used to elicit risk attitudes, loss aversion and ambiguity.[23] At the end of the experiment, the ECUs earned during the experiment were converted into Euros at the rate 10 ECUs = 1 Euro. The experiment lasted approximately 1 h. The average earnings were 10.5 Euros.

4. Experimental results

Our theory builds on the assumption that the observability of actions should facilitate successful coordination on the no-bank-run outcome in the INFO treatment. Fig. 2 summarizes the beliefs of impatient depositors regarding the occurrence of a bank run (defined as at least one patient depositor withdrawing) in each of the informational environments. According to the test of proportion, depositors expect more bank runs in the NoINFO treatment where they have no information on the decision of other depositors ($p < 0.01$). Recall that there is a (no) bank-run equilibrium if (none) both patient depositors withdraw their funds from the bank. We find that roughly 37% (44%) of depositors expect to see no withdrawals in the NoINFO (INFO) treatment, while 18% (6%) of depositors expect that both patient depositors will withdraw in the NoINFO (INFO) treatment, respectively. Statistically, the Kruskal-Wallis equality-of-populations rank test rejects the null hypothesis that depositors expect the same behavior in the two treatments ($p = 0.049$).

These findings suggests that depositors recognize the importance of observability (Kiss et al., 2014a). Next, we investigate whether (and how) this affects the formation of the line (Section 4.1) and the behavior of depositors in the bank run game (Section 4.2).

4.1. Behavior of depositors in the bidding stage

The upper panel of Table 2 summarizes the average bids (with corresponding standard deviations in brackets) for each type of depositor (patient / impatient) in each possible treatment (NoINFO / INFO), depending on the depositors' beliefs regarding their position in the line. The lower panel of Table 2 reports the average bid (standard deviation), the median bid, and the frequency of positive bids for each case.

We observe that depositors who believe to be in position 1 bid more on average than depositors who believe to be in position 2 or 3. The same holds for subsequent depositors, that is, depositors who believe to be in position 2 bid more than depositors who believe to be in position 3. The Kruskal–Wallis test suggests a statistically significant difference in the bidding behavior between the three different expected positions in the line (p-value < 0.0001). These findings are confirmed by a significant correlation between the depositors' bid and their expected position in the line (p-value < 0.0001).[24] At the bottom panel, we find that depositors bid around 7.20 ECUs (roughly 36% of their endowment) regardless of their role or the informational environment. Moreover, around 90% of the subjects bid a positive amount to arrive early at the bank. This result is in sharp contrast with Hypothesis 2 that conjectures that depositors should bid nothing in the INFO treatment. We employ a between-subject analysis to test whether subjects with the same liquidity needs behave differently depending on the treatment. Our non-parametric analysis suggests no differences in bids of patient and impatient depositors across informational environments ($p > 0.35$).[25]

A plausible explanation of the high bids in the INFO treatment is related to the rationality of depositors (Kiss et al., 2016b; Shakina and Angerer, 2018). Rationality can be measured in two ways in the INFO treatment. On the one hand, depositor 3 has a dominant strategy and should keep the funds deposited if patient. On the other hand, any patient depositor should keep her funds deposited in position 2 if she observes that depositor 1 has kept her funds deposited in the bank. If we use both criteria, 122 out of 156 (78%) would be classified as rational and 34 (22%) as irrational depositors in the INFO treatment. Irrational subjects make more costly efforts than rational subjects to arrive early at the bank in the INFO treatment, according to a Mann–Whitney Wilcoxon test (8.81 vs. 6.80, $p = 0.029$).[26] This indicates that the high bids observed in the INFO treatment are partly due to the irrationality of some depositors.

In order to compare the behavior of rational depositors across informational environments, we eliminate those depositors who believe to be in position 3 in the NoINFO treatment and still with-

[22] We decided to elicit the beliefs of the patient depositor regarding the behavior of the other patient depositor in the INFO treatment only for the case when observing a withdrawal. Asking this belief for all information set would have been cumbersome without much value added as in most of the information set the beliefs must be clear. For instance, in position 3 when observing all previous decisions the depositor can infer perfectly what the other patient depositor did. The same is true when a depositor 2 observes that somebody has kept her funds deposited.

[23] We also paid subjects if they guessed correctly their performance in the CRT or if they guessed correctly the number of questions answered correctly by another random participant.

[24] We interpret this finding (and the fact that depositors expect less bank runs in the INFO than in the NoINFO treatment) as evidence that participants understood the basic features of the underlying games.

[25] Unless otherwise noted, the reported p-values in this section refer to the Mann–Whitney–Wilcoxon test for the comparison across treatments. We use the Wilcoxon signed-rank test for within-subject comparisons; e.g., to test if participants in a particular treatment submit different bids depending on their liquidity types. We rely on a one-tailed analysis whenever there is a clear ex-ante hypothesis on the depositors' behavior.

[26] Our previous result that irrational depositors bid more than rational depositors in the INFO treatment is robust to if we only consider that irrational subjects are the ones who withdraw in position 3 (27 out of 156, 17%) (8.91 ECUs vs. 6.66 ECUs, $p = 0.013$).

Table 2
Summary of bids unconditional and conditional on the depositors' belief about their position. Standard deviations in parentheses.

	NoINFO		INFO	
	Patient	Impatient	Patient	Impatient
Believed position				
1	13.68 (4.41)	12.73 (4.44)	11.12 (6.11)	12.79 (5.12)
2	8.83 (3.37)	7.97 (2.28)	8.03 (3.80)	7.09 (2.94)
3	1.48 (1.66)	3.44 (4.32)	2.05 (4.68)	2.06 (2.88)
Average bid	7.25 (4.87)	7.53 (5.31)	7.15 (5.37)	6.96 (5.21)
Median bid	7	8	7	6
% Positive bid	88%	93%	88%	88%

draw their funds from the bank (3 out of 156 subjects, 2%). If we eliminate their bids from the analysis, we find that bids by rational (patient) depositors are higher in the NoINFO treatment than in the INFO treatment (7.61 ECUs vs 6.66 ECUs, $p = 0.046$). In the NoINFO treatment, we identify as irrational depositors those participants who withdraw when they expect no bank run (7 out of 156 subjects, 4%). Our result that bids are higher in the NoINFO than in the INFO treatment still holds if we eliminate these subjects from the analysis, although differences are only weakly significant (7.50 ECUs vs. 6.66 ECUs, $p = 0.073$).[27]

Finding 1: *Irrational depositors make more effort than rational depositors to arrive early at the bank in the INFO treatment. When we focus on the behavior of rational depositors in the NoINFO and INFO treatments, we find that bids are higher in the former setting.*

Overall, our previous findings show that *i*) depositors recognize the importance of observability, *ii*) the large effort (in the form of high bids) in the INFO treatment can be partially explained because of the irrational behavior of depositors, and *iii*) once we constrain the analysis to rational subjects, we find that there are differences in the bids of depositors in the NoINFO and the INFO treatments, in line with Hypotheses 1 and 2.

In what follows, we look at the bidding behavior of depositors in each environment separately. As we will see, the behavior of depositors in the NoINFO treatment suggests that depositors are more likely to rush to the bank if they expect a bank run to occur or if they want to withdraw their deposit from the bank (see Section 4.1.1). As for the INFO treatment, we show that the high bids are not only due to the irrational behavior of some depositors, but there is also evidence that depositors expect panic bank runs, in line with Hypothesis 3. Thus, patient depositors bid to arrive early at the bank to keep their funds deposited and facilitate coordination on the efficient equilibrium without bank runs. In contrast, impatient depositors bid higher when they expect that the two patient depositors will withdraw their deposits from the bank (see Section 4.1.2).

4.1.1. Bidding behavior of depositors in the NoINFO treatment

Hypothesis 1 states that depositors will run in the absence of information about their position and the action of others only if they expect a bank run. This, in turn, implies that any patient depositor should bid more if she expects that the other patient depositor will withdraw in the NoINFO treatment. Similarly, the impatient depositor should bid more when she expects the two patient depositors to withdraw. Fig. 3 presents the distribution of bids in the NoINFO treatment depending on the depositors' expectations on the occurrence of bank runs. We observe that whether a patient or impatient depositor submits a positive bid is greatly affected by her expectations on the occurrence of bank runs. More specifically, we find that the spike at the zero bid occurs only when depositors expect no bank runs; in fact, any patient or impatient depositor who expects a bank run always bids a positive amount to arrive early at the bank. This, in turn, suggests that expectations on bank runs are important for depositors to decide whether or not to bid any positive amount to arrive early at the bank (see our econometric analysis below).[28] Hypothesis 1 claims also that patient and impatient depositors will behave similarly if they expect (no) bank-run. When we condition the analysis on their beliefs regarding bank runs, we find that patient and impatient depositors do not bid differently ($p = 0.18$).

Finding 2: *Beliefs on the occurrence of bank runs influence depositors' decision to arrive early at the bank in the NoINFO treatment. In particular, those who expect a bank run are more likely to submit a positive bid. Conditional on their beliefs on the occurrence of bank runs, patient and impatient depositors do not bid differently.*

A second feature that we conjecture affects the decision to arrive early at the bank in the NoINFO treatment is the intention to withdraw. If a patient depositor plans to keep her funds deposited (believing that there will be no bank run), she has no incentives to arrive early at the bank. However, if she wants to withdraw (anticipating a bank run), she should make a costly effort in the form of a positive bid.[29] We find that depositors who keep their funds deposited are more likely to submit a zero bid than those who withdraw their funds from the bank (14% vs. 4%) (see Fig. D.4 in Appendix D for the distribution of bids). Thus, our data suggest that the withdrawal decision is important to explain whether or not depositors will make any effort to arrive early at the bank.

Finding 3: *The withdrawal decision does influence the depositors' decisions to arrive early at the bank in the NoINFO treatment. In particular, those who want to withdraw their funds from the bank are more likely to submit a positive bid.*

In what follows, we provide the results of our econometric analysis to understand depositors' decision in the NoINFO treatment. To accommodate the features present in the description of the data, we estimate a negative binomial-logit maximum-likelihood hurdle model, which considers two different data generating processes that can be modeled independently. The first one (Logit) models the depositor's decision on whether or not to bid any positive amount to arrive early at the bank; in particular, the estimates refer to the likelihood of observing a null bid (or the "spike" at 0). The second process (Negative-binominal) mod-

[27] While bids by irrational subjects in the INFO treatment are higher than bids by rational subjects, it seems that rationality does not play a role in the NoINFO treatment; i.e., bids by rational and irrational subjects are indistinguishable when depositors have no information on the action of others ($p > 0.57$).

[28] As we show in Section 4.2, beliefs on the occurrence of bank runs affect also the withdrawal decisions; e.g., patient depositors withdraw more frequently if they expect a bank run compared to when they do not (0.5 vs. 0.09). D.2 provides further evidence that beliefs are crucial to determine behavior in the NoINFO treatment.

[29] In fact, in the NoINFO treatment any patient depositor who keeps her funds deposited should believe that there will be no bank run, hence the other patient depositor will do so as well. Thus, patient depositors should withdraw more frequently when they expect a bank run. This is confirmed by our data (see Section 4.2).

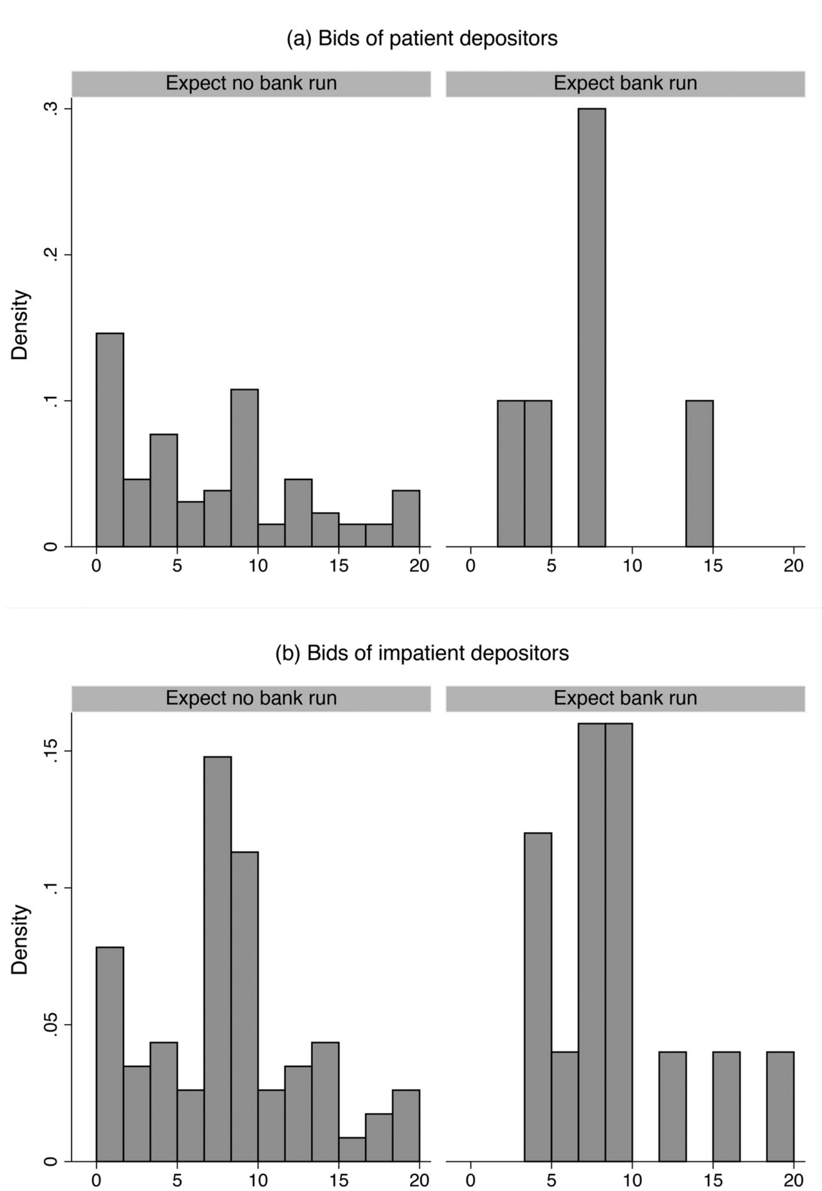

Fig. 3. Bids in the NoINFO treatment depending on the depositors' expectations on the occurrence of bank runs.

