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Redemption Fees and Gates in the Lab*†

Hubert János Kiss‡ Alfonso Rosa García§ Lukas Voellmy¶

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Abstract

Liquidity management tools—such as redemption fees (which impose a cost on withdrawals) or gates (which suspend withdrawals when they become excessive)—are commonly used in the fund industry with the aim of mitigating run behavior and reducing fund fragility. Recent attention has been paid to the fact that these tools may give rise to preemptive runs, where investors withdraw preemptively to avoid the risk of being affected by temporary redemption restrictions. Since real-market testing is not feasible, we use laboratory experiments to evaluate the effectiveness of redemption fees and gates in reducing money market fund runs, in a setting where investors may withdraw preemptively. We find that fees significantly reduce the propensity to run compared to the baseline without liquidity management tools, whereas gates do not lower the propensity to run. However, the effect of fees on withdrawal behavior is relatively small and takes some time to materialize. Overall, our experimental results indicate that preemptive runs are a real concern and that liquidity management tools are unlikely to eliminate fund fragility, which is consistent with the experience of the 2020 money market fund turmoil.

Keywords: *Coordination Problem, Experimental Economics, Money Market Funds, Redemption Fees, Runs, Suspension of Convertibility*

JEL codes: G01, G28, C92

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1 Introduction

Since the Global Financial Crisis (GFC), the fragility of money market funds (MMFs) and other open-ended mutual funds that engage in significant liquidity transformation has been a recurring topic in financial market regulation (Bouveret et al., 2022; FSB, 2021; GAO, 2023). These intermediaries issue liabilities that are redeemable on short notice (usually daily), while a significant portion of their assets is relatively illiquid.[1] As has been known since at least Diamond and Dybvig (1983), this liquidity transformation—combined with the lack of deposit insurance and access to the lender of last resort—makes these intermediaries susceptible to self-fulfilling runs. The fragility of MMFs came to the fore during the GFC and resurfaced during the financial turmoil following the COVID-19 pandemic, with widespread runs on MMFs occurring in both episodes.[2]

Following the GFC, both the US and the EU implemented reforms aimed at reducing the susceptibility of money market funds to runs.[3] An important element of these reforms were provisions allowing MMFs to impose gates (i.e., to temporarily suspend withdrawals) and redemption fees during periods of stress. In many jurisdictions, other open-ended funds besides MMFs also have the option to employ gates, redemption fees or similar liquidity management tools in response to heavy redemptions (OICV-IOSCO, 2015). The run on MMFs in the spring of 2020, however, occurred despite these fees-and-gates provisions being in place, which highlighted that these tools are not a panacea when it comes to preventing runs. Indeed, some evidence suggests that investors withdrew preemptively during the COVID-19 episode to avoid being affected by fees or gates (Li et al., 2021; Capota et al., 2022). In response, US regulators have recently amended the fees-and-gates provisions introduced after the GFC to reduce the likelihood of preemptive runs (see SEC (2023b) for the details).

In this paper, we contribute to the current regulatory discussions with an experimental study examining the effectiveness of redemption fees and gates in reducing runs. Our environment explicitly takes into account the possibility of preemptive runs, meaning that investors may have an incentive to withdraw preemptively to avoid the risk of being harmed by a temporary imposition of fees or gates. Our

[1]For example, Bouveret and Danieli (2021) documents that MMFs hold a significant portion of their portfolios in highly illiquid securities.

[2]See Schmidt et al. (2016) for a detailed account of the run on MMFs during the GFC and Eren et al. (2020) for a description of the run on MMFs in spring 2020. While it is difficult to disentangle the effect of fundamental risk from self-fulfilling dynamics during such episodes, there is substantial empirical evidence that strategic complementarities do play an important role in run behavior—especially in open-ended funds (see, e.g., Chen et al., 2010; Goldstein et al., 2017; Falato et al., 2021; Ma et al., 2022; Cetorelli et al., 2023).

[3]See SEC (2014) and Morgan Stanley (2019) for summaries of the MMF regulations adopted in the US and the EU, respectively, after the GFC.

experimental setup is loosely based on the model by Engineer (1989), which showed how such preemptive runs can occur in a version of the Diamond–Dybvig model where investors make withdrawal decisions before knowing their future liquidity needs. Run equilibria à la Engineer may exist even if investors are certain that they will never incur any credit losses on their claims: investors run because of the risk that access to their funds may temporarily be compromised if they remain invested, rather than out of fear that the intermediary might fail.[4]

From a policy perspective, the most important question is not whether fees and gates rule out run equilibria as a theoretical possibility, but whether these tools can significantly reduce the frequency of runs in practice. Despite the potential for preemptive runs, it seems a priori plausible that fees and gates can achieve this goal since they protect the value of investors' claims during heavy redemption pressures. Gates do this by preventing the fund from liquidating assets at a loss, while in the case of redemption fees, liquidation losses are internalized by the investors who withdraw.[5] Although imposing temporary restrictions on redemptions may be inconvenient for the affected investors, it is still preferable to the fund failing, which could result in investors losing part of their claims or having them tied up in lengthy bankruptcy procedures. Thus, even if fees and gates may not completely eliminate the first mover advantage, they should at least reduce the incentive to participate in a run by limiting the downside of remaining invested when others are running.

Intuitively, fees and gates reduce the "risk" of remaining invested in a fund by preventing its failure under heavy redemption pressures. We capture this notion with the *risk factor* of the no-run equilibrium, which is based on the concept of risk dominance (Harsanyi and Selten, 1988) and has previously been used in theoretical studies of bank runs (Ennis and Keister, 2003; Peck and Setayesh, 2023). The basic premise is that in any model with a run equilibrium, remaining invested is only the best response if an investor believes strongly enough that other investors will do the same. The risk factor of the no-run equilibrium is then defined as the probability p at which investors become indifferent between staying invested and running when they expect that all other investors will stay invested with probability p and will run with probability $1-p$. Roughly speaking, the higher the risk factor, the smaller the range of beliefs for which remaining invested is the best response—therefore, it is plausible to assume that investors' tendency to run increases with the risk factor. Gates and fees mitigate potential losses caused by heavy redemptions by either preventing asset

[4]See also Cipriani et al. (2014) and Voellmy (2021, 2024) for models of preemptive runs in a similar vein. Voellmy (2024) shows that Engineer-type run equilibria may be very difficult to eliminate without injection of outside liquidity, particularly if investors are highly risk averse and part of the funds' assets can only be sold at large discounts.

[5]Another popular liquidity management tool besides fees and gates is "swing pricing", where the net asset value (NAV) of a fund's liabilities is adjusted downward during heavy redemption pressures. Economically, swing pricing is very similar to a redemption fee.

liquidations (gates) or by internalizing liquidation costs (fees), with fees having the additional advantage that withdrawals are still possible if an investor experiences an urgent liquidity need. Therefore, in our setup, the risk factor is lowest when the fund uses redemption fees and highest when the fund activates neither fees nor gates in the face of heavy redemptions.

The goal of our experiment is to behaviorally examine investors' withdrawal choices under redemption fees and gates, and to test whether the risk factor of the no-run equilibrium can predict how often investors run. In our setup, investors make withdrawal decisions before they know the timing of their future liquidity needs, similar to Engineer (1989). We study run behavior under three treatments: i) "laissez-faire": the fund pays out withdrawing investors as long as it can, even if this means liquidating assets at a loss; (ii) gates: the fund temporarily suspends payouts once a certain number of investors have withdrawn; (iii) fees: the fund temporarily imposes a redemption fee once a certain number of investors have withdrawn.

Run equilibria exist in all treatments. The run equilibrium in the laissez-faire treatment is an instance of the classical Diamond and Dybvig (1983) run equilibrium, whereas the run equilibria in the treatments with fees and gates resemble the preemptive run equilibria described by Engineer (1989). Both redemption fees and gates decrease the risk factor of the no-run equilibrium relative to the laissez-faire treatment since these measures ensure that liquidation losses do not reduce the value of claims held by investors who remain invested. Redemption fees decrease the risk factor more than gates do, as they still allow withdrawals in the case of urgent liquidity needs (albeit at a fee), thereby reducing the potential downside of remaining invested compared with gates, where no withdrawals are allowed while the gates are in place.

Our main hypothesis is that whenever a run equilibrium exists, investors will run occasionally, but investors' tendency to run should be lower when the risk factor of the no-run equilibrium is lower. That is, we hypothesize that both fees and gates will reduce (but not completely eliminate) runs and that fees will be more effective than gates in doing so. Furthermore, we hypothesize that over time convergence to the no-run equilibrium is more likely when the risk factor of the no-run equilibrium is lower, i.e., convergence to the no-run equilibrium should be most likely in the treatment with redemption fees and least likely in the laissez-faire treatment.

