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Think twice before running! Bank runs and cognitive abilities

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ABSTRACT

We assess the effect of cognitive abilities on withdrawal decisions in a bank-run game. In our setup, depositors choose sequentially between withdrawing or keeping their funds deposited in a common bank. Depositors may observe previous decisions depending on the information structure. Theoretically, the last depositor in the sequence of decisions has a dominant strategy and should always keep the funds deposited, regardless of what she observes (if anything). Recognizing the dominant strategy, however, is not always straightforward. If there exists strategic uncertainty (e.g., if the last depositor has no information regarding the decisions of predecessors), then the identification of the dominant strategy is more difficult than in a situation with no strategic uncertainty (e.g., the last depositor is informed about all previous decisions). We find that cognitive abilities, as measured by the Cognitive Reflection Test (CRT), predict withdrawals in the presence of strategic uncertainty (participants with stronger abilities tend to identify the dominant strategy more easily) but that the CRT does not predict behavior when strategic uncertainty is absent.

1. Introduction

> *"If the people would only leave their money in the banks instead of withdrawing it . . . everything would work out all right."*
> J. P. Morgan in "Bankers Calm; Sky Clearing."
> New York Times, October 26, 1907.

Standard economic theory assumes that agents are rational and make optimal decisions. However, laboratory experiments emphasize that participants frequently undertake suboptimal decisions. This real-life phenomenon can have noteworthy economic consequences. The events in the US housing market that fostered the recent economic downturn, for example, were likely to be partly caused by poor financial decision making (see Gerardi, Goette, and Meier, 2013). Poor decisions are also made in other financial environments. Choi, Laibson, and Madrian (2011) find that some employees forgo arbitrage profits by making suboptimal investment choices to retirement plans (see also Van Rooij, Lusardi, and Alessie, 2011). Bertrand and Morse (2011) note that some individuals may not be aware of the real costs of a loan from payday lenders, which may induce them to take out extremely expensive loans (even when information about alternative ways of obtaining money is easily available).

Because poor financial decisions may lead to severe economic losses, it is instructive to understand what factors may cause them. A straightforward answer to consider is that individuals are not as rational as assumed in standard economic theory. Individuals may have not the necessary cognitive abilities to overcome potentially complex financial problems or they may act impulsively without appropriate deliberation. There is a growing body of literature studying how cognitive abilities affect financial decision making (see Korniotis and Kumar, 2010 for a survey). In this paper, we contribute to this literature by conducting a lab experiment to study participants' decisions in a bank-run game (see Kiss, Rodriguez-Lara, and Rosa-Garcia, 2014a, 2014b). As suggested by the opening sentence of J. P. Morgan, bank runs involve decisions in a situation in which choosing an action (in this case, withdrawing money from the bank) may be in conflict

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with the rationality assumption; thus, this scenario is suitable for analyzing the extent to which participants behave rationally.

We follow Diamond and Dybvig (1983) and model bank runs as a coordination problem among depositors. In our game, there is an impatient depositor who always withdraws money from the bank due to liquidity needs, and two patient depositors who must choose whether to withdraw their funds from the bank or keep them deposited (which we also call waiting). In our experiment, the impatient depositor is simulated by the computer, while the patient depositors are the participants in the experiment. The depositors decide based on various information sets that differ in the participants' position in the sequence of decision and the available information (both about previous depositors' decision and whether subsequent depositors will observe the decision of the participant). Payoffs are such that both patient depositors receive the highest possible payoff if both of them wait. Moreover, keeping the money deposited is the dominant strategy for a patient depositor choosing in the last position, regardless of what is observed (if anything). However, strategic uncertainty (that is, lacking information about the decision of the other patient depositor) makes the decision more difficult in our setup for at least two reasons. First, the computation of payoffs is easier when a patient depositor knows with certainty what the other participant in the lab did. For instance, when a depositor in the last position observes all the previous decisions or knows that a previous depositor has already decided to keep the money in the bank, she decides in a singleton information set. Comparing payoffs corresponding to the choices reveals that keeping the money deposited is optimal. However, when a depositor in the last position observes a withdrawal or none of the previous choices, the computation of payoff is not immediate. Keeping the money deposited is still a dominant strategy but it requires more complex thinking, in contrast with the straightforward comparison of payoffs in the previous case. The reason is that the depositor must think about all possible histories of decisions and must conclude that keeping the money deposited is the dominant strategy. Second, related to the previous point, strategic uncertainty also implies payoff uncertainty. Because the payoff for a depositor in the last position depends on what other depositors have chosen, a depositor who observes nothing is uncertain about the payoff that her action yields, and this uncertainty may cause some stress and therefore suboptimal decision-making.[1]