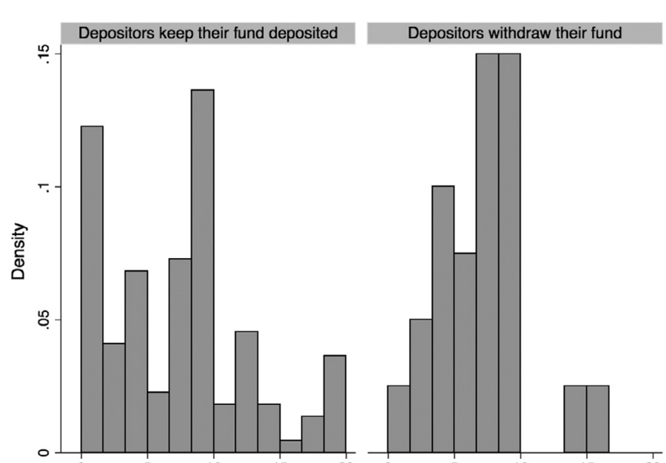

Fig. D.4. Bids of patient depositors in the NoINFO treatment depending on the withdrawal decision.

els the decision on the amount that depositors bid. As a result, this specification assumes that the factors that cause depositors to bid might differ from those that cause depositors to decide how much to bid.[30] The results for the patient (impatient) depositor are presented in Table 3 (Table 4), respectively. Our first regression (1) controls for risk tolerance, loss and ambiguity aversion. We include the demographic variables (Age and Gender) in our second regression (2). Our third regression (3) controls for income, trust

[30] The negative binomial-logit is preferred over the Poisson-logit maximum-likelihood hurdle model in our setting because there is over-dispersion in our data, as suggested by the likelihood-ratio test ($p < 0.001$). Hurdle models have been used to model donations in dictator games (Brañas-Garza et al., 2017), contribution to public good games (Botelho et al., 2009) or punishment decisions (Nikiforakis, 2010). See Moffatt (2015) for a general description of these models, and Cameron and Trivedi (2009) or Hilbe (2011) for further details on the negative-binominal models and how to estimate them. We acknowledge that our sample size (e.g., in the NoINFO treatment) may be limited to draw conclusions on bid amounts, but we still believe the results can provide some insights into the behavior of depositors that complement our previous results.

Table 3
Bidding behavior of patient depositors in the NoINFO treatment.

	Likelihood of bidding nothing (Logit regression)				Amount that depositors bid (Negative binomial)			
	(1a)	(2a)	(3a)	(4a)	(1b)	(2b)	(3b)	(4b)
Constant	−1.314*	−0.707	−2.079	−10.72*	2.343***	1.580***	1.634***	1.528
	(0.694)	(3.258)	(3.747)	(5.895)	(0.164)	(0.529)	(0.576)	(1.386)
Decision (=1 if withdrawal)	−16.90***	−14.10***	−14.07***	−14.60***	−0.249	−0.404*	−0.352	−0.350
	(0.735)	(0.790)	(1.476)	(1.089)	(0.237)	(0.245)	(0.270)	(0.368)
Expect bank run	−16.60***	−12.98***	−12.42***	−11.32***	−0.028	−0.160	−0.167	−0.423*
	(0.761)	(1.029)	(1.221)	(3.021)	(0.264)	(0.216)	(0.273)	(0.238)
Risk tolerance	0.269	0.070	−0.201	−0.257	0.221*	0.114	0.105	0.065
	(0.451)	(0.469)	(0.536)	(0.602)	(0.134)	(0.131)	(0.135)	(0.123)
Loss aversion	−0.479	0.015	0.310	0.308	−0.478***	−0.336*	−0.321*	−0.262
	(0.781)	(0.828)	(0.861)	(1.175)	(0.186)	(0.198)	(0.188)	(0.198)
Ambiguity aversion	0.013	0.034	0.052	0.053	0.005	0.014	0.015	0.022**
	(0.046)	(0.046)	(0.050)	(0.063)	(0.010)	(0.0010)	(0.009)	(0.009)
Age		0.003	0.045	0.035		0.054**	0.058**	0.052*
		(0.167)	(0.181)	(0.177)		(0.026)	(0.027)	(0.029)
Gender (=1 if female)		−1.489**	−1.453**	−2.134**		−0.502***	−0.504***	−0.620***
		(0.650)	(0.663)	(1.059)		(0.190)	(0.188)	(0.205)
Controls (income, confidence, CRT)			Yes	Yes			Yes	Yes
Personality (BIG5 and SVO)			No	Yes			No	Yes
Observations	69	69	69	69	69	69	69	69

Notes: Robust standard errors in parentheses are clustered at the individual level. Significance at the *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 4
Bidding behavior of impatient depositors in the NoINFO treatment.

	Likelihood of bidding nothing (Logit regression)				Amount that depositors bid (Negative binomial)			
	(1a)	(2a)	(3a)	(4a)	(1b)	(2b)	(3b)	(4b)
Constant	−16.44***	−15.14**	−17.56**	−612.3***	2.331***	2.816***	2.801***	2.405**
	(0.589)	(7.670)	(6.900)	(24.01)	(0.148)	(0.352)	(0.377)	(0.988)
Expect bank run	−14.99***	−14.96***	−15.46***	−49.48***	−0.0119	0.015	0.0538	0.065
	(0.609)	(0.696)	(1.177)	(3.201)	(0.136)	(0.141)	(0.150)	(0.162)
Risk tolerance	−0.770	−0.861	−1.213	−11.22	0.128	0.083	0.0295	0.020
	(0.655)	(0.747)	(0.807)	(10.48)	(0.091)	(0.071)	(0.070)	(0.076)
Loss aversion	14.99***	15.10***	16.68***	192.4***	−0.343***	−0.163	−0.127	−0.148
	(0.598)	(0.752)	(1.190)	(21.46)	(0.128)	(0.110)	(0.108)	(0.123)
Ambiguity aversion	−0.008	0.023	0.030	−0.713***	−0.009	−0.004	−0.002	−0.001
	(0.051)	(0.051)	(0.067)	(0.083)	(0.007)	(0.007)	(0.006)	(0.006)
Age		−0.010	−0.137	6.571***		−0.016	−0.009	−0.006
		(0.403)	(0.439)	(1.238)		(0.019)	(0.017)	(0.020)
Gender (=1 if female)		−1.752	−1.611	−35.42***		−0.414***	−0.477***	−0.431***
		(1.133)	(2.083)	(5.651)		(0.106)	(0.106)	(0.117)
Controls (income, confidence, CRT)			Yes	Yes			Yes	Yes
Personality (BIG5 and SVO)			No	Yes			No	Yes
Observations	69	69	69	69	69	69	69	69

Notes: Robust standard errors in parentheses are clustered at the individual level. Significance at the *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

in institutions and cognitive abilities, while the fourth regression (4) also includes personality traits (Big Five and Social Value Orientation).[31] In our analysis for patient depositors in Table 3, we consider a dummy variable (Decision) that takes the value 1 when a depositor withdraws her / his funds from the bank. We also include a dummy variable that takes the value 1 if the depositor expects a bank run, i.e., when she expects the other patient depositor to withdraw. In our analysis for impatient depositors in Table 4 this dummy variable takes the value 1 if she expects both patient depositors to withdraw.

Table 3 reveals that subjects in the role of patient depositors are less likely to bid nothing (i.e., more likely to rush to the bank) when they expect a bank run to occur (in line with Finding 2) or when they want to withdraw their deposit from the bank (in line with Finding 3), see columns (1a) to (4a). Note also that these variables are highly significant even in the presence of the other variable. However, these variables do not affect the magnitude of the bids in a significant and consistent way. These findings are in line with Figs. 3 and D.4 (and in turn with Findings 2 and 3) that exhibit a clear difference in the occurrence of zero bids depending on beliefs of an impending bank run or the decision to withdraw, but no clear difference if we restrict our attention to the positive bids.

Finding 4: *For patient depositors in the NoINFO treatment, the expectation of a bank run and the decision to withdraw decrease the likelihood of bidding zero, but do not affect the magnitude of positive bids.*

While attitudes towards uncertainty or loss do not seem to influence the bidding behavior of patient depositors systematically, gender has an intricate effect. In line with previous experimental evidence that females bid more than males in auctions, our results also indicate that female depositors are significantly less likely to bid zero compared with male depositors (see columns (2a) to (4a)), *ceteris paribus*. If there is a positive bid, however, female depositors seem to bid less than male depositors (see columns (2b) to (4b)).

Loss aversion seems to be a determinant of the amount that patient depositors bid, but the effect vanishes as we include additional controls (see columns (1b) to (4b)). Although this effect was expected, the negative sign of loss aversion indicates that loss-

[31] For simple correlations between bidding behavior and individual traits see Appendix C. For the results of a negative binomial-logit hurdle model that compares the behavior of patient and impatient depositors in the NoINFO treatment see D.2.

averse subjects tend to bid *less* than those who are not loss-averse. One possible reason is that subjects perceive that bidding in the NoINFO treatment (where they cannot make visible their decision to subsequent participants) will not help to foster coordination, so loss-averse subjects prefer to keep their initial endowment of 20 ECUs rather than bidding to decide when to go to the bank. Hence, loss-averse subjects possibly viewed as a loss to spend on bidding, and therefore they bid less.[32]

This is an interesting finding that suggests that loss-averse subjects are more willing to keep their funds deposited, than rushing to withdraw. As for the rest of the control variables, we find that cognitive reflection has a significant effect on the bidding behavior of patient depositors with regards to their decision on whether or not to bid; in particular, those who score higher in the CRT are more likely to bid zero. Our personality measures (Big Five and Social Value Orientation) are not significantly associated with the bids of patient depositors.

When we consider the decision of impatient depositors (who are forced to withdraw) in Table 4 we confirm that beliefs on the occurrence of bank runs are key to explaining whether or not they decide to bid (see columns (1a) to (4a)), that is those who believe that there will be a bank run are significantly less likely to submit a zero a bid. However, beliefs do not seem to affect the size of the bid.

Finding 5: *In the NoINFO treatment, impatient depositors are less likely to bid zero if they expect a bank run, but expectations do not affect the size of the bid.*

Again, loss aversion has a negative and significant effect on the bidding behavior of depositors, but this seems to affect the decision on whether or not to bid, rather than the amount that depositors bid; in particular, depositors are more likely to bid nothing in the NoINFO treatment if they are loss-averse. In line with our previous discussion, we also find that females bid less than males in case of positive bids; so the depositors' gender affects the decision on when to arrive at the bank, and females seem to be less panicky. As for the control variables, there is an effect of cognitive reflection as we find that a higher score in the CRT increases the likelihood of bidding zero, while the personality measures have no effect on the bids.

4.1.2. Bidding behavior of depositors in the INFO treatment

We have shown that the rationality of depositors can explain (at least partially) why they bid in the INFO treatment (see Finding 1). A second mechanism that we believe to be of great importance when depositors can observe the action of others is the possibility of panic bank runs (Kiss et al., 2018; Shakina and Angerer, 2018). Depositors might be perfectly rational but believe that observing a withdrawal (even if it is due to the impatient depositor) will induce additional withdrawals.[33] This will lead to a bank run if the impatient depositor decides first and a patient depositor observes the withdrawal. A way to counteract such behavior is to bid high in order to be the first in the sequence of decisions, and then to keep the funds deposited to induce the other patient depositor to do so as well. The previous reasoning assumes that the other patient depositor will choose her best response upon observing that another depositor chose to keep her money in the bank. In our data, subjects who decided to keep the money in the bank in position 1 bid higher than those who decided to withdraw in position 1 (7.54 vs. 5.73, $p = 0.045$); in fact, the test of proportion indicates that depositors are more likely to submit a positive bid if they want to keep their funds deposited in the bank (90% vs. 79%, $p = 0.045$). This finding, in turn, suggests that patient depositors tend to bid high to keep the funds deposited and *induce* the other patient depositor to coordinate on the efficient outcome with no bank runs (see our econometric analysis below for further evidence). We summarize these results as follows:

Finding 6: *Anticipating the possibility of panic bank runs urges some patient depositors to arrive early at the bank in the INFO treatment. These depositors keep their funds deposited to (possibly) induce other patient depositors to follow suit.*

The behavior of impatient depositors in the INFO treatment is also affected by whether or not they expect a panic bank run to occur. In particular, none of the depositors bid zero if they expect a bank run in the INFO treatment, so we find that participants are more likely to submit a positive bid if they expect a bank run, compared with the case in which they do not expect it. When we look at the average bid of depositors, we also find that depositors who expect a bank run bid more on average (7.81 ECus vs. 11 ECUs) (see Fig. D.5 in D.1 for the distribution of bids in the INFO treatment, depending on whether or not impatient depositors expect a bank run.)

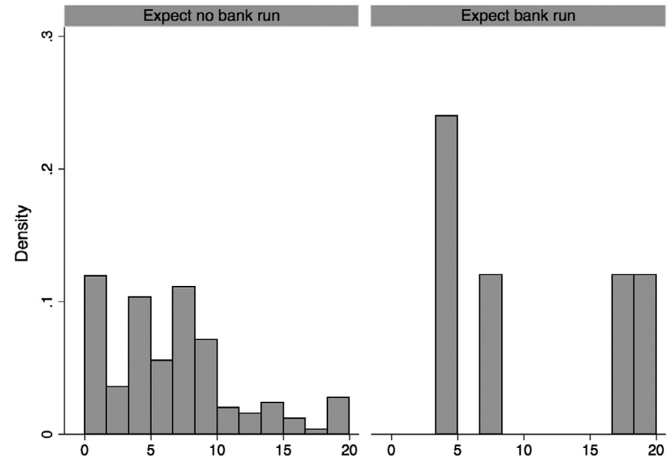

Fig. D.5. Bids of impatient depositors in the INFO treatment depending on their beliefs on the occurrence of bank runs.