Our experimental results indicate that gates are ineffective in preventing runs (and may even be counterproductive), whereas redemption fees do seem to reduce investors' propensity to run. These findings lend support to the recent regulatory push away from gates and toward redemption fees in MMF regulations (SEC, 2023b). However, the positive effect of redemption fees on withdrawal behavior is relatively small overall, implying that fees are unlikely to eliminate fund fragility, which is consistent with the experience from the spring 2020 MMF turmoil. Furthermore, we find that the positive effect of redemption fees takes some time to materialize: redemption fees do not lead to an immediate drop in withdrawal rates, but we do observe some convergence over time to the no-run equilibrium under fees, which is not observed in the other treatments. Our results thus lend credence to the notion, expressed by some policymakers in the wake of the spring 2020 MMF crisis, that redemption fees may only have the desired effect once investors have become accustomed to them (European Commission, 2023).[6]

Related literature. Laboratory experiments have become a valuable tool for investigating financial regulation and responses to crises. Experimental studies complement empirical research in behavioral finance by avoiding certain limitations and assumptions, thereby providing important insights into financial market functioning and individual financial behavior (Duxbury, 2015). Relevant to our study, researchers have used experimental methods to evaluate policies and regulations related to specific types of financial institutions. These experiments are particularly useful for assessing untested policies in novel circumstances (Davis and Korenok, 2023).

The most relevant strand of literature for our study is the experimental research on bank runs. This body of work focuses on the factors influencing the emergence of bank runs and examines the regulatory tools that might prevent them. A comprehensive overview is provided in Kiss et al. (2022a). The two tools we investigate in the present paper have natural counterparts in the bank run literature: gates correspond to the suspension of convertibility (or deposit freeze), where the bank temporarily suspends payouts after a certain number of withdrawals, while redemption fees are comparable to rescheduled payments, where the bank reduces payouts to subsequent customers in response to heavy redemptions (Ennis and Keister, 2009, 2010).[7]

Both the suspension of convertibility and the rescheduling of payments have been investigated experimentally in the lab. The only study on the suspension of convertibility is Madiès (2006), where—different from our setting—suspension is captured by a break in the experimental session without an actual change in payouts.

[6]European Commission (2023) notes that while there is evidence that US investors withdrew from MMFs due to concerns about the imposition of fees or gates during the spring 2020 crisis, there is little indication for such behavior among EU-based MMF investors. The report conjectures that this "may be explained by the fact that EU investors are by and large more comfortable with fees than US investors, due to their familiarity with fees under UCITS [the pre-GFC regulatory framework]" (p.11).

[7]A third policy tool commonly used to address bank runs, but less frequently to address runs on other financial intermediaries, is deposit insurance. There is a substantial experimental literature on deposit insurance (Madiès, 2006; Schotter and Yorulmazer, 2009; Kiss et al., 2012; Peia and Vranceanu, 2019), which shows that this tool is generally effective in reducing runs.

Madiès (2006) finds that short suspensions are effective in reducing the occurrence of bank runs, while long suspensions tend to make runs more frequent.

Turning to the rescheduling of payments, Davis and Reilly (2016) study a setup where payouts are adjusted when too many depositors withdraw. This restructuring of payouts proves to be effective in reducing runs provided that it prioritizes protecting depositors who do not withdraw prematurely. Relatedly, Davis et al. (2022) examine the impact of liquidity regulation that helps banks cover excess withdrawals at the cost of reduced profitability due to fewer long-term investments. They find that higher liquidity requirements reduce runs and lead to an efficiency gain, as the reduction in profitability caused by the liquidity requirements is more than offset by reduced losses from runs.[8]

A key novelty of our paper compared to the existing experimental literature on the suspension of convertibility and the rescheduling of payments is our focus on preemptive runs. Our setting explicitly accounts for the possibility that investors may withdraw preemptively to avoid the risk of being affected by (temporary) redemption restrictions when remaining invested. Our primary interest lies not in whether individuals eventually withdraw, but rather in whether they do so out of precaution, driven by the fear that a temporary imposition of fees or gates might occur exactly at that point in time when their future liquidity need arises. Thus, our contribution lies not only in investigating the effectiveness of redemption fees and gates but also in evaluating these mechanisms in a setup specifically designed to study preemptive runs.

Finally, run-like behavior can occur not only at financial intermediaries but also in financial markets (Bernardo and Welch, 2004). One regulatory tool to address financial market panics are "circuit breakers", where trade is halted temporarily in case of extraordinary selling pressures. There is an obvious analogy between circuit breakers and gates. Similar to gates, circuit breakers can have counteracting effects on selling behavior: on the one hand, circuit breakers can stabilize asset prices by preventing fire sales, but on the other hand, the anticipation of a trading freeze may induce investors to preempt the freeze by selling today. Magnani and Munro (2020) experimentally test the effect of circuit breakers on preemptive selling behavior. Consistent with our results, they find that preemptive asset sales are widespread in the laboratory and that circuit breakers have limited effects on selling behavior.[9]

[8] In the theoretical model by Andolfatto et al. (2017), it is neither the bank nor the regulator that modifies payoffs but the depositors themselves. Depositors can relocate their funds to a safe account if they anticipate a bank run, ensuring a payoff at least as high as an immediate withdrawal. Kiss et al. (2022b) provide some experimental evidence supporting this arrangement.

[9] Ackert et al. (2001, 2005) also study the effect of circuit breakers in the lab. Rather than focusing on preemptive selling behavior, these studies examine how circuit breakers impact price discovery under asymmetric information, and whether they help prevent unwarranted deviations of prices from fundamentals.

2 Experimental Environment

We model a withdrawal game in which investors of a fund must decide whether to withdraw before knowing their future liquidity needs. The model has two time periods, $t = 1, 2$, where period 1 is divided into "morning" and "evening" subperiods. The fund has four investors, each holding an identical claim to the fund's assets.

In the morning of period 1, the fund starts with two assets: 2 experimental currency units (ECUs) in cash and an investment project. If allowed to mature, the project pays $2 \times R$ ECUs in period 2, with $R > 1$. The project can be liquidated prematurely at a loss in period 1. Liquidating the entire project in period 1 yields 1 ECU immediately. Alternatively, the fund can liquidate only half the project in period 1, in which case 0.5 ECUs are retrieved at that time, and R ECUs are received in period 2 from the portion allowed to mature.

Investors experience random liquidity shocks à-la Diamond and Dybvig (1983). Specifically, the utility of investor $i \in \{1, 2, 3, 4\}$ is given by

$$U(c_{1,i}, c_{2,i}, \theta_i) = u(c_{1,i} + \theta_i c_{2,i}), \tag{1}$$

where $c_{t,i}$ denotes consumption in period t, and $\theta_i \in \{0, 1\}$ represents an idiosyncratic liquidity shock. The utility function $u(\cdot)$ is concave and strictly increasing. If $\theta_i = 0$, the investor only values consumption in period 1 and is said to be *impatient*. Conversely, if $\theta_i = 1$, the investor values consumption in both periods equally and is said to be *patient*. There is no risk with regard to aggregate liquidity needs: among the four investors, exactly two will turn out to be impatient and two patient.

In the morning of period 1, all investors start with an identical claim to the fund's assets. The claims take the form of demandable debt allowing investors to withdraw 1 ECU in period 1. In the morning of period 1, investors are asked sequentially whether they wish to withdraw 1 ECU. If an investor chooses to withdraw, they are paid immediately. The order in which investors are asked is random, and investors neither observe their own position in the line nor other investors' withdrawal decisions.

Importantly, investors learn their type (patient or impatient) only in the evening of period 1. This means that investors must make their initial withdrawal decision without knowing their type. An investor who did not withdraw in the morning of period 1 and later learns that they are impatient will have to withdraw in the evening of period 1 or end up with a payoff of zero. We focus on investors' withdrawal decisions in the morning. Once the game reaches the evening stage, we assume that all impatient investors who did not withdraw in the morning will do so in the evening, whereas patient investors do not withdraw. If neither of the two impatient investors withdrew in the morning, the order in which they are paid out in the evening is determined randomly. Finally, in period 2, the fund distributes the return from its project equally among the investors who did not withdraw in period 1.

The fund has sufficient cash reserves to pay out two investors in period 1. The question is thus how the fund will respond when it receives a third withdrawal request. We consider three treatments, which differ in the fund's payout policy in period 1:

(i) *Baseline (or laissez-faire):* The fund pays out investors in full as long as it can.

(ii) *Gates:* The fund suspends payouts in period 1 once it runs out of cash.

(iii) *Redemption Fees:* The fund charges a redemption fee on period-1 withdrawals once it runs out of cash.

In the following, we describe the three treatments in detail.

Baseline treatment. In the Baseline treatment, the fund adopts a payout policy similar to Diamond and Dybvig (1983), i.e., it pays out investors in full in period 1 as long as it has assets available. In our environment, this means that the fund can fully pay the first three investors who withdraw in period 1 (each receiving 1 ECU). However, the fourth investor receives nothing because, by this point, the fund's cash reserves are depleted, and the entire project has been liquidated to cover the third withdrawal.