We use data from a previous experiment (Kiss, Rodriguez-Lara, and Rosa-Garcia, 2014b) to investigate the behavior of depositors when the available information changes from round to round. We focus on the behavior of the last depositor in the sequence because suboptimal behavior is clearly defined in that setting. To measure cognitive abilities we use the Cognitive Reflection Test (hereafter, CRT) devised by Frederick (2005). All three questions in the test have an answer that immediately comes to mind, although the answer is wrong. The test is then intended to measure the tendency "to resist reporting the response that first comes to mind"; thus it may have some predictive power in depositors' behavior, as it is not only about intelligence but also about impulsiveness.[2] Given our experimental environment, we seek to test whether participants really play the dominant strategy. Moreover, we attempt to understand what may underlie the mistake of playing the dominated strategy. We conjecture that strategic uncertainty and cognitive abilities are the two main driving forces behind suboptimal decisions. More precisely, we expect that (i) participants with higher cognitive abilities (as measured by the CRT) make fewer mistakes, and (ii) strategic uncertainty (i.e., information about predecessors' actions) increases the likelihood of suboptimal choices. We also attempt to investigate the relationship between cognitive abilities and strategic uncertainty.

Our data show that participants tend to recognize the dominant strategy and withdraw in only 10% of the cases. Interestingly, we find that they incur more mistakes when there is strategic uncertainty. In this case, however, participants with higher cognitive abilities withdraw significantly less often. This finding is not applicable when there is no strategic uncertainty, as the CRT does not have any predictive power in that case.

The remainder of the paper is structured as follows. In Section 2, we briefly review the literature. Section 3 presents the bank-run game that we use in the experiment, which is also discussed in Section 3. The experimental results are presented in Section 4. Section 5 concludes the paper.

2. Related literature

Our paper is related to two strands of the literature. First, this study is connected to papers that investigate how cognitive abilities affect optimal decisions and economic behavior in general. Second, this research belongs to the body of work examining financial mistakes and analyzing its causes.

Related to the first branch of the literature, a noteworthy aspect of our study is that there is a dominant strategy that participants should play if they are rational. It has been long observed, however, that experimental participants do not always choose as theory predicts. Recently, several papers attempt to explain this discordance with cognitive abilities. These studies connect individuals' cognitive abilities, as measured by standard tests, with performance in different games. Casari, Ham, and Kagel (2007) study auctions and find that individuals with higher scores on the Scholastic Achievement Test (SAT) or the American College Test (ACT) avoid the winner's curse more often than those with lower scores.[3] It has also been observed that cognitive abilities affect the degree of strategic sophistication in the Hit-15 game (Carpenter, Graham, and Wolf, 2013); in games that require the application of iterated dominance, such as the beauty context (Brañas Garza, García-Muñoz, and González, 2012; Carpenter, Graham, and Wolf, 2013; Gill and Prowse, 2014; Rydval, Ortmann, and Ostatnicky, 2009); coordination games (Hanaki et al., 2014) and in some two-person 3×3 normal form games (Grimm and Mengel, 2012).[4] Cognitive abilities also have an important role in behavioral economics, as they are correlated with behavioral biases such as anchoring (Bergman et al., 2010) or the conjunction fallacy (Oechssler, Roider, and Schmitz, 2009). We depart from these studies in that we investigate the effect of cognitive abilities on the choice of a dominant strategy in the context of financial decisions in which subjects make their decisions sequentially, i.e., we allow for observability of actions in our experiment.

Related to the second strand of the literature, there is a recent but rapidly growing body of literature on cognitive abilities and financial decisions (see Korniotis and Kumar, 2010 for a survey of this topic). These papers show that cognitive abilities correlate with bubbles (Corgnet et al., 2014), savings (Ballinger et al., 2011) and consumption or investment decisions (Insler, Compton, and Schmitt, 2015). Greater participation in the stock market (which is frequently

[1] Risk preferences are indeed correlated with different measures of cognitive abilities, as shown by Andersson et al. (2013), Brañas Garza, Guillen, and del Paso (2008), Burks et al. (2009), Dohmen et al. (2010) and Oechssler, Roider, and Schmitz (2009).

[2] As noted by Bosch-Domènech, Brañas Garza, and Espín (2014) "What makes the CRT different from problem-solving or math tests is that the latter tests do not usually trigger a plausible intuitive response that must be overridden." (p. 2). See also Kahneman (2011) for the relationship between the CRT and "lazy" thinking.

[3] Both the SAT and the ACT attempt to capture academic achievement. Originally, SAT was an abbreviation for Scholastic Aptitude Test, but SAT does not currently denote a sequence of words.

[4] Grimm and Mengel (2012) investigate learning and whether play converges to Nash equilibrium, and they find that the complexity of the environment affects convergence and the failure to converge is attributed to higher cognitive costs (see also Baghestanian and Frey, 2014 for the relationship between strategic skills and Nash behavior). For further studies on the relationship between cognitive abilities and strategic behavior, see Allred, Duffy, and Smith (2014), Bayer and Renou (2012), Benito-Ostolaza, Hernández, and Sanchis-Llopis (2015), Brañas Garza, Espinosa, and Rey-Biel (2011); Brañas Garza, García-Muñoz, and González (2012), Burks et al. (2009) and Jones (2008, 2014), among others.