Finding 7: *Beliefs on the occurrence of bank runs influence impatient depositors' decision to arrive early at the bank in the INFO treatment. In particular, impatient depositors who expect a bank run are more likely to submit a positive bid, and tend to bid more than those who expect no bank run.*

We provide further evidence for these findings by using our econometric approach. We look at the bidding behavior of patient depositors if actions can be observed in the INFO treatment. The results are summarized in Table 5. If bank runs are due to coordination problems, depositors should bid nothing in this environment. However, we have seen that irrational behavior and the desire to signal their intention to keep their funds deposited lead patient depositors to bid in the INFO treatment. We consider a dummy variable for irrational depositors that take the value 1 if the subject withdraws in position 3 in the INFO treatment to account for these factors.[34] We also consider a dummy variable (Decision) that takes the value 1 for a depositor 1 who withdraws her funds from the bank; so this variable indicates whether a patient

[32] One may argue that some depositors submitted their bids without thinking in the position in the line (see footnote [21]). In our analysis in Appendix C we exclude these subjects from the analysis, but the finding does not change.

[33] This may be due to the fact that depositors believe that other depositors are not rational. Or they may believe that other depositors are rational, but those other depositors may believe that other depositors are not rational and so on. Hence, the lack of common knowledge of rationality may be behind the withdrawals that we observe in panic bank runs.

[34] Our results are consistent if we include as irrational subjects also those patient depositors who withdraw upon observing that somebody kept her funds deposited.

Table 5
Bidding behavior of patient depositors in the INFO treatment.

	Likelihood of bidding nothing (Logit regression)				Amount that depositors bid (Negative binomial)			
	(1a)	(2a)	(3a)	(4a)	(1b)	(2b)	(3b)	(4b)
Constant	−18.02***	−15.57***	−17.11***	−14.77***	1.743***	1.756***	1.754***	2.330***
	(1.315)	(2.334)	(2.180)	(3.049)	(0.244)	(0.329)	(0.345)	(0.669)
Decision (=1 if withdraw)	0.998*	1.051*	1.361**	1.546**	−0.078	−0.0300	−0.00945	−0.0320
	(0.569)	(0.597)	(0.633)	(0.674)	(0.150)	(0.157)	(0.156)	(0.152)
Irrational depositor	−15.04***	−14.41***	−15.02***	−14.50***	0.137	0.123	0.113	0.143
	(0.344)	(0.372)	(0.404)	(0.445)	(0.127)	(0.123)	(0.124)	(0.126)
Risk tolerance	0.345	0.543	0.545	0.507	0.026	0.008	0.0208	0.0119
	(0.375)	(0.384)	(0.375)	(0.378)	(0.100)	(0.094)	(0.094)	(0.102)
Loss aversion	0.841	0.777	0.583	0.670	0.447**	0.448**	0.450**	0.453**
	(1.200)	(1.257)	(1.232)	(1.239)	(0.210)	(0.212)	(0.209)	(0.214)
Ambiguity aversion	0.002	0.005	0.008	0.011	−0.001	−0.001	−0.001	−0.0004
	(0.007)	(0.008)	(0.008)	(0.009)	(0.002)	(0.002)	(0.002)	(0.002)
Age		−0.073	−0.078	−0.079		0.004	0.004	0.007
		(0.080)	(0.071)	(0.076)		(0.008)	(0.009)	(0.009)
Gender (=1 if female)		−0.501	−0.660	−0.499		−0.184	−0.176	−0.158
		(0.535)	(0.639)	(0.685)		(0.120)	(0.130)	(0.137)
Controls (income, confidence, CRT)			Yes	Yes			Yes	Yes
Personality (BIG5 and SVO)			No	Yes			No	Yes
Observations	144	144	144	144	144	144	144	144

Notes: Robust standard errors in parentheses are clustered at the individual level. Significance at the *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

depositor will rush to the bank to withdraw (maybe because she expects that other patient depositor will withdraw, regardless of what she observes) or she is interested in keeping the money deposited to induce the other patient depositors to follow suit.

Overall, our econometric analysis supports our previous findings, since patient depositors who withdraw in position 1 are more likely to bid zero than those who keep their money in the bank (see Table 5). There is also a significant effect of rationality in that those who are irrational are less likely to bid nothing, in line with Finding 3.[35] When we look at the behavior of depositors who bid a positive amount, we find that loss-averse subjects in the role of patient depositors tend to bid more than subjects who are not classified as loss-averse (see columns (1b) to (4b)). This result is in line with the idea that subjects in the INFO treatment want to avoid a bank run and prefer to bid to show their choice to other depositors. Seemingly, subjects in the INFO treatment see it as a loss if they fail to coordinate on the efficient outcome and a way to avoid this failure is to promote coordination actively. A loss-averse depositor is more likely to keep her funds deposited in position 1 than a depositor who is not loss-averse (31.2% vs. 21.1%). As for the rest of the control variables, we do not find any significant effect on the behavior of patient depositors in the INFO treatment.

Finally, Table 6 presents our estimates for the impatient depositors in the INFO treatment. We find that beliefs on the occurrence of bank runs are important to explain the behavior of impatient depositors. Our findings also suggest that risk and loss aversion have a significant effect on the decision to bid when depositors are forced to withdraw; in particular, depositors are more (less) likely to bid nothing if they are more risks-tolerant (loss-averse). These results are intuitive: i) those who tolerate better the risk of lower payoff due to a bank run spend less on avoiding this possibility; ii) in contrast, loss-averse depositors are eager to expend resources to avoid lower payoff due to a bank run. In line with our previous discussion, there is an effect of gender on the bid of depositors, but this effect vanishes as we include additional controls. Again, demographic characteristics and personality traits show no significant association with the bids.

[35] As we will see in Section 4.2, the differences in the withdrawal rates of rational (21.70%) and irrational (22.22%) subjects is not statistically significant using a test of proportion ($p = 0.953$), thus we can conclude that irrational subjects do not tend to bid more because they are more likely to withdraw in position 1.

4.2. Behavior of depositors in the bank-run game

While our main interest concerns line formation, we also examine the behavior of depositors in the bank-run game for the sake of completeness. We report in Table 7 the withdrawal rates of patient depositors in the NoINFO and the INFO treatments.[36] In this section, we also discuss the importance of beliefs and rationality on the depositors' behavior. We conclude this section with a sensitivity analysis to show that our results are robust when we condition depositors' decision on their expected position in the line. This would allow us to address potential concerns regarding the use of the strategy method, given that participants in the role of patient depositors were asked to make a decision for every possible situation in the INFO treatment.

Table 7 indicates that the withdrawal rate is slightly over 15% in the NoINFO treatment. Theoretically, beliefs on the occurrence of bank runs are the key variable to explain the behavior of patient depositors in this environment. Empirically, we find support for this hypothesis; e.g., the test of proportion suggests that patient depositors are more likely to withdraw when they expect a bank run compared with the case in which they do not expect a bank run (50% vs. 9%, $p = 0.003$). The results are robust if we only consider in the analysis those depositors who submitted their bids thinking that this would affect their position in the line (60% vs. 9.2%, $p < 0.001$). The likelihood of withdrawal in the NoINFO treatment does not seem to depend on the depositor's belief regarding her position in the line, according to the Kruskal–Wallis test ($p = 0.89$). We undertake an econometric approach to study the decision to withdraw in the NoINFO treatment using a logit model (see Table 8). Our econometric analysis confirms that beliefs on the occurrence of bank runs are key to determining whether or not patient depositors decide to withdraw in the NoINFO treatment. When we control for individual characteristics, we find that females are less likely to withdraw in the NoINFO treatment than males.

[36] When observing that a depositor kept her funds in the bank and another one withdrew, we asked participants what they would do if depositor 1 kept the money in the bank and depositor 2 withdrew and the other way around. As expected, depositor 3 does not react differently to this information (9% vs. 8.3%, $p = 0.808$), thus we pool the results ("Obs. that a depositor kept her funds in the bank and another one withdrew").

Table 6
Bidding behavior of impatient depositors in the INFO treatment.

	Likelihood of bidding nothing (Logit regression)				Amount that depositors bid (Negative binomial)			
	(1a)	(2a)	(3a)	(4a)	(1b)	(2b)	(3b)	(4b)
Constant	−1.619**	0.352	0.739	−0.434	2.175***	2.120***	1.948***	2.775***
	(0.664)	(1.140)	(1.415)	(2.770)	(0.216)	(0.267)	(0.280)	(0.611)
Expect bank run	−14.31***	−13.35***	−11.80***	−12.27***	0.390	0.462*	0.518**	0.538*
	(0.856)	(0.934)	(0.713)	(0.874)	(0.279)	(0.265)	(0.249)	(0.285)
Risk tolerance	0.804**	0.995**	0.919**	0.755**	0.0330	−0.0446	−0.0343	−0.0268
	(0.410)	(0.487)	(0.398)	(0.363)	(0.125)	(0.105)	(0.0996)	(0.106)
Loss aversion	−1.176**	−1.264**	−1.612**	−1.567**	−0.225	−0.165	−0.205	−0.167
	(0.591)	(0.598)	(0.691)	(0.682)	(0.190)	(0.182)	(0.182)	(0.173)
Ambiguity aversion	0.004	0.007	0.008	0.010	−0.002	−0.001	−0.001	−0.001
	(0.007)	(0.008)	(0.007)	(0.008)	(0.002)	(0.002)	(0.002)	(0.002)
Age		−0.084*	−0.085**	−0.080*		0.012*	0.00922	0.00965
		(0.044)	(0.0413)	(0.042)		(0.006)	(0.006)	(0.006)
Gender (=1 if female)		−0.282	−0.567	−0.361		−0.305***	−0.209*	−0.183
		(0.532)	(0.656)	(0.618)		(0.110)	(0.127)	(0.128)
Controls (income, confidence, CRT)			Yes	Yes			Yes	Yes
Personality (BIG5 and SVO)			No	Yes			No	Yes
Observations	144	144	144	144	144	144	144	144

Notes: Robust standard errors in parentheses are clustered at the individual level. Significance at the *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 7
Withdrawal rates of patient depositors in each informational treatment.

	Withdrawal rate
NoINFO treatment	15.4%
Depositor expects a bank run	50%
Depositor expects no bank run	9%
INFO treatment	
Depositor 1 (Obs. nothing)	21.8%
Depositor 2 (Obs. withdrawal)	57.7%
Depositor 2 (Obs. keeping money in the bank)	5.1%
Depositor 3 (Obs. a keeping money in the bank and a withdrawal)	8.6%
Depositor 3 (Obs. two withdrawals)	9%

Table 8
Marginal effects after logistic regression for the withdrawal decision (1 if withdraws) of patient depositors in the NoINFO treatment.

	(a)	(b)	(c)	(c)
Expect bank run	0.217***	0.168***	0.177***	0.199*
	(0.118)	(0.018)	(0.016)	(0.110)
Risk tolerance		−0.024	−0.038	−0.001
		(0.067)	(0.058)	(0.027)
Loss aversion		−0.129	−0.084	−0.129***
	(0.081)	(0.084)	(0.017)	
Ambiguity aversion		0.001	0.003	0.002
		(0.002)	(0.002)	(0.003)
Age			0.006***	0.003**
			(0.002)	(0.001)
Gender (=1 if female)			−0.130***	−0.143***
			(0.080)	(0.024)
Controls (income, confidence, CRT)			No	Yes
Observations	84	69	69	54

Notes: Robust standard errors in parentheses. Significance at the *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Finding 8: *The expectation of a bank run affects the withdrawal decisions of patient depositors in the NoINFO treatment in an expected way.*

The INFO treatment allows depositors to choose depending on their position in the line and what they have observed from previous depositors. Theoretically, this should facilitate coordination in that *i*) any patient depositor should keep her funds deposited, regardless of what she observes, and *ii*) any withdrawal from depositor 1 should be assigned to the impatient depositor. Although we expect no bank runs due to coordination problems because of these reasons, we find that panic bank runs emerge when choices are observable, as reported in Kiss et al. (2018, 2021). We employ a within-subject analysis to see whether observing withdrawals influence the decision of patient depositors. In our data, the test of proportion suggests that depositor 2 is more likely to withdraw upon observing a withdrawal than when she observes that a depositor kept her money in the bank (57.7% vs. 5.1%, $p < 0.001$). In addition, depositors believe that withdrawals due to depositor 1 are not always due to the impatient depositor. More concretely, 66% believe that the withdrawal was due to the patient depositor or any of the two depositors (the patient and the impatient) with the same probability. When depositor 2 observes a withdrawal, she tends to withdraw regardless of whether she believes that the observed withdrawal was due to the patient or the impatient depos-

Table 9
Marginal effects after logistic regression for the withdrawal decision of patient depositors in the INFO treatment.

	Depositor 1			Depositor 2 (after observing withdrawal)		
	(a)	(b)	(c)	(a)	(b)	(c)
Irrational depositor	−0.046	−0.038	0.015	−0.120	−0.106**	−0.108
	(0.065)	(0.070)	(0.083)	(0.087)	(0.053)	(0.083)
Beliefs on observed withdrawal				0.189	0.191	0.210
				(0.183)	(0.197)	(0.237)
Risk tolerance	−0.158*	−0.135	−0.092*	−0.213	−0.237	−0.190
	(0.083)	(0.086)	(0.051)	(0.173)	(0.191)	(0.167)
Loss aversion	−0.132	−0.135	−0.085	0.249	0.228**	0.271**
	(0.098)	(0.104)	(0.106)	(0.172)	(0.121)	(0.121)
Ambiguity aversion	0.0004	0.0004	−0.001***	0.004	0.005**	0.008
	(0.0004)	(0.0004)	(0.000)	(0.005)	(0.003)	(0.009)
Age		−0.007*	−0.007*		−0.007***	−0.009***
		(0.004)	(0.004)		(0.002)	(0.000)
Gender (=1 if female)		0.104***	0.162***		−0.188	−0.057
		(0.023)	(0.037)		(0.117)	(0.247)
Controls (income, confidence, CRT)		No	Yes		No	Yes
Observations	144	144	144	76	76	76

Notes: Robust standard errors in parentheses. Significance at the *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

itor (test of proportions, $p = 0.29$), which suggests that the observation of the withdrawal distorts the beliefs that a bank run is underway and provokes panic behavior.