Table 1: *Payouts in the baseline treatment*

Period-1 payouts:		
First investor who withdraws:	1 ECU	Cash reserve
Second investor who withdraws:	1 ECU	Cash reserve
Third investor who withdraws:	1 ECU	Project liquidated
Fourth investor:	0 ECU	
Period-2 payout: R ECU if no more than two investors withdrew in period 1, 0 ECU otherwise.		

Treatment with gates. In the treatment with gates, the fund suspends payouts in period 1 when its cash reserves are exhausted. This means that the fund permits only two withdrawals in period 1. Once two investors have withdrawn, the remaining investors cannot withdraw and are paid out in period 2. Gates prevent the fund from ever liquidating the project in period 1, which means that investors who do not withdraw in period 1 receive R ECUs in period 2 with certainty. However, this

Table 2: *Payouts in the treatment with gates*

Period-1 payouts:		
First investor who withdraws:	1 ECU	Cash reserve
Second investor who withdraws:	1 ECU	Cash reserve
No further withdrawals are allowed after two investors have withdrawn.		
Period-2 payout: R ECU		

payout holds no value for an impatient investor, who requires liquidity in period 1.

Treatment with redemption fees. In this treatment, the fund imposes a redemption fee on period-1 withdrawals when its cash reserves are exhausted. The fee is designed to ensure that those who withdraw internalize the liquidation costs incurred by the fund. Specifically, the fund charges a redemption fee of 0.5 ECUs on the third and fourth withdrawals in period 1, meaning that these investors receive only 0.5 ECUs each. To fulfill the third withdrawal request, the fund liquidates half of the project and pays the proceeds of 0.5 ECUs to the withdrawing investor. To meet the fourth request, the fund liquidates the remaining half of the project. Because the redemption fee fully internalizes the liquidation costs, any investor who does not withdraw in period 1 is guaranteed to receive R ECUs in period 2.

Our experimental fee is in line with current MMF regulations in the US and Europe in the sense that the fee reflects the cost of liquidating assets, as is required in US and EU regulations.[10] It is worth noting, however, that the liquidation cost of 50% in our experiment is higher than what could plausibly be observed in reality. Nevertheless, our experimental redemption fee reflects actual redemption fees in qualitative terms, and a quantitatively realistic fee, e.g., in the low single-digit percentage range, would likely not be salient enough in an experimental context.

Table 3: *Payouts in the treatment with redemption fees*

Period-1 payouts:		
First investor who withdraws:	1 ECU	Cash reserve
Second investor who withdraws:	1 ECU	Cash reserve
Third investor who withdraws:	0.5 ECU	Half the project liquidated
Fourth investor who withdraws:	0.5 ECU	Half the project liquidated
Period-2 payout: R ECU		

[10] In the US, the redemption fee needs to equal the estimated liquidation costs the fund would incur if it sold a pro rata amount of each security in its portfolio (SEC, 2023a, Section II.B), while EU regulations stipulate that the redemption fee should “adequately reflect the cost to the MMF of achieving liquidity” (European Union, 2017, Chapter V).

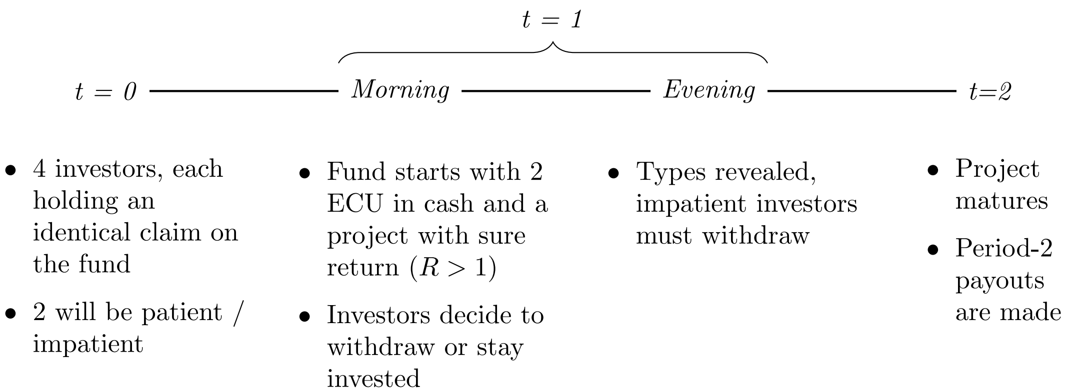
Withdrawal strategies. In our withdrawal game, investors are sequentially asked whether they want to withdraw from the fund and are informed of the amount they receive if they choose to withdraw.[11] Formally, a (pure) withdrawal strategy is a mapping $\mathbb{X} \mapsto \mathbb{W}$, where $x \in \mathbb{X}$ is the amount that can be withdrawn, and $w \in \mathbb{W} = \{0, 1\}$ represents the binary withdrawal choice, with $w = 1$ indicating withdrawal. In the Baseline treatment and the Gates treatment, we have $\mathbb{X} = \{1\}$, whereas in the redemption fees treatment, we have $\mathbb{X} = \{1, 0.5\}$. We denote $w_i^k(x)$ as player i's withdrawal strategy in treatment $k \in \{\text{B(aseline)},\text{G(ates)},\text{F(ees)}\}$, with $\boldsymbol{w}^k = \{w_i^k(x)\}_{i=1}^4$ representing a profile of strategies. To ease notation, we often omit the i and k sub- and superscripts when there is no ambiguity.

We say that an investor *runs* when they choose to withdraw in the morning of period 1. Our main interest is to assess whether gates and redemption fees reduce investors' propensity to run on the fund. Note that a run where no more than two investors withdraw in the morning does not necessarily lead to adverse consequences: if the investor(s) who withdraw(s) in the morning happen(s) to be impatient, then the payoffs of all investors are the same as if no run had occurred.

In Appendix A, we show that our setup can easily be generalized to an arbitrary number of investors and an arbitrary share of impatient investors. In the general version of the model, we also allow for an arbitrary liquidation return of the fund's project, rather than fixing it at 1/2 as in this section.

Figure 1 summarizes the timeline and decisions.

Figure 1: *Timeline and investor decisions*



[11] This is a game of imperfect information since investors do not know how many other investors have been asked before them. In other words, investors do not know their "position in the line" when making their withdrawal decision. If investors knew their position in the line, a standard backward induction argument à-la Green and Lin (2003) would imply that run equilibria do not exist.

3 Equilibria, Risk Factor, and Hypotheses

We define an equilibrium of the withdrawal game in treatment $k \in \{B, G, F\}$ as a strategy profile $\boldsymbol{w}^k$ such that each investor i's withdrawal strategy $w_i^k(x)$ maximizes their expected payoff given that they are asked whether they want to withdraw x from the fund, and given the withdrawal strategies of the other investors.[12] Note that in the treatment with the redemption fee, withdrawing 0.5 ECUs in the morning of period 1 is strictly dominated: if an investor remains invested, they can still withdraw 0.5 ECUs in the evening of period 1 should they turn out to be impatient, while keeping the option to receive R ECUs in period 2 if they turn out to be patient. Therefore, we must have $w^F(0.5) = 0$ in equilibrium, and we can thus focus on the withdrawal choice $w(1)$ across all three treatments when deriving equilibria.

As is straightforward, there is a no-run equilibrium in all treatments, in which none of the investors withdraw in the morning of period 1. In this equilibrium, since no one else runs, the payoff from withdrawing 1 ECU is strictly less than the expected payoff from remaining invested, which is $0.5u(1) + 0.5u(R)$.

We will next show that as long as R is not too high, there is also a run equilibrium in all treatments. In this equilibrium, all investors play $w(1) = 1$, i.e., all investors withdraw 1 ECU in the morning when given the choice. To derive the run equilibria, it will be useful to denote U_{NR}^k as an investor's expected payoff from *not* running (i.e., from playing $w(1) = 0$) when all other investors run, in treatment k. A run equilibrium exists in treatment k if $u(1) \geq U_{NR}^k$, i.e., if withdrawing 1 ECU, and thus obtaining a sure payoff $u(1)$, is the best response given that all others run.[13]

In the Baseline treatment, the fund liquidates all its assets in a run, such that we have

$$U_{NR}^B = 0, \tag{2}$$

which immediately implies the existence of a run equilibrium.

Consider next the treatment with gates. If all other investors run, the fund will suspend convertibility after the first two investors have withdrawn, and the two investors who did not withdraw in the morning of period 1 will receive R ECUs in period 2. Since this period-2 payout holds no value for an impatient investor, and

[12] Our equilibrium definition implies that strategies must be sequentially rational in the sense that the withdrawal choice constitutes a best response at the point in time when the investor is asked whether they want to withdraw x from the fund. Formally, this corresponds to the *perfect Bayesian equilibrium* concept. Note that investor i's *ex ante* incentive (i.e., before the order in which investors are asked has been determined) to play $w_i(1) = 1$ may decrease if more other investors do so, as the probability that investor i arrives early enough in the line to receive 1 ECU decreases when more other investors play $w(1) = 1$. However, the *ex post* incentive to play $w_i(1) = 1$ (once investor i is asked whether they want to withdraw 1 ECU) always increases with the number of other investors that play $w(1) = 1$.

[13] A run equilibrium is *strict* when $u(1) > U_{NR}^k$.

an investor turns out to be impatient with probability 0.5, we obtain

$$U_{NR}^{G} = \frac{1}{2}u(0) + \frac{1}{2}u(R). \tag{3}$$

From Jensen's inequality, we know that if $U_{NR}^{G} \leq u(1)$ holds for linear utility, then it holds for any concave utility function $u(\cdot)$. It follows that a sufficient condition for the existence of a run equilibrium in the treatment with gates is $R \leq 2$. If $u(\cdot)$ is strictly concave, then run equilibria exist for values of R higher than 2.

Finally, consider the treatment with redemption fees. If all other investors run, the fund will impose a redemption fee after two investors have withdrawn in the morning of period 1. In such a scenario, an investor who plays $w(1) = 0$ and turns out to be impatient will be forced to withdraw in the evening of period 1 and incur the fee; if the investor turns out to be patient, they will receive a payout of R ECUs in period 2. Therefore, we have that

$$U_{NR}^{F} = \frac{1}{2}u(R) + \frac{1}{2}u(0.5). \tag{4}$$

When we again apply Jensen's inequality, we obtain that a sufficient condition for $U_{NR}^{F} \leq u(1)$, and thus for the existence of a run equilibrium under redemption fees, is $R \leq 1.5$. As before, run equilibria exist for $R > 1.5$ if investors are risk averse.

Except for knife-edge cases, the no-run equilibrium (where all investors play $w(1) = 0$) and the run equilibrium (where all investors play $w(1) = 1$) are the only two pure strategy equilibria in all treatments.[14] For very specific parametrizations of R and the utility function $u(\cdot)$, one can obtain equilibria in which only one investor runs, and investors are just indifferent between running and not running given this strategy profile. These equilibria are not robust to tiny changes in R or $u(\cdot)$, and we abstract from them henceforth.

Risk factors and the propensity to run. As we have seen, a run equilibrium exists in all three treatments as long as $R \leq 1.5$ (and for higher values of R if investors are risk averse). The mere existence of two equilibria does not yet predict how often the two equilibria are played in each treatment. However, it seems reasonable to assume that investors' tendency to run is related to the potential loss in payoff when anticipating the "wrong" equilibrium, particularly the loss incurred when "mistakenly" choosing not to run—i.e., the difference $u(1) - U_{NR}$. In a sense, the greater this difference, the riskier it is for investors to keep their funds invested, since they incur a larger loss if the other investors do run.

These considerations suggest invoking the concept of risk dominance (Harsanyi

[14]As long as the no-run equilibrium and the run equilibrium are both strict equilibria, there is also a mixed strategy equilibrium. We limit attention to pure strategies throughout the paper.

and Selten, 1988) to make predictions about equilibrium selection. The issue with using risk dominance is that it predicts the risk dominant equilibrium to be selected with probability one. Using risk dominance as an equilibrium selection criterion would thus predict that, depending on R and the postulated utility function $u(\cdot)$, the run equilibrium is either always played or never played in a given treatment. It seems more plausible to assume that the frequency with which investors run depends in a more gradual fashion on the relative payoffs in the two equilibria and the losses associated with making the wrong prediction about other investors' withdrawal choices.

A helpful concept in this regard is the *risk factor* of an equilibrium, which is closely related to risk dominance and has been used in theoretical studies of bank runs to predict the frequency of runs (Ennis and Keister, 2003; Peck and Setayesh, 2023). The risk factor of the no-run equilibrium in treatment k, denoted p^k, is such that an investor is exactly indifferent between remaining invested and running if they expect that the other investors will play according to the no-run (run) equilibrium with probability p^k $(1-p^k)$. Then, if an investor expects other investors to play the no-run equilibrium with probability $p > p^k$ $(p < p^k)$, remaining invested (running) becomes the strictly best response.[15] Formally, the risk factor of the no-run equilibrium is defined by

$$u(1) = p^k \left[\frac{1}{2}u(1) + \frac{1}{2}u(R)\right] + (1-p^k)U^k_{NR}, \tag{5}$$

where the left-hand side is the payoff obtained from running, and the right-hand side is the expected payoff obtained from keeping the funds invested given that the other investors play according to the no-run (run) equilibrium with probability p^k $(1-p^k)$.[16] To derive an intuitive expression for the risk factor, it is useful to define

$$L^k_{NR} \equiv u(1) - U^k_{NR} \quad \text{and} \quad L_R \equiv \frac{1}{2}[u(R) - u(1)]. \tag{6}$$

L^k_{NR} denotes the loss in payoff in treatment k from "mistakenly" keeping one's funds invested when the other investors run, and L_R denotes the loss in payoff from "mistakenly" choosing to run when the other investors keep their funds invested. Note that the latter is identical in all treatments, and it equals the probability of being patient times the loss of foregoing the return R. After some algebra, we then

[15] Risk dominance predicts that the no-run (run) equilibrium is selected with probability one in treatment k if $p^k < 0.5$ $(p^k > 0.5)$.

[16] Recall that the payoff from running is defined as the payoff obtained from withdrawing 1 ECU once an investor reaches the decision node where they can decide whether to withdraw—at that point in the game, withdrawing yields a certain payoff of $u(1)$.

obtain from (5) that

$$p^k = \frac{L^k_{NR}}{L^k_{NR} + L_R}, \tag{7}$$

i.e., the risk factor of the no-run equilibrium is the higher the greater the loss in payoff incurred by "mistakenly" choosing to remain invested relative to the loss incurred by "mistakenly" choosing to run.

From (2)-(4), we have $U^B_{NR} < U^G_{NR} < U^F_{NR}$, which implies that $L^B_{NR} > L^G_{NR} > L^F_{NR}$ and thus $p^B > p^G > p^F$, i.e., the risk factor of the no-run equilibrium is highest in the Baseline treatment and lowest in the treatment with redemption fees. Intuitively, gates and fees reduce the potential loss incurred when choosing to remain invested since these measures ensure that a run in period 1 does not impair the fund's payouts in period 2—either because the fund refrains from liquidating assets (in the case of gates) or because withdrawing investors internalize liquidation costs (in the case of fees). Relative to gates, the potential downside of remaining invested is further reduced with fees since withdrawals in the case of urgent liquidity needs are always possible, even if they may be subject to a fee. Note that a run-proof debt contract would be one for which $L_{NR} < 0$. In that sense, while fees and gates fail to make the fund run-proof, they at least come closer to doing so than the baseline policy.

3.1 Hypotheses

We formulate three hypotheses, each grounded in a theoretical analysis based on the role of risk as described above. Specifically, we hypothesize that the three treatments—Baseline, Gates, and Fees— induce different withdrawal behaviors owing to differences in the risk factor of the no-run equilibrium.

Our first and main hypothesis posits that these predicted treatment effects will lead to different frequencies of withdrawals and runs across the treatments. The second hypothesis concerns participants' decision-making when they are exposed to a different regulatory tool in the second half of the experiment. The third hypothesis pertains to convergence toward a given equilibrium.[17] We preregistered our hypotheses at AsPredicted.

First, following Ennis and Keister (2003) and Peck and Setayesh (2023), we predict that participants will be more likely to run when the risk factor of the no-run equilibrium is higher.

Hypothesis 1. ***(Treatment Effect)*** *Early withdrawals (runs) occur most frequently in the Baseline treatment, followed by the Gates treatment, and then the*

[17]Strictly speaking, our theoretical analysis directly supports the first hypothesis; the other two hypotheses can be regarded as corollary hypotheses to this main hypothesis.

Fees treatment.

Next, while our theory does not make explicit predictions about regime changes, it does predict different propensities to run across treatments. If participants adjust to these incentives, we expect withdrawal behavior to respond accordingly when the environment changes. In particular, when moving from a regime with a higher risk factor to one with a lower risk factor, runs should decrease and vice versa.