One potential concern regarding the behavior of depositors is that we employ the strategy method, so depositors do not know their actual position in the line when choosing between withdrawing or keeping their funds deposited; i.e., they make a choice for every possible position. We conduct a series of robustness checks, and the results still hold. In particular, we find that depositor 2 is more likely to withdraw upon observing a withdrawal when we only consider depositors who submitted their bids thinking in their position (58.5% vs. 5.3%, $p < 0.001$) or when we focus the analysis on depositors who believe they are in position 2 (54% vs. 2.7%, $p < 0.001$). These depositors' beliefs regarding the withdrawal decision of the depositor 1 is in line with the one reported above: 64.9% believe that a withdrawal from depositor 1 may be due to the patient depositor or any of the two depositors (the patient and the impatient) with the same probability.

In line with our previous analysis, we undertake an econometric approach to study the behavior of depositors in the INFO treatment. Table 9 reports the results of logit models that examine the behavior of depositors 1 and depositors 2 who observe a withdrawal. We find no effect of rationality on the decision of depositor 1. Thus, depositor 1 is not more likely to withdraw if irrational, although rationality affects her bid to arrive early at the bank. Our results also suggest gender differences in the behavior of depositor 1 in that females are more likely to withdraw than males when their actions are observed. The analysis for depositors 2 replicates Kiss et al. (2018), but we control for the possibility that subjects are irrational and their beliefs regarding the observed withdrawal (this variable takes the value 1 when depositors assign a positive probability that this was due to the impatient depositor). As in Kiss et al. (2018), loss aversion seems to be an important determinant of the withdrawal decisions of depositors who observe a withdrawal in position 2.

Overall, our findings highlight that expectation of a bank run affects withdrawal decisions in the NoINFO treatment, and these two factors influence the willingness to arrive early at the bank. In the INFO treatment, depositors should keep their funds deposited regardless of what they observe, and this should prevent them from rushing early to the bank. Arguably, we find that depositors believe that panic bank runs may occur in the INFO treatment. Depositors react to these beliefs by making costly efforts to arrive early at the bank; patient depositors rush to keep their funds deposited and facilitate the coordination on the equilibrium without bank runs, while impatient depositors who expect a panic bank run bid more to arrive early and withdraw their money from the bank.

5. Discussion and conclusion

This study was motivated by the paucity of theoretical and empirical evidence regarding how lines of depositors form in front of banks. Theoretically, researchers assume that lines form randomly, reflecting their lack of knowledge about who rushes to the banks. Empirically, it is hard to address this question. Even if we observe the line, we ignore the liquidity needs of the depositors and the information they use when choosing whether to withdraw or not. Covering this gap, we are the first to study the formation of the line in front of banks to our best knowledge.

To achieve our objective, we propose a model that yields useful hypotheses about line formation, depending on the informational environment. We hypothesize that when decisions of withdrawing or keeping the money deposited are (fully) observable, we should not observe any bank runs (for any line that may arise), and as a consequence, no effort is needed to achieve the first best. In contrast, when these decisions cannot be observed, then beliefs about the decision of other depositors (that is, the expectation of a bank run or the lack of it) determine both the efforts made to arrive early at the bank and the subsequent decisions.

Our theoretical model shows that bank runs may occur as an equilibrium only if the possible maximum efforts are bounded. If costs to arrive early at the bank were not limited, strategic behavior would lead to extreme efforts to arrive early, making such a possibility not profitable. Hence, bank runs would not occur. This result suggests that, if the possible effort levels are bounded (for instance, online banking makes depositors' lives easier), bank runs may be more likely to occur. This result may have important policy implications. For instance, our results rely on a given utility function, so future research should investigate if our findings hold in other setups with different utility functions.[37]

Our experimental results suggest that participants expect fewer bank runs when they have information about the decision of others, but still they make costly efforts (in the form of bids) to obtain

[37] We are grateful to an anonymous referee for pointing out that the utility function that we use is special in the sense that patient and impatient depositors obtain the same level of utility from the same consumption in period 1, obfuscating the role of liquidity shocks for impatient depositors. Assuming higher utility from consumption for impatient depositors in period 1, or setting a penalty in utility terms for impatient depositors unable to withdraw are two possibilities to enrich the theoretical model.

an early position in the line in this setting. We observe that irrational behavior and the desire to coordinate on the efficient equilibrium play a role in explaining the level of effort in this setting. 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 make a costly effort 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 panic bank run). Possibly, this wish to coordinate with other depositors (also documented by Kinateder et al., 2020) 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 find that loss aversion plays an important role even if we control for the personality traits captured by the Big Five and the Social Value Orientation (that do not affect bids). If depositors have no information on the withdrawal decisions of others, loss-averse subjects seem to perceive money spent on the bid as a loss, so they submit significantly lower bids. However, when withdrawal decisions are observed, loss-averse subjects in the role of patient depositors submit significantly higher bids, *ceteris paribus*. This is in line with the desire to coordinate on the efficient equilibrium. Possibly, subjects as patient depositors in this setup perceive as a loss if they fail to achieve the highest payoff related to the no-bank-run outcome, and are willing to make costly efforts to obtain those payoffs.

Our analysis also suggests that gender affects the willingness to arrive early at the bank in the absence of information on previous withdrawal decisions in an intricate way, as females are more likely to bid a positive amount, but bid less than males for a position in the line. When we look at the willingness to withdraw, we find that males tend to withdraw more frequently than females when their withdrawal decisions cannot be observed, while females are more likely to withdraw than males if their withdrawal decisions are observed. In line with previous evidence, females and males do not react differently to panic bank runs (Kiss et al., 2014b).

Our results contribute to the current literature on bank runs on various fronts. On the theoretical front, we propose a theoretical model that examines the behavior of depositors when they can make an effort to arrive early at the bank. Our theoretical results also suggest that future attempts to model the line formation should consider using utility functions that capture loss aversion. Regarding policy recommendations, our findings indicate that expectation of a bank run is crucial to line formation. The policy governing financial stability has an important role in affecting these expectations because if depositors believe that others will not withdraw their funds, they will not rush to the bank to withdraw early. For instance, a credible deposit insurance scheme may prevent inefficient bank runs even if the decisions of other depositors are not observable.

Our study has some limitations as wells. For example, we employ the strategy method to elicit the bids of patient and impatient depositors. While we provide evidence that participants seem to understand our game, we cannot rule out the possibility that the experimental design or the confusion of some subjects influence our findings. In addition, we only considered the polar cases of observability by looking at the cases in which no previous choices can be observed and when all previous choices are observable. In this regard, we followed previous studies that examine simultaneous or fully sequential decisions in bank-run games (Schotter and Yorulmazer, 2009; Kiss et al., 2012; 2018; 2021), but real-life situations often lie in between. In particular, some of the previous decisions are observable, while others remain unobserved. Previous research has found that some structures are conducive to fewer bank runs than others (Kiss et al., 2014a). There is also evidence that having information at the aggregate or the individual level is key to influence behavior; e.g., Kiss et al. (2017) show that citizens will revolt to overthrow a dictator if they can observe the individual decision of others (e.g., using of social media), while there is an equilibrium in which citizens do not revolt if they can only observe the total number of participants in the mobilization. In bank-run episodes, depositors can receive information on the level of withdrawals at the aggregate or at bank level, but not at the individual depositor level. We believe that conducting experiments with the direct method or considering a model of endogenous line formation during bank runs where depositors have partial information or information at the aggregate level would be fruitful areas for future research.

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Appendix A. Proof of Proposition 1

Proposition 1. *There is always an equilibrium where patient depositors keep their money deposited, and in this equilibrium nobody makes any effort to go to the bank. Additionally, there is a bank-run equilibrium where depositors make a positive effort to arrive early at the bank if and only if the highest possible effort is bounded and the bound is sufficiently low.*

Proof. First, we prove that there is always an equilibrium where patient depositors keep their money deposited and nobody bids.

1) $\sigma^* = (0, 0, 0)$ is always an equilibrium. Note that if all the depositors choose those strategies, they obtain the highest possible payment as impatient or patient. Thus, there are no profitable deviations.
2) $\sigma^* = (0, 0, 0)$ is the only equilibrium where patient depositors keep deposited the money. Note that if there exists any other equilibrium where patient depositors keep the money deposited, it must include positive bids. However, then any depositor with a positive bid has a profitable deviation, because bidding 0 reduces the efforts but maintains the payoff obtained from the bank. Thus, there exists no equilibrium where patient

depositors keep the money deposited, and any depositor submits a positive bid.

Second, we prove that a bank-run equilibrium where depositors make a positive effort to arrive early to the bank exists if and only if the highest possible effort is bounded and the bound is sufficiently low.

Let us define u_{BR} as the expected utility that a depositor obtains in a bank run when everybody submits the same bid and withdraws in period 1, excluding the cost of the bid (that is b_i).

$$u_{BR} = \frac{int\left[\frac{N}{c_1^*}\right]u(c_1^*) + u(c_1^{low})}{N} \tag{A.1}$$

Note that u_{BR} expresses that utility gain of withdrawing early relative to keeping the money deposited and earning nothing, as we assumed that $u_i(0) = 0$).

There are two possible bank run equilibria (in pure strategies) that may arise: $\sigma^* = (b_{\max}, b_{\max}, 1)$ and $\sigma^* = (0, b_{\max}, 1)$. In particular, the equilibrium defined by $\sigma^* = (b_{\max}, b_{\max}, 1)$ is a bank-run equilibrium where patient and impatient depositors make a positive effort, and it exists if and only if the highest possible effort is bounded and the bound is sufficiently low.

Next, we prove that those equilibria are the only bank-run equilibria that may exist. In particular, we prove that:

$\sigma^* = (b_{\max}, b_{\max}, 1)$ is an equilibrium if and only if

- $N - \frac{N}{c_1^*} \geq 1$ and $b_{\max} \leq u_{BR}$, or
- $N - \frac{N}{c_1^*} \in (0, 1)$ and $b_{\max} \leq u_{BR} - u(Rc_1^{low})$.

$\sigma^* = (0, b_{\max}, 1)$ is an equilibrium if and only if

- $p - \frac{N}{c_1^*} \geq 1$ and $\frac{int\left[\frac{N}{c_1^*}\right]u(c_1^*) + u(c_1^{low})}{p+1} \leq b_{\max} \leq \frac{int\left[\frac{N}{c_1^*}\right]u(c_1^*) + u(c_1^{low})}{p}$, or
- $p - \frac{N}{c_1^*} \in (0, 1)$ and $\frac{int\left[\frac{N}{c_1^*}\right]u(c_1^*) + u(c_1^{low})}{p+1} \leq b_{\max} \leq \frac{int\left[\frac{N}{c_1^*}\right]u(c_1^*) + u(c_1^{low})}{p} - u(c_1^{low})$.

The rationale of the proof is as follows: Lemma 1 proves that $\sigma^* = (b_{\max}, b_{\max}, 1)$ is the only bank-run equilibrium where bids are equal. Lemmas 2 to 4 focus on equilibria with different bids for each type: Lemma 2 proves that there are no equilibria where impatient depositors bid strictly more than patient depositors; Lemma 3 proves that there exist no equilibria where impatient depositors bid strictly less than patient depositors if the bank has funds enough to pay c_1^* to each of the patient depositors, i.e., if $p \leq \frac{N}{c_1^*}$; Lemma 4 proves that, if there exists an equilibrium with different bids for each type, the equilibrium is $\sigma^* = (0, b_{\max}, 1)$; Lemmas 5 and 6 prove when $\sigma^* = (b_{\max}, b_{\max}, 1)$ and $\sigma^* = (0, b_{\max}, 1)$ are equilibria, respectively. □

Lemma 1. *If there is a bank-run equilibrium where patient and impatient depositors bid the same, such an equilibrium is* $\sigma^* = (b_{\max}, b_{\max}, 1)$.