Hypothesis 2. ***(Treatment Effect Conditional on History)*** *Switching from the Baseline treatment to either the Fees or the Gates treatment reduces the frequency of early withdrawals. Switching from the Gates treatment to the Fees treatment also reduces withdrawals, whereas switching from Fees to Gates increases the frequency of withdrawals.*

Finally, the fact that Fees and Gates limit the potential downside of keeping one's funds invested suggests that participants should be more likely to settle on the no-run equilibrium in these treatments than in the Baseline treatment. Conversely, in the Baseline treatment, participants should be more likely to settle on the run equilibrium. This prediction aligns with the theoretical result in Ennis and Keister (2005), which finds that convergence to the no-run (run) equilibrium is more likely when the risk factor of the no-run equilibrium is lower (higher).[18]

Hypothesis 3. ***(Convergence)*** *Convergence to the no-run equilibrium is most likely in the Fees treatment, followed by the Gates treatment, and is least likely in the Baseline treatment. Conversely, convergence to the run equilibrium is most likely in the Baseline treatment, followed by the Gates treatment, and is least likely in the Fees treatment.*

4 Experimental Procedures

We conducted our experiment using the z-tree software (Fischbacher, 2007) at the LINEEX lab (Universitat de Valencia, Spain) in October 2024. We ran eight sessions with a total of 320 participants, none of whom had prior experience with coordination problems or financial decision-making experiments. Each participant took part in only one session. We set the return to the fund's investment project to $R = 1.5$ in all sessions.

To test whether switching from one regime to another affects behavior, each session was divided into two parts lasting for 15 rounds each. In each part, the participants encountered a different regulatory regime. The sessions followed these

[18] Similarly, Temzelides (1997) finds that the economy tends to converge to the risk-dominant equilibrium in an evolutionary model of runs.

four treatment sequences: (1) Baseline followed by Gates, (2) Baseline followed by Fees, (3) Gates followed by Fees, and (4) Fees followed by Gates.[19]

There were two sessions for each of the constellations (i.e., sequences of treatments) described above. In each session, 40 participants made decisions in fixed matching groups of 8. Participants from different matching groups did not interact with one another during the session. Within each matching group, participants were randomly and anonymously paired into subgroups of 4 at the beginning of each period. We did not elicit participants' beliefs about their co-players' withdrawal choices, assuming that such beliefs would naturally influence their decisions.

The first parts of the sessions allow us to investigate the existence of a treatment effect (see Hypothesis 1), while the second parts provide insights into whether participants react differently to a regulatory tool depending on prior history (see Hypothesis 2). The fact that 15 rounds were played in both session halves allows us to examine whether convergence to a given equilibrium can be observed (see Hypothesis 3).

After seating and welcoming the participants, the instructions were read aloud, and participants were given the opportunity to ask questions. Before proceeding to the payoff-relevant rounds, participants were required to correctly answer 5 control questions. If a participant gave an incorrect answer, they were informed of the mistake and had to try again; when they answered correctly, a short explanation appeared, and they continued to the next question. Appendix D provides the English wording of the instructions.[20] The setup was briefly summarized on the screen at the start of the experiment.

The experiments followed the procedure described in the experimental environment (see Section 2). In the baseline treatment, participants were asked whether they wished to withdraw in the morning of period 1. The investors who decided to withdraw were paid out sequentially in random order. In the evening, two investors were randomly selected to be impatient, and they were forced to withdraw if they had not already decided to do so. On each screen, participants saw a payoff table explaining that (i) they would receive 1 ECU upon withdrawal in period 1 if they were the first, second or third investor to withdraw and zero otherwise, and (ii) if they choose to stay invested, they would receive 1.5 ECUs if no more than two participants withdraw in period 1 and zero otherwise. At the end of each round, an information screen was displayed to participants where they saw the total number

[19] We did not analyze all possible transitions between treatments, as a return from the Gates or Fees treatments to the Baseline treatment seems unlikely in practice. Instead, we focus on transitions away from the Baseline treatment as well as switches between different liquidity management tools. The recent changes in US MMF regulations, which remove the possibility of using gates and place more emphasis on redemption fees, highlight that the latter case may be relevant in practice.

[20] These are the instructions for the first half of the experiment. The participants received abbreviated instructions for the second half of the experiment.

of investors that requested to withdraw during period 1 (morning + evening) along with their payoff and an explanation of how the payoff was determined. An example of such an explanation is as follows: "We have reached period 2. In this round, there have been a total of 3 withdrawals. Your decision had been to leave the money in the fund. However, you needed the money urgently at the end of the period, so you withdrew it. When it was your turn to receive your money from the fund, the fund had taken care of 2 previous withdrawals. Therefore, your payout in this round is 1."

The procedure in the Gates treatment was the same as that in the Baseline treatment, with the difference that only two withdrawals were possible in period 1. In the Fees treatment, it is important that players make withdrawal decisions contingent on the amount they receive should they choose to withdraw. Therefore, investors were asked whether they wish to withdraw in the morning if a withdrawal yields 1 ECU as well as what they wish to do if a withdrawal yields 0.5 ECUs. In both the Gates and the Fees treatments, participants were informed about their payoff and the total number of withdrawal requests at the end of each round in the same manner as in the Baseline treatment. Note that, in all treatments, the number of period-1 withdrawal requests for 1 ECU may be higher than the number of period-1 payments that are actually made since the number of investors that can receive 1 ECU in period 1 is limited.[21]

At the end of the experiment, the participants completed a questionnaire to provide additional information regarding their gender, age, risk attitudes, cognitive abilities, and trust in financial institutions. Risk attitudes were measured using a self-assessed willingness to take risks on a scale from 0 to 10, with a question adapted from the Global Preference Survey (Falk et al., 2018). Cognitive abilities were assessed using the Cognitive Reflection Test (Frederick, 2005). Using standard questions, we also measured financial trust on a scale from 0 to 10. By accounting for these factors in our analysis, we can determine whether the treatments have an effect on withdrawal behavior beyond these variables.

Tables B.1-B.4 in Appendix B present the summary statistics for the questionnaire items. They also provide an analysis of whether participants differ in their observable characteristics, as measured in the post-experiment questionnaire, across constellations. In terms of gender, there are significantly fewer female participants in the Gates–Fees constellation than in the other constellations. With respect to age, participants in the Fees–Gates constellation are somewhat older, and the difference is statistically significant in some comparisons. In terms of risk tolerance, participants in the Baseline–Fees constellation are somewhat more risk tolerant, with the difference being significant when compared with the Baseline–Gates and Fees–Gates

[21] Withdrawal requests for 0.5 ECUs in the Fees treatment can always be executed.

constellations. With respect to cognitive abilities, participants in the Gates–Fees constellation perform somewhat better, and the difference is significant when compared with the Baseline–Fees constellation. With respect to financial trust, those in the Gates–Fees constellation score higher than participants in the other constellations, with the difference being significant when compared with the Baseline–Fees and Baseline–Gates constellations. These observables are included as controls in our regression analyses.

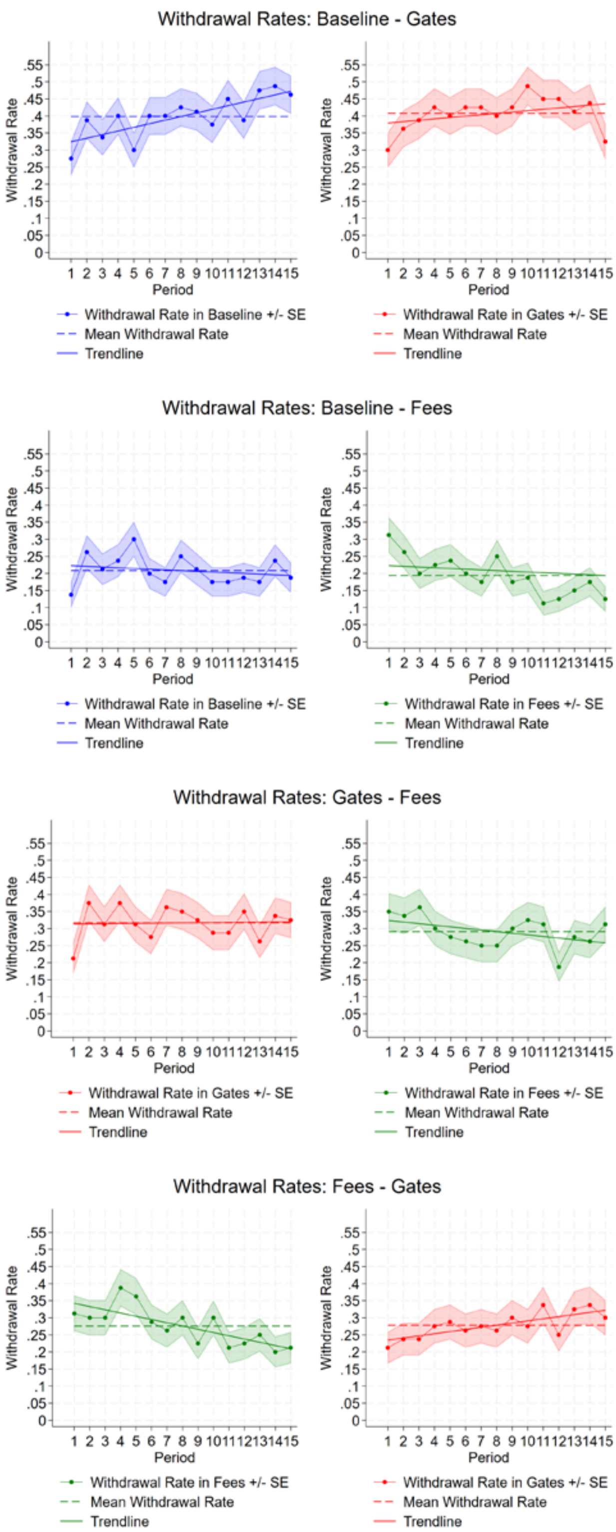
The sessions lasted approximately 90 minutes, with a minimum of 72 minutes and a maximum of 91 minutes. For the payment, we used a random lottery incentive procedure in which three rounds were randomly chosen, and participants were paid the sum of the money earned in those rounds. The random selection of rounds prevents participants from developing feasible hedging strategies. We selected three rounds instead of the usual one to reduce the probability of receiving a payment of zero, which can occur in our setup, e.g., in the Gates treatment when an impatient investor is assigned position 3 and the two preceding investors withdraw. The ECUs earned in the chosen rounds were converted into Euros. On average, participants received €11.4, with amounts ranging from €6 to €14.

5 Results

Let us begin our analysis with some overall descriptive results. Figure 2 shows the evolution of early withdrawal rates across the different constellations. (Example: "Gates–Fees" shows the withdrawal rates for the sessions where the Gates treatment is played in the first half of the experiment, followed by the Fees treatment in the second half.) The figure also includes the mean withdrawal rate and a trend line. Although the withdrawal rates exhibit considerable fluctuations, some patterns emerge. While the differences are not large, the mean withdrawal rate tends to be lower in the Fees treatment than in the other treatments. Contrary to our hypothesis, withdrawal rates in the Gates treatment do not appear to be lower than those in the Baseline treatment. We also observe that withdrawal rates follow a downward trend in the Fees treatment, whereas trends in the other treatments are less consistent. The lower withdrawal rates in the Fees treatment typically emerge in later rounds, while withdrawal rates during the early rounds tend to be higher than those in the other treatments. This suggests that participants may need time to adapt to this regulatory tool, which ultimately does lead to decreasing withdrawal rates.[22]

[22]Somewhat unexpectedly, withdrawal rates in the Baseline treatment differ markedly between sessions, with higher withdrawal rates in the Baseline–Gates constellation than in the Baseline–Fees constellation. Two main factors may explain this difference. First, as shown in Tables B.3 and B.4, the only post-experiment questionnaire variable on which the two groups differed significantly was

Figure 2: *Evolution of withdrawal rates across constellations*



5.1 Treatment Effect

Hypothesis 1 predicts that the frequency of early withdrawals will be highest in the Baseline treatment, followed by the Gates treatment, and lowest in the Fees treatment. To test this hypothesis, we focus on the first half of each session. This provides a cleaner test of the treatment effect since participants' behavior in the second half may be influenced by prior experience. Nonetheless, we also consider the results from the entire sessions as a robustness check.

Figure 3: *Evolution of withdrawal rates across treatments (first session halves only)*

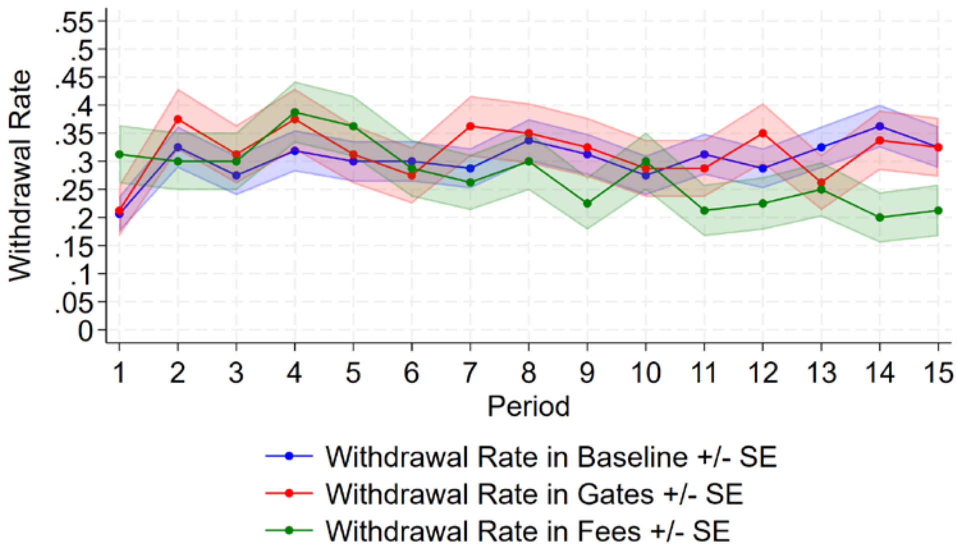


Figure 3 shows the evolution of early withdrawal rates across treatments during the first halves of the sessions. The shaded bands indicate standard errors. During the first ten periods, withdrawal rates fluctuate without a clear trend, and their confidence intervals overlap across periods. From period 11 onward, however, the Fees treatment consistently results in the lowest withdrawal rates, with clearly separated error bands in the final periods. Contrary to our hypothesis, Gates does not outperform Baseline—the overlap in standard errors suggests no substantial difference between them. Overall, while Fees appear to curb runs somewhat relative to the no-intervention Baseline, Gates seem to be ineffective. It is worth noting that withdrawal rates are initially higher in Fees than in Baseline and Gates, such that that examining only the first period could misleadingly suggest that runs are more

risk tolerance, with participants in the Baseline–Gates constellation being more risk-tolerant on average. This difference may underlie the divergent behaviors of the two groups. Second, the theory predicts multiple equilibria in the Baseline treatment. It is therefore possible that participants in different sessions follow different paths that lead to distinct outcomes. The variation in withdrawal rates observed in the first round may have set the groups on divergent trajectories—one resulting in higher withdrawal rates than the other.

prevalent under Fees.

Table 4 reports the withdrawal rates by treatment for 5-period segments, again limiting the analysis to the first session halves. The last three columns display p-values from tests of proportions. We report one-sided p-values since our theoretical prediction specifies a directional alternative hypothesis.[23] When aggregating over all 15 periods, withdrawal rates are lowest in the Fees treatment, followed by the Baseline treatment and then the Gates treatment. Proportion tests confirm significantly lower withdrawal rates in the Fees treatment than in both Baseline and Gates at the 5% level, whereas no significant difference is found between Baseline and Gates. Significant differences in the expected direction between the Fees treatment and the other treatments emerge only in the final 5-period segment, which reflects the fact that withdrawal rates in the Fees treatment steadily decrease—a pattern not observed in the other treatments. No significant differences in withdrawal rates are observed between the Baseline and Gates treatments. It is worth pointing out that when comparing Baseline and Fees, withdrawal rates in the first 5-period segment are significant in the opposite direction (i.e., with p-value above 0.95), indicating that withdrawal rates in the Fees treatment initially start higher and then decrease over time.

Table 4: *Withdrawal rates across treatments (first session halves only)*

Periods	Baseline	Gates	Fees	Baseline vs Gates	Baseline vs Fees	Gates vs Fees
All	0.303	0.317	0.276	0.793	0.044	0.014
1–5	0.285	0.318	0.333	0.878	0.955	0.325
6–10	0.303	0.320	0.275	0.732	0.162	0.082
11–15	0.323	0.313	0.22	0.345	0.018	0.005

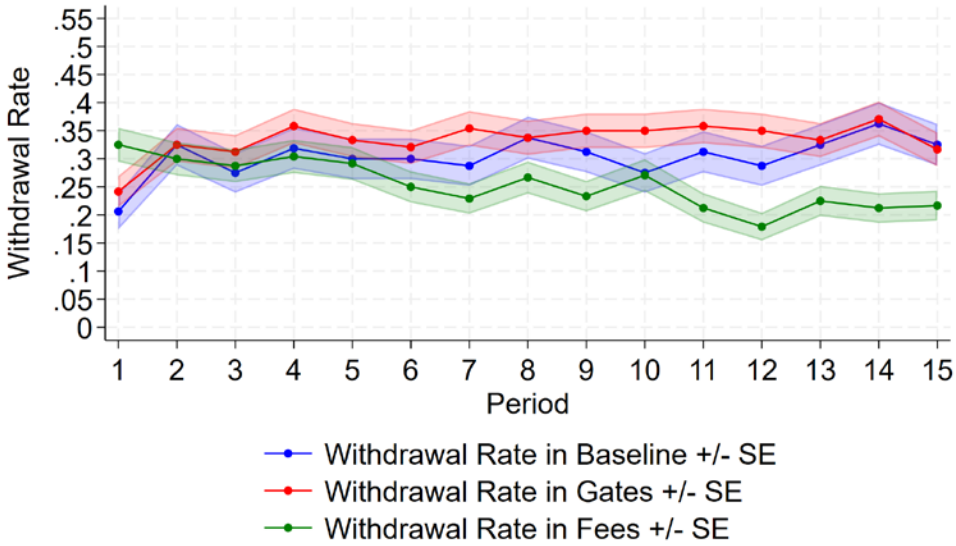
The three columns on the right report one-sided p-values based on the test of proportions.