Proof. We prove it by contradiction: Suppose that $\sigma' = (b', b', 1)$, with $b' < b_{\max}$ is an equilibrium. The expected payoff of depositor i in the equilibrium is $\pi_i = (\sigma_i = \sigma'; \sigma_j = \sigma', \forall j \neq i) = u_{BR} - b'$. Note that by increasing the bid, the depositor will be the first one in the line and therefore she receives from the bank $u(c_1^*)$. Thus an ϵ increase in the bid gives a higher payoff to the depositor, and is, therefore, a profitable deviation. For instance,

$$\pi_i(\sigma_i = (\sigma' + \epsilon, \sigma' + \epsilon, 1); \sigma_j = \sigma', \forall j \neq i) = u(c_1^*) - b' - \epsilon), \tag{A.2}$$

with $\epsilon = \min(\frac{u(c_1^*) - u_{BR}}{2}, \frac{b_{\max} - b'}{2})$ is always a feasible deviation where the depositor increases her payoff. Thus $\sigma' = (b', b', 1)$, with $b' < b_{\max}$ cannot be an equilibrium. □

Lemma 2. *There is no bank-run equilibrium where impatient depositors bid strictly more than patient depositors.*

Proof. We prove it by contradiction: Suppose that $\sigma' = (b^{imp}, b^{pat}, 1)$, with $b^{imp} > b^{pat}$ is an equilibrium. Note that in this case impatient depositors arrive first at the bank and receive c_1^*. But if an impatient depositor submits a bid between b^{imp} and b^{pat} (for instance $b^{imp} - \frac{b^{imp} - b^{pat}}{2}$), she still arrives at the bank before impatient depositors, thus receives c_1^*, and is paying less, i.e., $\pi_i = (\sigma_i = (b^{imp} - \frac{b^{imp} - b^{pat}}{2}, b^{pat}, 1); \sigma_j = (b^{imp}, b^{pat}, 1), \forall j \neq i) - \pi_i = (\sigma_i = (b^{imp}, b^{pat}, 1); \sigma_j = (b^{imp}, b^{pat}, 1), \forall j \neq i) = \frac{N-p}{N}\frac{b^{imp} - b^{pat}}{2} > 0$, and therefore depositor i has a profitable deviation. Thus $\sigma' = (b^{imp}, b^{pat}, 1)$, with $b^{imp} > b^{pat}$ cannot be an equilibrium. □

Lemma 3. *If the bank has enough funds to pay* c_1^* *to all patient depositors, i.e., if* $p - \frac{N}{c_1^*} \leq 0$, *then there is no bank-run equilibrium where patient depositors bid strictly more than impatient depositors.*

Proof. We prove it by contradiction: Suppose that $p - \frac{N}{c_1^*} \leq 0$ and $\sigma' = (b^{imp}, b^{pat}, 1)$, with $b^{imp} < b^{pat}$ is an equilibrium. Note that in this case, all the patient depositors arrive at the bank at the same time, followed by the impatient depositors. Since $p - \frac{N}{c_1^*} \leq 0$, each patient depositor receives c_1^* from the bank. But if a patient depositor submits a bid between b^{imp} and b^{pat} (for instance $b^{pat} - \frac{b^{pat} - b^{imp}}{2}$, she still arrives at the bank before impatient depositors, thus receives c_1^*, and is paying less, i.e., $\pi_i = (\sigma_i = (b^{imp}, b^{pat} - \frac{b^{pat} - b^{imp}}{2}, 1); \sigma_j = (b^{imp}, b^{pat}, 1), \forall j \neq i) - \pi_i = (\sigma_i = (b^{imp}, b^{pat}, 1); \sigma_j = (b^{imp}, b^{pat}, 1), \forall j \neq i) = \frac{N-p}{N}\frac{b^{pat} - b^{imp}}{2} > 0$, and therefore depositor i has a profitable deviation. Thus, if $p - \frac{N}{c_1^*} \leq 0$, then $\sigma' = (b^{imp}, b^{pat}, 1)$, with $b^{imp} < b^{pat}$ cannot be an equilibrium. □

Lemma 4. *If there is a bank-run equilibrium where patient and impatient depositors bid differently, that equilibrium is* $\sigma^* = (0, b_{\max}, 1)$.

Proof. Because of Lemma 2, if there is a bank run equilibrium with different bids, it is $\sigma' = (b^{imp}, b^{pat}, 1)$, with $b^{imp} < b^{pat}$.

First, we show that $b^{imp} = 0$. Because of Lemma 3, if $\sigma' = (b^{imp}, b^{pat}, 1)$, with $b^{imp} < b^{pat}$ is an equilibrium is must be the case that $p - \frac{N}{c_1^*} > 0$. Note that in such a case, the patient depositors arrive first at the bank and withdraw all the funds from the bank (total funds amount to N, and the bank cannot pay pc_1^*). Thus, when the impatient depositors contact the bank, there are no funds left, and they receive nothing from the bank. Therefore, if impatient depositors submit a positive bid, they have a profitable deviation by bidding 0. Thus, if $\sigma' = (b^{imp}, b^{pat}, 1)$, with $b^{imp} < b^{pat}$ is an equilibrium, then it must be $\sigma' = (0, b^{pat}, 1)$, with $0 < b^{pat}$.

Second, we show that $b^{pat} = b_{\max}$, by contradiction. Suppose that $p - \frac{N}{c_1^*} > 0$ and that $\sigma' = (0, b^{pat}, 1)$, with $0 < b^{pat} < b_{\max}$ is an equilibrium. Note that the expected payment from the bank of a patient depositor in the equilibrium $\sigma' = (b^{imp}, b^{pat}, 1)$, with $b^{imp} < b^{pat}$, is strictly lower than c_1^*, because it is

$$\pi_i(\sigma_i = (0, b^{pat}, 1); \sigma_j = (0, b^{pat}, 1), \forall j \neq i) = \\ = \frac{p}{N}\left[\frac{int\left[\frac{N}{c_1^*}\right]u(c_1^*) + u(c_1^{low})}{p} - b^{pat}\right]. \tag{A.3}$$

But note that given that $b^{pat} < b_{\max}$, there is a feasible profitable deviation if the depositor bids slightly more when patient, because in that case she arrives at the bank in the first position and receives c_1^* with probability 1. For instance, it is feasible with the bid

$$b' = b^{pat} + \min\left(\frac{b_{\max} - b^{pat}}{2}, \frac{u(c_1^*) - \frac{int\left[\frac{N}{c_1^*}\right]u(c_1^*) + u(c_1^{low})}{p}}{2}\right). \tag{A.4}$$

Note that it is a feasible bid for a patient depositor and that

$$\pi_i(\sigma_i = (0, b', 1); \sigma_j = (0, b^{pat}, 1), \forall j \neq i) = \\ = \frac{p}{N}\left[u(c_1^*) - b'\right] \geq \frac{p}{N}\left[u(c_1^*) - b^{pat} - \frac{u(c_1^*) - \frac{int\left[\frac{N}{c_1^*}\right]u(c_1^*) + u(c_1^{low})}{p}}{2}\right] \\ = \frac{p}{N}\left[\frac{u(c_1^*) - \frac{int\left[\frac{N}{c_1^*}\right]u(c_1^*) + u(c_1^{low})}{p}}{2} - b^{pat}\right] \\ > \frac{p}{N}\left[\frac{int\left[\frac{N}{c_1^*}\right]u(c_1^*) + u(c_1^{low})}{p} - b^{pat}\right] = \\ \pi_i(\sigma_i = (0, b^{pat}, 1); \sigma_j = (0, b^{pat}, 1), \forall j \neq i). \tag{A.5}$$

Thus, if $\sigma' = (0, b^{pat}, 1)$, with $0 < b^{pat}$ is an equilibrium, then b^{pat} cannot be lower than $b_{\max}$. The previous arguments prove that, if there is a bank-run equilibrium where patient and impatient depositors bid differently, that equilibrium is $\sigma^* = (0, b_{\max}, 1)$. □

Lemma 5. $\sigma^* = (b_{\max}, b_{\max}, 1)$ *is an equilibrium if and only if*

- $N - \frac{N}{c_1^*} \geq 1$ *and* $b_{\max} \leq u_{BR}$, *or*
- $N - \frac{N}{c_1^*} \in (0, 1)$ *and* $b_{\max} \leq u_{BR} - u(Rc_1^{low})$

Proof. We prove, first, that if $N - \frac{N}{c_1^*} \geq 1$ and $b_{\max} \leq u_{BR}$, then $\sigma^* = (b_{\max}, b_{\max}, 1)$ is an equilibrium; second, that if $N - \frac{N}{c_1^*} \geq 1$ and $b_{\max} > u_{BR}$, then $\sigma^* = (b_{\max}, b_{\max}, 1)$ is not an equilibrium; third, that if $N - \frac{N}{c_1^*} \in (0, 1)$ and $b_{\max} \leq u_{BR} - u(Rc_1^{low})$, then $\sigma^* = (b_{\max}, b_{\max}, 1)$ is an equilibrium; and fourth, that if $N - \frac{N}{c_1^*} \in (0, 1)$ and $b_{\max} > u_{BR} - u(Rc_1^{low})$, then $\sigma^* = (b_{\max}, b_{\max}, 1)$ is not an equilibrium. Note that if all the depositors choose $\sigma^* = (b_{\max}, b_{\max}, 1)$, the expected payoff of depositor i is $\pi_i(\sigma_i = (b_{\max}, b_{\max}, 1); \sigma_j = (b_{\max}, b_{\max}, 1), \forall j \neq i) = u_{BR} - b_{\max}$.

First, suppose that $N - \frac{N}{c_1^*} \geq 1$ and $b_{\max} \leq u_{BR}$ and that all depositors choose $\sigma^* = (b_{\max}, b_{\max}, 1)$. Given that $N - \frac{N}{c_1^*} \geq 1$, the last depositor in the line receives 0 from the bank. Submitting a bid less than $b_{\max}$, the depositor arrives last and receives zero payoff, so a bid equal to 0 dominates any bid lower than $b_{\max}$. Possible optimal deviations would be therefore $(0, b_{\max}, 1)$, $(b_{\max}, 0, 1)$ or (0,0,1). However, note that for $(0, b_{\max}, 1)$

$$\pi_i(\sigma_i = (0, b_{\max}, 1); \sigma_j = (b_{\max}, b_{\max}, 1), \forall j \neq i) = \\ = \frac{p}{N}[u_{BR} - b_{\max}] \leq \\ \leq [u_{BR} - b_{\max}] = \\ = \pi_i(\sigma_i = (b_{\max}, b_{\max}, 1); \sigma_j = (b_{\max}, b_{\max}, 1), \forall j \neq i). \tag{A.6}$$

Similarly, for $(b_{\max}, 0, 1)$

$$\pi_i(\sigma_i = (b_{\max}, 0, 1); \sigma_j = (b_{\max}, b_{\max}, 1), \forall j \neq i) = \\ = \frac{N - p}{N}[u_{BR} - b_{\max}] \leq \\ \leq [u_{BR} - b_{\max}] = \\ = \pi_i(\sigma_i = (b_{\max}, b_{\max}, 1); \sigma_j = (b_{\max}, b_{\max}, 1), \forall j \neq i). \tag{A.7}$$

Similarly, for (0,0,1)

$$\pi_i(\sigma_i = (b_{\max}, 0, 0); \sigma_j = (b_{\max}, b_{\max}, 1), \forall j \neq i) \leq \\ \leq [u_{BR} - b_{\max}] = \\ = \pi_i(\sigma_i = (b_{\max}, b_{\max}, 1); \sigma_j = (b_{\max}, b_{\max}, 1), \forall j \neq i) \tag{A.8}$$

Thus, there is no profitable deviation, and $\sigma^* = (b_{\max}, b_{\max}, 1)$ is an equilibrium.

Second, suppose that $N - \frac{N}{c_1^*} \geq 1$ and $b_{\max} > u_{BR}$ (note that this condition is the opposite of what we had in the previous paragraph) and that all depositors choose $\sigma^* = (b_{\max}, b_{\max}, 1)$. Given that $N - \frac{N}{c_1^*} \geq 1$, the last depositor in the line receives 0 from the bank. We show that bidding 0 as impatient is a profitable deviation (it would also be a profitable deviation bidding 0 as patient):

$$\pi_i(\sigma_i = (0, b_{\max}, 1); \sigma_j = (b_{\max}, b_{\max}, 1), \forall j \neq i) = \\ = \frac{p}{N}[u_{BR} - b_{\max}] > \\ > [u_{BR} - b_{\max}] = \\ = \pi_i(\sigma_i = (b_{\max}, b_{\max}, 1); \sigma_j = (b_{\max}, b_{\max}, 1), \forall j \neq i). \tag{A.9}$$

Thus, there is a profitable deviation, and $\sigma^* = (b_{\max}, b_{\max}, 1)$ is not an equilibrium.

Third, suppose that $N - \frac{N}{c_1^*} \in (0, 1)$ and $b_{\max} \leq u_{BR} - u(Rc_1^{low})$ and that all depositors choose $\sigma^* = (b_{\max}, b_{\max}, 1)$. Given that $N - \frac{N}{c_1^*} \in (0, 1)$, the last depositor in the line receives $c_1^{low} > 0$ from the bank. Submitting a bid less than $b_{\max}$ implies that the depositor arrives last and receives that payoff. Thus a bid equal to 0 dominates any bid lower than $b_{\max}$. Moreover, note that if the depositor is patient and the last one in the line, keeping the deposit in the bank dominates withdrawal, because in such case the funds in the bank are increased by the interest rate. Possible optimal deviations would be therefore $(0, b_{\max}, 1)$, $(b_{\max}, 0, 0)$ or (0,0,0). However, note that for $(0, b_{\max}, 1)$

$$\begin{aligned}
&\pi_i(\sigma_i = (0, b_{\max}, 1); \sigma_j = (b_{\max}, b_{\max}, 1), \forall j \neq i) = \\
&= \frac{N-p}{N} u(c_1^{low}) + \frac{p}{N}[u_{BR} - b_{\max}] < \\
&< \frac{N-p}{N} u(Rc_1^{low}) + \frac{p}{N}[u_{BR} - b_{\max}] \leq \\
&\leq \frac{N-p}{N}[u_{BR} - b_{\max}] + \frac{p}{N}[u_{BR} - b_{\max}] = \\
&= [u_{BR} - b_{\max}] = \\
&= \pi_i(\sigma_i = (b_{\max}, b_{\max}, 1); \sigma_j = (b_{\max}, b_{\max}, 1), \forall j \neq i)
\end{aligned} \tag{A.10}$$

Similarly, for $(b_{\max}, 0, 0)$

$$\begin{aligned}
&\pi_i(\sigma_i = (b_{\max}, 0, 0); \sigma_j = (b_{\max}, b_{\max}, 1), \forall j \neq i) = \\
&= \frac{N-p}{N}[u_{BR} - b_{\max}] + \frac{p}{N} u(Rc_1^{low}) \leq \\
&\leq \frac{N-p}{N}[u_{BR} - b_{\max}] + \frac{p}{N}[u_{BR} - b_{\max}] = \\
&= [u_{BR} - b_{\max}] = \\
&= \pi_i(\sigma_i = (b_{\max}, b_{\max}, 1); \sigma_j = (b_{\max}, b_{\max}, 1), \forall j \neq i)
\end{aligned} \tag{A.11}$$

Similarly, for (0,0,0)

$$\begin{aligned}
&\pi_i(\sigma_i = (0, 0, 0); \sigma_j = (b_{\max}, b_{\max}, 1), \forall j \neq i) = \\
&= \frac{N-p}{N} u(c_1^{low}) + \frac{p}{N} u(Rc_1^{low}) < \\
&< \frac{N-p}{N} u(Rc_1^{low}) + \frac{p}{N} u(Rc_1^{low}) = \\
&= u(Rc_1^{low}) \leq \\
&\leq [u_{BR} - b_{\max}] = \\
&= \pi_i(\sigma_i = (b_{\max}, b_{\max}, 1); \sigma_j = (b_{\max}, b_{\max}, 1), \forall j \neq i)
\end{aligned} \tag{A.12}$$

Thus, there is no profitable deviation, and $\sigma^* = (b_{\max}, b_{\max}, 1)$ is an equilibrium.