Robustness: entire sessions considered. Considering withdrawal rates over both session halves (instead of only the first halves) confirms and amplifies the findings described above. Figure 4 shows that fees yield consistently lower withdrawal rates starting from period 4, with nonoverlapping error bands in nearly half of the periods. Gates do not perform better than Baseline, and in several periods, they exhibit higher withdrawal rates (although not significantly so). As before, the initially higher withdrawal rate under Fees could be misleading if the first period is considered in isolation.

Table 5 reports withdrawal rates across treatments for all periods combined and for 5-period segments, using the data from both session halves. Differences between treatments are statistically significant at conventional levels in all pairwise

[23] Using the nonparametric Mann—Whitney test instead of the proportion test leads to the same results—see Table C.1 in Appendix C.1.

Figure 4: *Evolution of withdrawal rates across treatments over time, using the data from both session halves*



comparisons. The overall withdrawal rates under Fees are significantly lower than those in the other two treatments. Comparing Gates with Baseline shows that overall withdrawal rates are significantly higher under Gates, which is the reverse of our hypothesis. No significant differences between treatments are observed when the first 5-period segment is considered, but differences become significant in the later segments.

Table 5: *Withdrawal rates across treatments, using the data from both session halves*

Periods	Baseline	Gates	Fees	Baseline vs Gates	Baseline vs Fees	Gates vs Fees
All	0.303	0.334	0.254	0.994	0.000	0.000
1–5	0.285	0.314	0.302	0.918	0.788	0.254
6–10	0.303	0.343	0.250	0.969	0.005	0.000
11–15	0.323	0.346	0.209	0.860	0.000	0.000

The three columns on the right report one-sided p-values based on the test of proportions.

Regression analysis. In this section, we present a regression analysis that incorporates a broader set of factors to better understand the relationship between the treatments and investor decisions. Given the panel structure of our data, we estimate random-effects panel regressions, where the dependent variable is a binary indicator for whether the investor withdraws. Table 6 reports the results from linear probability models. As before, we restrict the sample to observations from the first halves of the sessions. Standard errors are clustered at the session–matching group level.

Table 6: *Random-effects panel linear probability model of withdrawals (first session halves only)*

	Dependent Variable: Withdraw (0/1)			
	(1)	(2)	(3)	(4)
Gates	0.013	0.044	0.038	0.036
	(0.058)	(0.048)	(0.043)	(0.044)
Fees	-0.027	0.083**	0.075*	0.057
	(0.049)	(0.040)	(0.038)	(0.045)
Period		0.004	-0.000	-0.000
		(0.004)	(0.003)	(0.003)
Fees×Period		-0.014***	-0.012***	-0.012***
		(0.005)	(0.004)	(0.005)
Gates×Period		-0.004	-0.003	-0.003
		(0.005)	(0.004)	(0.004)
Avg. Withdr. Req. (1 to t-2)			0.002	0.002
			(0.009)	(0.009)
Withdr. Req. (t-1)			0.059***	0.059***
			(0.010)	(0.010)
Female				-0.045
				(0.027)
Age				-0.002
				(0.005)
Risk Tolerance				-0.035***
				(0.009)
Cognitive				-0.034**
				(0.014)
Fin. Trust				-0.001
				(0.006)
Constant	0.303***	0.269***	0.158***	0.471***
	(0.040)	(0.026)	(0.029)	(0.123)
Observations	4,800	4,800	4,800	4,755
Number of Participants	320	320	320	317

Standard errors clustered at the session-matching group level are reported in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

The first specification—Model (1)—includes only treatment dummies. The constant captures the withdrawal rate in the Baseline treatment, while the coefficients on the treatment dummies represent deviations from this benchmark. These deviations are small in magnitude and not statistically significant at the 5% level.

In the second specification—Model (2)—we include a *Period* variable to account for time trends in withdrawal rates, along with interaction terms between *Period* and the treatment dummies (*Fees*×*Period* and *Gates*×*Period*). This specification is motivated by the earlier observation that the Fees treatment results in a consistent downward trend over time.

In this model, the coefficient on *Period* suggests that there is no time trend in withdrawal rates under the Baseline treatment, and the trend in the Gates treatment is not significantly different. In contrast, the interaction between *Period* and *Fees* is negative and statistically significant, indicating that the Fees treatment had an increasingly mitigating effect on withdrawals over time. Notably, the main coefficient for the Fees treatment becomes positive and significant, implying that withdrawal rates initially started higher under Fees but declined substantially thereafter. Overall, the lower withdrawal rates observed in the Fees treatment appear to be driven primarily by this downward trend over time.

Participants' choices may have been influenced by their prior experience during the experiment. To account for this, Model (3) introduces two additional variables that capture the total period-1 withdrawal requests at the fund level experienced by a participant.[24] To reflect the most recent experience, we include the variable *Withdr. Req. (t–1)*, which equals the number of period-1 withdrawal requests at the fund level in the previous round. To incorporate earlier experiences, we include *Avg. Withdr. Req. (1 to t–2)*, the average number of fund-level withdrawal requests prior to the last round.[25]

Recent experience is strongly predictive: each additional withdrawal request in the previous round increases the likelihood of withdrawal by approximately 6 percentage points. In contrast, earlier experiences do not have a statistically significant effect. Importantly, the core findings remain robust: in the Fees treatment, withdrawal rates start at a higher level but decline significantly over time, whereas no comparable downward trend is observed in the Baseline and Gates treatments.

The final specification, Model (4), includes individual-level characteristics. While the main findings remain unchanged, we additionally find that individuals with higher risk tolerance are significantly less likely to withdraw.[26] Furthermore, partic-

[24]Recall that at the end of each round, participants were informed of the total number of period-1 withdrawal requests submitted to the fund in that round. As explained previously, not all submitted withdrawal requests were necessarily executed.

[25]In early periods where the history is too short, these variables are set to zero.

[26]This is a surprising result, as the existing literature generally finds that risk tolerance is not

ipants who performed better on the cognitive test had a lower propensity to withdraw. Gender, age, and trust in financial institutions are not significantly associated with withdrawal behavior.

We conduct several robustness checks, the results of which are presented in Appendix C.1. Table C.2 shows the results from a simple linear probability model that does not account for the panel structure of the data, with standard errors clustered at the session–matching group level. Table C.3 reports the same panel specifications as the main model, estimated using a logit model. Finally, Table C.4 presents the results from random-effects linear probability models using data from the entire sessions rather than only the first halves. The results remain qualitatively consistent across all these estimations.

5.2 Switching Regimes

Hypothesis 2 posits that changing from one regulatory regime to another may influence participant behavior. Specifically, and in line with Hypothesis 1, we expect that moving from the Baseline treatment to any of the other treatments will lead to a reduction in the withdrawal rate. Switching from the Gates to the Fees treatment is also expected to reduce withdrawals, whereas the reverse transition—from Fees to Gates—is predicted to increase them. Accordingly, we examine different sequences of regulatory regimes (Baseline–Gates, Baseline–Fees, Gates–Fees, and Fees–Gates) to determine whether participants behave differently across the two halves of the experiment.

Table 7 presents the withdrawal rates for each constellation, both for the pooled data across all periods and for 5-period blocks.[27] The table compares behavior across the two parts of each constellation and reports one-sided p-values from proportion tests, with alternative hypotheses aligned with Hypothesis 2. Overall, differences in withdrawal rates between the two parts of each constellation are modest, and significant differences in the expected direction are rarely observed. At the 5% significance level, no such differences are found in the Baseline–Gates or Gates–Fees constellations. In the Baseline–Fees and Fees–Gates constellations, withdrawal rates in the final segment are significantly lower under the Fees treatment, which is consistent with our hypothesis. Generally, when there is a significant difference in withdrawal rates, it occurs in the last 5-period segment.[28]

a significant predictor of withdrawal behavior. One possible explanation is that in those studies, risk tolerance reflects attitudes in strategic environments, whereas in our setting, the preemptive nature of the decision may cause risk preferences to reflect concerns about the extrinsic probability of turning out to be of the impatient type.

[27] Tables C.5–C.8 in Appendix C.2 also provide period-by-period comparisons.