Fourth, suppose that $N - \frac{N}{c_1^*} \in (0, 1)$ and $b_{\max} > u_{BR} - u(Rc_1^{low})$ (note that this condition is the opposite of what we had in the previous paragraph) and that all depositors choose $\sigma^* = (b_{\max}, b_{\max}, 1)$. Given that $N - \frac{N}{c_1^*} \in (0, 1)$, the last depositor in the line receives c_1^{low} from the bank. We show that bidding 0 as patient and withdrawing the deposit is a profitable deviation:

$$\begin{aligned}
&\pi_i(\sigma_i = (b_{\max}, 0, 0); \sigma_j = (b_{\max}, b_{\max}, 1), \forall j \neq i) = \\
&= \frac{N-p}{N}[u_{BR} - b_{\max}] + \frac{p}{N} u(Rc_1^{low}) > \\
&> \frac{N-p}{N}[u_{BR} - b_{\max}] + \frac{p}{N}[u_{BR} - b_{\max}] = \\
&= [u_{BR} - b_{\max}] = \\
&= \pi_i(\sigma_i = (b_{\max}, b_{\max}, 1); \sigma_j = (b_{\max}, b_{\max}, 1), \forall j \neq i)
\end{aligned} \tag{A.13}$$

Thus, there is a profitable deviation and $\sigma^* = (b_{\max}, b_{\max}, 1)*$ is not an equilibrium. □

Lemma 6. *$\sigma^* = (0, b_{\max}, 1)$ is an equilibrium if and only if*

- $p - \frac{N}{c_1^*} \geq 1$ *and* $\frac{int\left[\frac{N}{c_1^*}\right]u(c_1^*) + u(c_1^{low})}{p+1} \leq b_{\max} \leq \frac{int\left[\frac{N}{c_1^*}\right]u(c_1^*) + u(c_1^{low})}{p}$, *or*
- $p - \frac{N}{c_1^*} \in (0, 1)$ *and* $\frac{int\left[\frac{N}{c_1^*}\right]u(c_1^*) + u(c_1^{low})}{p+1} \leq b_{\max} \leq \frac{int\left[\frac{N}{c_1^*}\right]u(c_1^*) + u(c_1^{low})}{p} - u(c_1^{low})$

Proof. We prove, first, that if $p - \frac{N}{c_1^*} \geq 1$ and $\frac{int\left[\frac{N}{c_1^*}\right]u(c_1^*) + u(c_1^{low})}{p+1} \leq b_{\max} \leq \frac{int\left[\frac{N}{c_1^*}\right]u(c_1^*) + u(c_1^{low})}{p}$, then $\sigma^* = (0, b_{\max}, 1)$ is an equilibrium; second, that if $p - \frac{N}{c_1^*} \geq 1$ and $\frac{int\left[\frac{N}{c_1^*}\right]u(c_1^*) + u(c_1^{low})}{p+1} > b_{\max}$, then $\sigma^* = (0, b_{\max}, 1)$ is not an equilibrium; third, that if $p - \frac{N}{c_1^*} \geq 1$ and $b_{\max} > \frac{int\left[\frac{N}{c_1^*}\right]u(c_1^*) + u(c_1^{low})}{p}$, then $\sigma^* = (0, b_{\max}, 1)$ is not an equilibrium; fourth, that if $p - \frac{N}{c_1^*} \in (0, 1)$ and $\frac{int\left[\frac{N}{c_1^*}\right]u(c_1^*) + u(c_1^{low})}{p+1} \leq b_{\max} \leq \frac{int\left[\frac{N}{c_1^*}\right]u(c_1^*) + u(c_1^{low})}{p} - u(c_1^{low})$, then $\sigma^* = (0, b_{\max}, 1)$ is an equilibrium; fifth, that if $p - \frac{N}{c_1^*} \in (0, 1)$ and $\frac{int\left[\frac{N}{c_1^*}\right]u(c_1^*) + u(c_1^{low})}{p+1} > b_{\max}$, then $\sigma^* = (0, b_{\max}, 1)$ is not an equilibrium; sixth, that if $p - \frac{N}{c_1^*} \in (0, 1)$ and $b_{\max} > \frac{int\left[\frac{N}{c_1^*}\right]u(c_1^*) + u(c_1^{low})}{p} - u(c_1^{low})$, then $\sigma^* = (0, b_{\max}, 1)$ is not an equilibrium. Note that if all the depositors choose $\sigma^* = (0, b_{\max}, 1)$, the expected payoff of depositor i is $\pi_i(\sigma_i = (0, b_{\max}, 1); \sigma_j = (0, b_{\max}, 1), \forall j \neq i) = u_{BR} - \frac{p}{N} b_{\max}$. This is the case because although with this strategy patient depositors arrive first and impatient depositors arrive later, since all depositors act symmetrically, their expected payoff is the same as in the bank-run situation where all of them arrive at the same time.

First, suppose that $p - \frac{N}{c_1^*} \geq 1$ and $\frac{int\left[\frac{N}{c_1^*}\right]u(c_1^*) + u(c_1^{low})}{p+1} \leq b_{\max} \leq \frac{int\left[\frac{N}{c_1^*}\right]u(c_1^*) + u(c_1^{low})}{p}$ and that all depositors choose $\sigma^* = (0, b_{\max}, 1)$. Given that $p - \frac{N}{c_1^*} \geq 1$, the impatient depositors and at least one patient depositor receive 0 from the bank. Increasing the bid when impatient could only be profitable if the bid is high enough to get some payoff from the bank, i.e., if the impatient depositor bids $b_{\max}$. For a patient depositor, making any bid less than $b_{\max}$ implies not receiving anything from the bank, so a bid equal to 0 dominates any bid lower than $b_{\max}$. Possible optimal deviations would be therefore $(b_{\max}, b_{\max}, 1)$ or (0,0,1). However, note that for $(b_{\max}, b_{\max}, 1)$

$$\begin{aligned}
&\pi_i(\sigma_i = (b_{\max}, b_{\max}, 1); \sigma_j = (0, b_{\max}, 1), \forall j \neq i) = \\
&= \frac{N-p}{N}\left[\frac{int\left[\frac{N}{c_1^*}\right]u(c_1^*) + u(c_1^{low})}{p+1} - b_{\max}\right] \\
&+ \frac{p}{N}\left[\frac{int\left[\frac{N}{c_1^*}\right]u(c_1^*) + u(c_1^{low})}{p} - b_{\max}\right] \\
&\leq \frac{p}{N}\left[\frac{int\left[\frac{N}{c_1^*}\right]u(c_1^*) + u(c_1^{low})}{p} - b_{\max}\right] \\
&= u_{BR} - \frac{p}{N}b_{\max} = \\
&= \pi_i(\sigma_i = (0, b_{\max}, 1); \sigma_j = (0, b_{\max}, 1), \forall j \neq i)
\end{aligned} \tag{A.14}$$

Note that the inequality holds because $\frac{int\left[\frac{N}{c_1^*}\right]u(c_1^*) + u(c_1^{low})}{p+1} \leq b_{\max}$ and hence $\left[\frac{int\left[\frac{N}{c_1^*}\right]u(c_1^*) + u(c_1^{low})}{p+1} - b_{\max}\right] \leq 0$.

Similarly, for (0,0,1)

$$\begin{aligned}
&\pi_i(\sigma_i = (0, 0, 1); \sigma_j = (0, b_{\max}, 1), \forall j \neq i) = 0 \leq \\
&\leq \frac{p}{N}\left[\frac{int\left[\frac{N}{c_1^*}\right]u(c_1^*) + u(c_1^{low})}{p} - b_{\max}\right] = \\
&= u_{BR} - \frac{p}{N}b_{\max} = \\
&= \pi_i(\sigma_i = (0, b_{\max}, 1); \sigma_j = (0, b_{\max}, 1), \forall j \neq i)
\end{aligned} \tag{A.15}$$

Thus, there is no profitable deviation, and $\sigma^* = (0, b_{\max}, 1)$ is an equilibrium.

Second, suppose that $p - \frac{N}{c_1^*} \geq 1$ and $\frac{int\left[\frac{N}{c_1^*}\right]u(c_1^*) + u(c_1^{low})}{p+1} > b_{\max}$, and that all depositors choose $\sigma^* = (0, b_{\max}, 1)$. Given that $p - \frac{N}{c_1^*} \geq 1$, the last patient depositor in the line receives 0 from the bank. We show that bidding $b_{\max}$ as impatient is a profitable deviation.

$$\begin{aligned}
&\pi_i(\sigma_i = (b_{\max}, b_{\max}, 1); \sigma_j = (0, b_{\max}, 1), \forall j \neq i) \\
&= \frac{N-p}{N}\left[\frac{int\left[\frac{N}{c_1^*}\right]u(c_1^*) + u(c_1^{low})}{p+1} - b_{\max}\right] \\
&+ \frac{p}{N}\left[\frac{int\left[\frac{N}{c_1^*}\right]u(c_1^*) + u(c_1^{low})}{p} - b_{\max}\right] \\
&> \frac{p}{N}\left[\frac{int\left[\frac{N}{c_1^*}\right]u(c_1^*) + u(c_1^{low})}{p} - b_{\max}\right] \\
&= u_{BR} - \frac{p}{N}b_{\max} = \\
&= \pi_i(\sigma_i = (0, b_{\max}, 1); \sigma_j = (0, b_{\max}, 1), \forall j \neq i)
\end{aligned} \tag{A.16}$$

Thus, there is a profitable deviation and $\sigma^* = (0, b_{\max}, 1)$ is not an equilibrium.

Third, suppose that $p - \frac{N}{c_1^*} \geq 1$ and $b_{\max} > \frac{int\left[\frac{N}{c_1^*}\right]u(c_1^*) + u(c_1^{low})}{p}$, and that all depositors choose $\sigma^* = (0, b_{\max}, 1)$. Given that $p - \frac{N}{c_1^*} \geq 1$, the last patient depositor in the line receives 0 from the bank. We show that bidding 0 as patient is a profitable deviation.

$$\begin{aligned}
&\pi_i(\sigma_i = (0, 0, 1); \sigma_j = (b_{\max}, b_{\max}, 1), \forall j \neq i) = 0 > \\
&> \frac{p}{N}\left[\frac{int\left[\frac{N}{c_1^*}\right]u(c_1^*) + u(c_1^{low})}{p} - b_{\max}\right] = \\
&= u_{BR} - \frac{p}{N}b_{\max} = \\
&= \pi_i(\sigma_i = (0, b_{\max}, 1); \sigma_j = (0, b_{\max}, 1), \forall j \neq i)
\end{aligned} \tag{A.17}$$

Thus, there is a profitable deviation and $\sigma^* = (0, b_{\max}, 1)$ is not an equilibrium.

Fourth, suppose that $p - \frac{N}{c_1^*} \in (0, 1)$ and $\frac{int\left[\frac{N}{c_1^*}\right]u(c_1^*) + u(c_1^{low})}{p+1} \leq b_{\max} \leq \frac{int\left[\frac{N}{c_1^*}\right]u(c_1^*) + u(c_1^{low})}{p} - u(c_1^{low})$ and that all depositors choose $\sigma^* = (0, b_{\max}, 1)$. Given that $p - \frac{N}{c_1^*} \in (0, 1)$, the last patient depositor in the line receives $c_1^{low} > 0$ from the bank. For an impatient depositor, the only possibly profitable deviation is to increase the bid, and it could be profitable only if she is able to obtain some payoff from the bank, i.e., if she bids $b_{\max}$. For a patient depositor, making a bid lower than $b_{\max}$ but higher than 0, she arrives last at the bank and receives $c_1^{low} > 0$. Thus, any positive bid when patient is dominated by a lower bid that remains higher than 0. Therefore, a possible optimal deviation would be $(b_{\max}, b_{\max}, 1)$. The other possibility that we need to check is $\lim_{\epsilon \to 0^+} \sigma = (0, \epsilon, 1)$.

For $(b_{\max}, b_{\max}, 1)$, we have

$$\begin{aligned}
&\pi_i(\sigma_i = (b_{\max}, b_{\max}, 1); \sigma_j = (0, b_{\max}, 1), \forall j \neq i) \\
&= \frac{N-p}{N}\left[\frac{int\left[\frac{N}{c_1^*}\right]u(c_1^*) + u(c_1^{low})}{p+1} - b_{\max}\right] \\
&\quad + \frac{p}{N}\left[\frac{int\left[\frac{N}{c_1^*}\right]u(c_1^*) + u(c_1^{low})}{p} - b_{\max}\right] \\
&\leq \frac{p}{N}\left[\frac{int\left[\frac{N}{c_1^*}\right]u(c_1^*) + u(c_1^{low})}{p} - b_{\max}\right] \\
&= u_{BR} - \frac{p}{N}b_{\max} \\
&= \pi_i(\sigma_i = (0, b_{\max}, 1); \sigma_j = (0, b_{\max}, 1), \forall j \neq i).
\end{aligned} \tag{A.18}$$

Similarly, for $(0, \epsilon, 1)$

$$\begin{aligned}
&\lim_{\epsilon\to 0^+} \pi_i(\sigma_i = (0, \epsilon, 1); \sigma_j = (0, b_{\max}, 1), \forall j \neq i) = \\
&= \lim_{\epsilon\to 0^+}\left[\frac{p}{N}u(c_1^{low}) - \epsilon\right] = \\
&= \frac{p}{N}u(c_1^{low}) \leq \\
&\leq \frac{p}{N}\left[\frac{int\left[\frac{N}{c_1^*}\right]u(c_1^*) + u(c_1^{low})}{p} - b_{\max}\right] = \\
&= u_{BR} - \frac{p}{N}b_{\max} = \\
&= \pi_i(\sigma_i = (0, b_{\max}, 1); \sigma_j = (0, b_{\max}, 1), \forall j \neq i).
\end{aligned} \tag{A.19}$$

Thus, there is no profitable deviation, and $\sigma^* = (0, b_{\max}, 1)$ is an equilibrium.

Fifth, suppose that $p - \frac{N}{c_1^*} \in (0, 1)$ and $\frac{int\left[\frac{N}{c_1^*}\right]u(c_1^*) + u(c_1^{low})}{p+1} > b_{\max}$, and that all depositors choose $\sigma^* = (0, b_{\max}, 1)$. Given that $p - \frac{N}{c_1^*} \in (0, 1)$, the last patient depositor in the line receives $c_1^{low} > 0$ from the bank. We show that bidding $b_{\max}$ as impatient is a profitable deviation.

$$\begin{aligned}
&\pi_i(\sigma_i = (b_{\max}, b_{\max}, 1); \sigma_j = (0, b_{\max}, 1), \forall j \neq i) \\
&= \frac{N-p}{N}\left[\frac{int\left[\frac{N}{c_1^*}\right]u(c_1^*) + u(c_1^{low})}{p+1} - b_{\max}\right] \\
&\quad + \frac{p}{N}\left[\frac{int\left[\frac{N}{c_1^*}\right]u(c_1^*) + u(c_1^{low})}{p} - b_{\max}\right] \\
&> \frac{p}{N}\left[\frac{int\left[\frac{N}{c_1^*}\right]u(c_1^*) + u(c_1^{low})}{p} - b_{\max}\right] \\
&= u_{BR} - \frac{p}{N}b_{\max} \\
&= \pi_i(\sigma_i = (0, b_{\max}, 1); \sigma_j = (0, b_{\max}, 1), \forall j \neq i).
\end{aligned} \tag{A.20}$$

Thus, there is a profitable deviation and $\sigma^* = (0, b_{\max}, 1)$ is not an equilibrium.

Sixth, suppose that $p - \frac{N}{c_1^*} \in (0, 1)$ and $b_{\max} > \frac{int\left[\frac{N}{c_1^*}\right]u(c_1^*) + u(c_1^{low})}{p} - u(c_1^{low})$, and that all depositors choose $\sigma^* = (0, b_{\max}, 1)$. Given that $p - \frac{N}{c_1^*} \in (0, 1)$, the last patient depositor in the line receives $c_1^{low} > 0$ from the bank. We show that bidding $\epsilon' = \frac{u(c_1^{low}) - (\frac{int\left[\frac{N}{c_1^*}\right]u(c_1^*) + u(c_1^{low})}{p} - b_{\max})}{2}$ as patient is a profitable deviation.

$$\begin{aligned}
&\pi_i(\sigma_i = (0, \epsilon', 1); \sigma_j = (0, b_{\max}, 1), \forall j \neq i) \\
&= \frac{p}{N}\left[u(c_1^{low} - \epsilon'\right] \\
&= \frac{p}{N}\left[u(c_1^{low} - \frac{u(c_1^{low}) - (\frac{int\left[\frac{N}{c_1^*}\right]u(c_1^*) + u(c_1^{low})}{p} - b_{\max})}{2}\right] \\
&= \frac{p}{N}\left[\frac{u(c_1^{low}) + (\frac{int\left[\frac{N}{c_1^*}\right]u(c_1^*) + u(c_1^{low})}{p} - b_{\max})}{2}\right] \\
&> \frac{p}{N}\left[\frac{\frac{int\left[\frac{N}{c_1^*}\right]u(c_1^*) + u(c_1^{low})}{p} - b_{\max} + (\frac{int\left[\frac{N}{c_1^*}\right]u(c_1^*) + u(c_1^{low})}{p} - b_{\max})}{2}\right] \\
&= \frac{p}{N}\left[\frac{int\left[\frac{N}{c_1^*}\right]u(c_1^*) + u(c_1^{low})}{p} - b_{\max} + (\frac{int\left[\frac{N}{c_1^*}\right]u(c_1^*) + u(c_1^{low})}{p} - b_{\max})\right] \\
&= u_{BR} - \frac{p}{N}b_{\max} \\
&= \pi_i(\sigma_i = (0, b_{\max}, 1); \sigma_j = (0, b_{\max}, 1), \forall j \neq i)
\end{aligned} \tag{A.21}$$

Thus, there is a profitable deviation and $\sigma^* = (0, b_{\max}, 1)$ is not an equilibrium. □

Overall, we have shown that in the NoINFO setup, there are three equilibria. In the no-run equilibrium, no depositor withdraws, and each depositor submits a zero bid (that is, makes no effort to arrive early at the bank). In the full-fledged bank-run equilibrium, all depositors withdraw and submit the maximum bid. In the partial run equilibrium, only patient depositors submit the maximum bid to arrive early at the bank. The main result is that there are multiple equilibria in the NoINFO setup.

Appendix B. 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 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 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 on your decisions.

Remember that all the decisions you make during the experiment are anonymous and will not be linked to you. If you have any doubts or questions 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 and those who can choose whether to keep their money deposited or withdraw it) can submit a bid from her initial endowment (0, 1, 2, ..., 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 your initial endowment of 20 ECUs. You will receive the amount not used for bidding at the end of the experiment as part of your 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 decisions, 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 the 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 paying 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 a 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, she earns 30 ECUs, independently of her position in the line.

To sum up,

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)

As you see, not all three depositors of the same bank may 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 withdrawing.

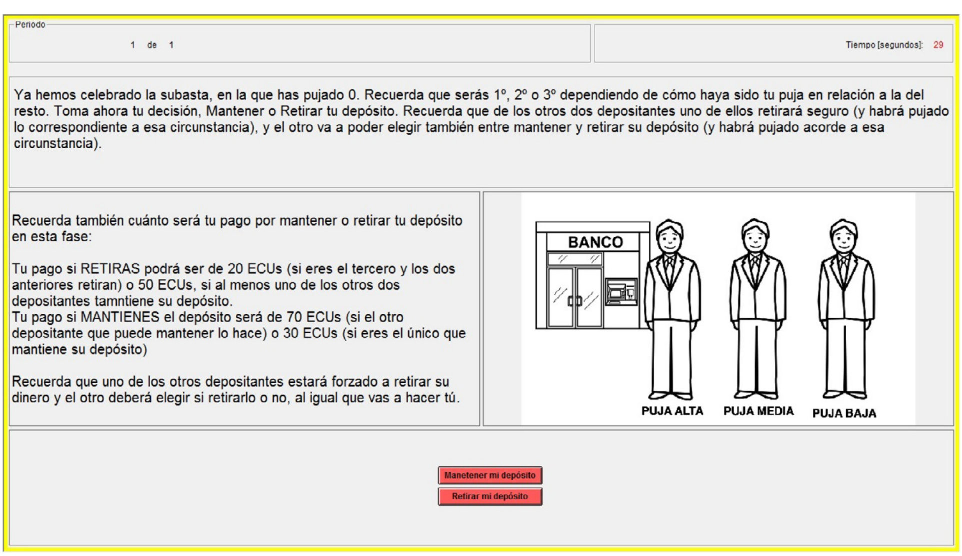
How many decisions do I have to make in this experiment?

In this experiment, we ask you to submit a bid as a depositor forced to withdraw and also as one who can choose between keeping her funds deposited or withdrawing. In both cases, you may submit a bid from 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 whether 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 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 the bids of the other depositors of your bank). Keeping 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 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 whether 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 panel, 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 of 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 of the picture, we remind you of your payoffs related to withdrawal and keeping the money deposited. Your decision can be made by clicking the corresponding button in the lower panel.

What determines your final earnings?

At the end of the experiment, the computer will randomly choose 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 decisions and deducts the bids from the initial endowments of 20 ECUs. Next, the computer tells the decision of each depositor as a function of the decisions given for all possibilities.

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

		If you keep your money deposited and ...	
Your position in the line	If you withdraw	another depositor keeps her funds in the bank	you are the only one who keeps the money deposited
1°	50	70	30
2°	50		
3°	20 or 50		

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 of whether 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 C 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 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 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 on your decisions.

Remember that all the decisions you make during the experiment are anonymous and will not be linked to you. If you have any doubts or questions 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 and those who can choose whether to keep their money deposited or withdraw it) can submit a bid from her initial endowment (0, 1, 2, ..., 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 your initial endowment of 20 ECUs. You will receive the amount not used for bidding at the end of the experiment as part of your 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 decisions, 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 the 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, you also receive 50 ECUs, because the bank has no problems paying 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 a 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, she earns 30 ECUs, independently of her position in the line.

To sum up,

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)

As you see, not all three depositors of the same bank may decide to keep their funds deposited. This is the case because there will be a depositor in each bank 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 withdrawing.

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 keeping her funds deposited or withdrawing. In both cases, you may submit a bid from your initial endowment (between 0 and 20 ECUs).

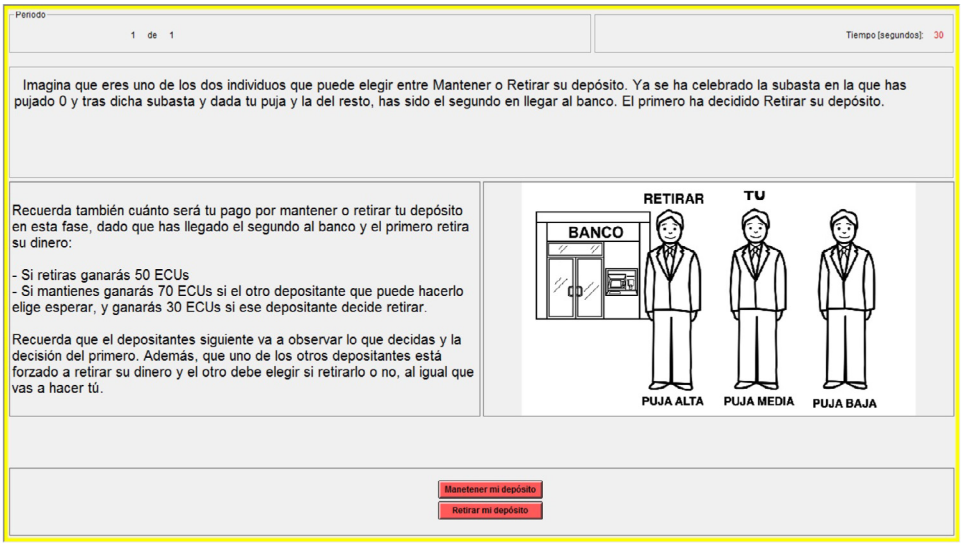
In this experiment, you do not know anything about the bids submitted by the other depositors, but you can condition your decision of withdrawing or keeping the money in the bank on what the other depositors decided to do with their deposits, if they decided before you. Thus, we ask you to tell us what you would like to do with your deposit (keep it deposited or withdraw it) if you are in the first, second or third position of the sequence of decision after the auction. 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 one 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 and also the first depositor's decision. Remember also that one of the other depositors is forced to withdraw, and the other one has to choose whether 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 panel, 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 of your payoffs related to withdrawal and keeping the money deposited. Your decision can be made by clicking the corresponding button in the lower panel.

What determines your final earnings?

At the end of the experiment, the computer will randomly choose one of the three depositors 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 decisions, and deducts the bids from the initial endowments of 20 ECUs. Next, the computer tells the decision of each depositor as a function of the decisions given for all possibilities.

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

		If you keep your money deposited and ...	
Your position in the line	If you withdraw	another depositor keeps her funds in the bank	you are the only one who keeps the money deposited
1°	50	70	30
2°	50		
3°	20 or 50		

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 of whether 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 that 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 C 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).

Appendix C. Individual characteristics and bids

C1. Elicitation of individual traits

We collect information on individual traits using a questionnaire. Our questionnaire started with the elicitation of age and gender. Then, we elicited risk attitudes using the bomb risk elicitation task (BRET) by Crosetto and Filippin (2013). This task requires that subjects decide how many boxes to pick from a store, each numbered from 0 to 100. Subjects 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 wanted 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. Crosetto and Filippin (2016) show that this task is appropriate to distinguish subjects according to their risk attitude; in fact, they provide a range for the risk aversion parameter $r \in (r_0, r_1)$ depending on the number of boxes that a subject collects, assuming a CRRA utility function, $u(k) = k^r$. We hereafter use the midpoint of this interval as the risk aversion parameter for each of the subjects; i.e., our risk aversion parameter for each individual is $r = (r_1 + r_0)/2$. Since r increases in the number of boxes, we refer to this variable as risk tolerance.

We estimated loss aversion following Gächter et al. (2007). Participants were presented 5 different lotteries. Each of them paid out 4 Euros if the result of tossing a coin turned up tails, while subjects would lose an amount between 1 and 5 Euros if the coin turned up heads. Subjects had to indicate whether or not they would be willing to accept each of the lotteries (see Table C.10).

If we apply cumulative prospect theory (Tversky and Kahneman, 1992), and assume that subjects assign the same probability weights to the 0.5-chance of gaining and losing, then the coefficient of loss aversion λ will be given by the ratio between the utility of winning

Table C.10
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	○	○

and losing the gamble, where $\lambda = u(G/L)^r$ under CRRA utility function (Gächter et al., 2007). In our data, we obtain the degree of risk aversion r from the BRET and define a loss-averse agent as the one with $\lambda > 1$.

We followed Halevy (2007) to elicit ambiguity aversion. Subjects were presented a series of urns, composed of a different quantity of colored balls, and they had to bet on the color of the ball to be drawn from the urn, earning 2 euros if they guessed correctly (0 euros otherwise). Urn 1 was composed of 5 red and 5 blue balls. Urn 2 also had 10 balls, but the number of red and blue balls was unknown. After betting on a color in each urn, participants had the opportunity of selling their bet, asking for a minimal price (in cents) between 0 and 2 Euros. Then, the computer chose a random number between 0 and 200, and paid it if the selling price was below. We use the difference in the selling price between urn 1 and urn 2 as a measure of ambiguity aversion.[38]

The next item in our questionnaire was the Cognitive Reflection Test (CRT) by Frederick (2005). This test consists of three questions that have an intuitive answer that is wrong. Thus, the test measures the tendency to override the spontaneous response and engage in further reflection to give the correct answer to each question. We use the number of correct answers in the test to measure cognitive abilities.[39]

Our questionnaire included other self-reported variables that were not incentivized. We asked subjects their income level and trust in several institutions (monarchy, government, army, banks, police, church, and political parties). These questions were taken from a questionnaire of the Spanish National Statistics Institute (INE). We were especially interested in the trust in banks so that we can control for the fact that some individuals may not trust banks, and this may affect their propensity to run and withdraw their funds. We also elicited personality traits using a 48-item Big Five test. Finally, we measured Social Value Orientation of our participants with the 9-Item Triple-Dominance Measure (Van Lange et al., 1997).

C2. Correlation between individual characteristics and bids

We move now to see how individual traits affect the size of the bid. We begin with Table C.11 that shows raw correlations between individual traits and bids in the different informational environments as impatient and patient depositors.[40]

Starting from the bottom of Table C.11, we can observe that in the case of Social Value Orientation and the Big Five personality traits the (absolute value of the) correlations are 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 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 (mainly in the sequential setup).[41] As impatient depositors, females tend to submit significantly lower bids. Contrary to our conjecture, loss aversion is weakly negatively correlated with bids, suggesting that more loss-averse depositors tend to bid less. 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.

Appendix D. Distribution of bids and additional analysis

D1. Distribution of bids

Fig. D.4 presents the distribution of bids of patient depositors in the NoINFO treatment, depending on their withdrawal decision. As we mention in the manuscript, depositors who keep their funds deposited are more likely to submit a zero bid than those who withdraw their funds from the bank (14% vs 4%).

Fig. D.5 depicts the distribution of bids in the INFO treatment, depending on the beliefs of the impatient depositor regarding the occurrence of bank runs.

We observe that participants are more likely to submit a positive bid if they expect a bank run; in fact, none of the depositors bid zero if they expect a bank run. Depositors who expect a bank run bid more on average (7.81 ECus vs 11 ECUs).

[38] As in the original design of Halevy (2007), we also presented subjects with urn 3 that contained some number (between 0 and 10) of red balls, the rest of balls being blue; this number was chosen from a bag with 11 balls numbered from 0 to 10. Finally, urn 4 was 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.

[39] See Korniotis and Kumar (2010) for the effect of cognitive reflection on financial decisions and Kiss et al. (2016b) for the case of bank runs.

[40] 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.

[41] 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.

Table C.11
Raw correlations between individual traits and bidding as impatient / patient depositors in different information setups (*/**/*** denotes significance at the 10/5/1% level.).

		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

Table D.12
Bidding behavior in the NoINFO treatment.

	Logit regression (bid = 0)		Negative binomial (bid > 0)	
	(1a)	(2a)	(1b)	(2b)
Constant	-2.042***	-2.351***	2.210***	2.227***
	(0.259)	(0.430)	(0.047)	(0.063)
Belief bank run	-13.66***	-13.86***	0.051	-0.015
	(0.342)	(0.502)	(0.127)	(0.136)
Patient depositor	0.337	0.759	-0.054	-0.061
	(0.408)	(0.538)	(0.080)	(0.081)
Belief * Patient	-0.339	0.260	-0.229	-0.136
	(0.610)	(0.825)	(0.273)	(0.295)
Patient * Withdraw		-14.09***		-0.086
		(0.496)		(0.212)
Observations	252	168	252	168

Notes. Robust standard errors in parentheses are clustered at the individual level. *** p<0.01, ** p<0.05, * p<0.1

D2. Robustness checks

We estimate a negative binomial-logit maximum-likelihood hurdle model for the bidding behavior of depositors in the NoINFO treatment, depending on the depositors' type (patient or impatient) and whether or not the depositor expects a bank run. Our results in Table D.12 provide further evidence that beliefs on the occurrence of bank runs are crucial to explaining whether or not depositors bid a positive amount in this environment -the dummy variable "Belief bank run" takes the value 1 if the depositor expects a bank run. The depositor's type does not seem to affect the bids, and patient depositors are less likely to bid zero if they want to withdraw their deposit from the bank.

Tables D.13 –D.16 replicate the analysis in the main text for the bidding behavior of patient and impatient depositors in the simultaneous and the INFO treatment. In our regressions below, we restrict the analysis to those subjects who submitted their bids thinking in their position in the line. Our results support the main conclusions in the text: beliefs on the occurrence of bank runs and the intention to withdraw are crucial to explaining bidding in the NoINFO treatment, where loss aversion and gender also have a predictive power. In the INFO treatment, there is evidence that patient depositors are more likely to bid if they are irrational or want to keep their deposit in the bank, and loss averse depositors bid more. For impatient depositors in the INFO treatment, beliefs on the occurrence of bank runs seem to be the main determinant of their bids.

Table D.13
Bidding behavior of patient depositors in the NoINFO treatment.

	Logit regression (bid = 0)				Negative binomial (bid > 0)			
	(1a)	(2a)	(3a)	(4a)	(1b)	(2b)	(3b)	(4b)
Constant	-1.305*	-1.501	-2.521	-19.89***	2.404***	1.703***	1.816***	2.174
	(0.734)	(3.148)	(3.655)	(6.495)	(0.155)	(0.552)	(0.598)	(1.551)
Decision (=1 if withdrawal)	-14.59***	-15.44***	-15.09***	-18.02***	-0.311	-0.472*	-0.455*	-0.648
	(0.826)	(0.861)	(1.623)	(2.024)	(0.242)	(0.247)	(0.274)	(0.406)
Belief bank run	-13.89***	-14.29***	-13.79***	-20.00***	0.150	-0.0358	-0.00126	-0.479*
	(0.847)	(1.717)	(1.605)	(3.238)	(0.213)	(0.211)	(0.295)	(0.248)
Risk tolerance	0.394	0.167	-0.0901	2.210**	0.231*	0.113	0.105	0.0755
	(0.427)	(0.457)	(0.532)	(0.954)	(0.134)	(0.133)	(0.137)	(0.155)
Loss aversion	-0.715	-0.341	-0.0454	1.920	-0.547***	-0.409**	-0.408**	-0.353*
	(0.807)	(0.829)	(0.853)	(1.243)	(0.181)	(0.187)	(0.185)	(0.194)
Ambiguity aversion	0.0211	0.0385	0.0540	0.112	0.00517	0.0133	0.0134	0.0284**
	(0.0496)	(0.0482)	(0.0521)	(0.0734)	(0.0103)	(0.00953)	(0.00900)	(0.0115)
Age		0.0450	0.0769	0.509**		0.0527*	0.0545*	0.0524*
		(0.163)	(0.181)	(0.202)		(0.0278)	(0.0282)	(0.0306)
Gender (=1 if female)		-1.324**	-1.288*	-3.983***		-0.528***	-0.543***	-0.696***
		(0.669)	(0.683)	(1.385)		(0.189)	(0.189)	(0.240)
Controls (income, confidence, CRT)			Yes	Yes			Yes	Yes
Personality (BIG5 and SVO)			No	Yes			No	Yes

Notes. We have a total of 64 observations. Robust standard errors in parentheses are clustered at the individual level. Significance at the *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table D.14
Bidding behavior of impatient depositors in the NoINFO treatment.

	Logit regression (bid = 0)				Negative binomial (bid > 0)			
	(1a)	(2a)	(3a)	(4a)	(1b)	(2b)	(3b)	(4b)
Constant	-16.85***	-17.49**	-18.53**	-584.2***	2.399***	3.013***	2.989***	2.507**
	(0.667)	(8.760)	(7.681)	(19.66)	(0.154)	(0.410)	(0.404)	(1.042)
Belief bank run	-15.22***	-15.31***	-15.99***	-46.35***	0.0457	0.0918	0.119	0.133
	(0.633)	(1.010)	(1.175)	(2.622)	(0.138)	(0.147)	(0.155)	(0.167)
Risk tolerance	-0.551	-0.416	-1.102*	-14.54*	0.0433	0.0242	-0.0341	-0.0359
	(0.723)	(0.631)	(0.668)	(8.586)	(0.115)	(0.0895)	(0.0860)	(0.0928)
Loss aversion	15.30***	15.54***	17.30***	175.6***	-0.387***	-0.210*	-0.188*	-0.217*
	(0.603)	(0.885)	(1.165)	(17.58)	(0.131)	(0.121)	(0.108)	(0.129)
Ambiguity aversion	-0.00719	0.0327	0.0326	-0.666***	-0.0119*	-0.00667	-0.00593	-0.00497
	(0.0501)	(0.0567)	(0.0711)	(0.0681)	(0.00662)	(0.00710)	(0.00628)	(0.00686)
Age		0.0816	-0.115	5.778***		-0.0242	-0.0193	-0.0171
		(0.437)	(0.483)	(1.014)		(0.0208)	(0.0188)	(0.0205)
Gender (=1 if female)		-1.989	-1.688	-35.18***		-0.372***	-0.419***	-0.379***
		(1.342)	(2.271)	(4.629)		(0.123)	(0.119)	(0.135)
Controls (income, confidence, CRT)			Yes	Yes			Yes	Yes
Personality (BIG5 and SVO)			No	Yes			No	Yes

Notes. We have a total of 64 observations. Robust standard errors in parentheses are clustered at the individual level. Significance at the *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table D.15
Bidding behavior of impatient depositors in the INFO treatment.

	Logit regression (bid = 0)				Negative binomial (bid > 0)			
	(1a)	(2a)	(3a)	(4a)	(1b)	(2b)	(3b)	(4b)
Constant	-19.05***	-16.63***	-17.19***	-14.85***	1.734***	1.733***	1.728***	2.351***
	(1.320)	(2.328)	(2.178)	(2.736)	(0.246)	(0.332)	(0.350)	(0.709)
Decision (=1 if withdraw)	1.032*	1.077*	1.370**	1.923**	-0.070	-0.0240	-0.00706	-0.0801
	(0.570)	(0.595)	(0.625)	(0.775)	(0.153)	(0.161)	(0.160)	(0.159)
Irrational depositor	16.06***	15.43***	15.02***	15.63***	-0.131	-0.115	-0.108	-0.164
	(0.342)	(0.378)	(0.407)	(0.483)	(0.130)	(0.126)	(0.127)	(0.129)
Risk tolerance	0.337	0.531	0.523	0.534	0.028	0.011	0.0215	0.003
	(0.375)	(0.383)	(0.377)	(0.388)	(0.101)	(0.095)	(0.0948)	(0.101)
Loss aversion	0.871	0.801	0.610	0.364	0.459**	0.458**	0.459**	0.503**
	(1.205)	(1.256)	(1.224)	(1.226)	(0.210)	(0.212)	(0.209)	(0.245)
Ambiguity aversion	0.002	0.00465	0.00776	0.0135	-0.001	-0.001	-0.0009	-0.0005
	(0.007)	(0.008)	(0.008)	(0.010)	(0.002)	(0.002)	(0.002)	(0.002)
Age		-0.073	-0.0770	-0.077		0.004	0.004	0.009
		(0.080)	(0.0715)	(0.069)		(0.008)	(0.008)	(0.009)
Gender (=1 if female)		-0.466	-0.616	-0.665		-0.172	-0.164	-0.161
		(0.534)	(0.637)	(0.691)		(0.120)	(0.130)	(0.139)
Controls (income, confidence, CRT)			Yes	Yes			Yes	Yes
Personality (BIG5 and SVO)			No	Yes			No	Yes

Notes. We have a total of 141 observations. Robust standard errors in parentheses are clustered at the individual level. Significance at the *** p<0.01, ** p<0.05, * p<0.1.

Table D.16
Bidding behavior of impatient depositors in the INFO treatment.

	Logit regression (bid = 0)				Negative binomial (bid > 0)			
	(1a)	(2a)	(3a)	(4a)	(1b)	(2b)	(3b)	(4b)
Constant	-2.032***	-0.145	-0.286	-1.329	2.164***	2.084***	1.893***	2.462***
	(0.717)	(1.185)	(1.460)	(3.013)	(0.216)	(0.263)	(0.274)	(0.593)
Belief bank run	-13.00***	-13.88***	-12.01***	-12.17***	0.383	0.463*	0.508**	0.501*
	(0.816)	(0.912)	(0.695)	(0.807)	(0.276)	(0.262)	(0.240)	(0.265)
Risk tolerance	0.740*	0.915*	0.802**	0.716*	0.0456	-0.032	-0.0199	-0.011
	(0.411)	(0.477)	(0.386)	(0.369)	(0.125)	(0.104)	(0.0993)	(0.106)
Loss aversion	-0.665	-0.750	-1.071	-1.072	-0.225	-0.168	-0.200	-0.158
	(0.684)	(0.697)	(0.760)	(0.750)	(0.189)	(0.181)	(0.181)	(0.177)
Ambiguity aversion	0.003	0.00607	0.00787	0.009	-0.002	-0.00157	-0.001	-0.001
	(0.007)	(0.008)	(0.008)	(0.008)	(0.002)	(0.002)	(0.002)	(0.002)
Age		-0.077*	-0.0802*	-0.0733*		0.012**	0.0103*	0.0105*
		(0.045)	(0.0410)	(0.0433)		(0.006)	(0.00563)	(0.006)
Gender (=1 if female)		-0.391	-0.627	-0.486		-0.310***	-0.205	-0.183
		(0.544)	(0.645)	(0.616)		(0.109)	(0.126)	(0.128)
Controls (income, confidence, CRT)			Yes	Yes			Yes	Yes
Personality (BIG5 and SVO)			No	Yes			No	Yes

Notes. We have a total of 144 observations. Robust standard errors in parentheses are clustered at the individual level. Significance at the *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

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