[28] Note, however, that in the Fees–Gates constellation, withdrawal rates are significantly higher in the initial five-period segment of the Fees treatment—contrary to our hypothesis—as indicated

Table 7: *Comparison of withdrawal rates between treatments in different constellations*

Period	First Part	Second Part	Rate Diff	P-value (One-sided)
	Baseline	**Gates**		
All	0.398	0.408	-0.010	0.676
1–5	0.340	0.375	-0.035	0.849
6–10	0.403	0.433	-0.030	0.440
11–15	0.453	0.415	0.038	0.142
	Baseline	**Fees**		
All	0.208	0.194	0.014	0.193
1–5	0.230	0.248	-0.018	0.719
6–10	0.203	0.198	0.005	0.430
11–15	0.193	0.138	0.055	0.018
	Gates	**Fees**		
All	0.317	0.291	0.026	0.084
1–5	0.318	0.325	-0.007	0.590
6–10	0.320	0.278	0.042	0.095
11–15	0.313	0.270	0.043	0.093
	Fees	**Gates**		
All	0.276	0.278	-0.002	0.554
1–5	0.333	0.250	0.083	0.995
6–10	0.275	0.275	0.000	0.500
11–15	0.220	0.310	-0.090	0.002

Table 8 presents regression results from random-effects panel linear probability models, where the dependent variable indicates whether the investor withdraws. Each specification corresponds to a different constellation, as indicated at the top of the table. The two key variables of interest are the dummy for the treatment in the second part of the constellation (labeled *Second Part*) and the interaction term capturing whether the trend in the second part differs from that in the first (labeled *Sec. Part*×*Period*). To properly account for time trends, the *Period* variable runs from 1 to 30, meaning that we consider trends across the full constellation rather than separately for each half. The interaction term thus captures changes in the slope of the trend between the two parts. We also include the control variables used in earlier analyses.[29]

In line with our earlier results from Table 7, in the Baseline–Gates constellation, neither the dummy for the treatment in the second part nor the interaction term is statistically significant, suggesting that the change in the regulatory regime did not lead to meaningful differences in withdrawal behavior. In the constellations where the Fees treatment is introduced in the second half, the treatment dummy is positive and significant, whereas the interaction term is negative and significant. This indicates that the Fees treatment begins with higher withdrawal rates, which then exhibit a clear downward trend. In the Fees–Gates constellation, the treatment dummy is not significant, whereas the interaction term is positive and significant. This pattern aligns with Figure 2: the Fees treatment shows a downward trend, which reverses into an upward trend after the switch to Gates.

With respect to the other covariates, recent experience with heightened withdrawals consistently increases withdrawal rates, whereas higher risk tolerance and better cognitive performance are significantly associated with a lower likelihood of withdrawal in most cases.

Overall, we find that introducing a liquidity management tool—or switching from one such tool to another—has only modest effects on run behavior. However, the introduction of fees consistently leads to a significant change in the trend of withdrawal rates, highlighting their mitigating effect on run behavior over time.

by a p-value above 0.95 from the one-sided test of proportions. This reflects that withdrawal rates in the Fees treatment start at a relatively high level and then decrease over time; after the change to the Gates treatment in the second half of the experiment, withdrawal rates start to exhibit an increasing trend.

[29] Tables C.9–C.12 in Appendix C.2 show results from progressively specified models, where control variables are added step by step—mirroring the structure of Table 6.

Table 8: *Random-effects panel linear probability models of withdrawals*

	Base–Gates	**Base–Fees**	**Gates–Fees**	**Fees–Gates**
	(1)	(2)	(3)	(4)
Second Part	0.084	0.277***	0.185***	-0.108
	(0.063)	(0.092)	(0.065)	(0.076)
Period	0.004	-0.007***	-0.005*	-0.014***
	(0.005)	(0.002)	(0.003)	(0.004)
Sec.Part×Period	-0.006	-0.007**	-0.004**	0.016***
	(0.005)	(0.003)	(0.002)	(0.003)
Avg. Withdr. Req. (1 to t-2)	0.006	0.019	0.029*	0.024
	(0.010)	(0.018)	(0.017)	(0.016)
Withdr. Req. (t-1)	0.061***	0.045***	0.026**	0.043***
	(0.018)	(0.013)	(0.011)	(0.015)
Female	-0.006	-0.048	-0.037	-0.074
	(0.047)	(0.053)	(0.039)	(0.053)
Age	0.007	-0.004	0.000	-0.010**
	(0.017)	(0.015)	(0.007)	(0.004)
Risk Tolerance	-0.045***	-0.024*	-0.042***	-0.026
	(0.011)	(0.013)	(0.016)	(0.021)
Cognitive	-0.024	-0.060***	-0.035**	-0.046*
	(0.034)	(0.021)	(0.018)	(0.024)
Fin. Trust	0.016	0.009	-0.012	-0.003
	(0.010)	(0.009)	(0.013)	(0.009)
Constant	0.271	0.397	0.600***	0.693***
	(0.328)	(0.349)	(0.151)	(0.205)
Observations	2,370	2,400	2,400	2,340
Number of Participants	79	80	80	78

Standard errors clustered at the session-matching group level are reported in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

5.3 Convergence

In Hypothesis 3, we conjecture that convergence to the no-run equilibrium is most likely in the Fees treatment, followed by the Gates treatment, and least likely in the Baseline.

Table 9: *Random-effects panel linear probability models of withdrawals with interaction terms*

	Dependent Variable: Withdraw (0/1)			
	(1)	(2)	(3)	(4)
Base×Per.	0.001	0.001	-0.001	-0.001
	(0.003)	(0.003)	(0.002)	(0.002)
Gates×Per.	0.001	0.001	-0.001	-0.001
	(0.002)	(0.002)	(0.002)	(0.002)
Fees×Per.	-0.004**	-0.003**	-0.005***	-0.005***
	(0.002)	(0.002)	(0.002)	(0.002)
Controls				
Constellations	No	Yes	Yes	Yes
Sessions	No	Yes	Yes	Yes
Ind. History	No	No	Yes	Yes
Ind. Characteristics	No	No	No	Yes
Base×Per. = Gates×Per.	0.917	0.986	0.975	0.952
Base×Per. = Fees×Per.	0.050	0.061	0.045	0.049
Gates×Per. = Fees×Per.	0.014	0.026	0.021	0.022

Standard errors clustered at the session-matching group level are reported in parentheses.
The bottom three rows report p-values from Wald tests.
*** p<0.01, ** p<0.05, * p<0.1

In Table 9, we present the coefficients of the interaction terms between *Treatment* and *Period* across different specifications of random-effects panel linear probability models, using data from both halves of the sessions. The first specification (1) includes only the interaction terms. The second adds controls for constellation and session. Specification (3) introduces controls for history, while the final specification also incorporates individual characteristics. Standard errors are clustered at the session-matching group level.

Table 9 shows that only the *Fees×Period* interaction term is consistently negative and significant across specifications. The interaction terms for the other two treatments (Baseline and Gates) become negative only in the final two specifications. Moreover, the coefficient for the Fees treatment has the largest magnitude, suggesting that convergence toward the no-run equilibrium is strongest under this treatment. Wald tests, reported at the bottom of Table 9, indicate that the differences in coefficients are typically statistically significant at the 5% level when comparing Fees to the other two treatments, whereas the difference between Baseline and Gates is insignificant.

As a robustness check, we run the same regressions separately for each treatment. The results are reported in Table C.13 in Appendix C.3. For all specifications, withdrawal rates decline over time in the Fees treatment, with consistently negative and significant coefficients. In the Baseline treatment, withdrawal rates do not change over time, as indicated by the nonsignificant coefficient of *Period*. For the Gates treatment, the coefficient of *Period* is consistently positive. Across all specifications, a decrease in withdrawal rates is only observed in the Fees treatment, reinforcing the evidence of stronger convergence to the no-run equilibrium under Fees.

Overall, evidence for convergence to the no-run equilibrium is strongest for the Fees treatment, in line with Hypothesis 3. In contrast, we do not find clear evidence that Gates lead to stronger convergence to the no-run equilibrium than the Baseline treatment.

6 Conclusion

In this study, we experimentally examine the effectiveness of redemption fees and gates in mitigating run behavior in a setting where redemption restrictions may lead investors to withdraw preemptively. Our theoretical results predict that both fees and gates should be effective in reducing runs and that fees should reduce the propensity to run more than gates. Consistent with these predictions, we find in our laboratory experiments that redemption fees are significantly more effective than gates in mitigating run behavior, particularly in the later stages of the experimental sessions. In contrast, gates fail to consistently lower withdrawal rates and, in some cases, may even exacerbate the tendency to run.

Notably, the impact of redemption fees emerges gradually, with their effectiveness becoming more pronounced over time. This suggests that redemption fees may require sustained exposure to elicit the desired behavioral changes, aligning with policymakers' observation that familiarity with fees can influence their effectiveness.

Overall, our experimental findings reinforce impressions from the spring 2020 MMF turmoil, indicating that gates and fees are unlikely to eliminate fund fragility. Nevertheless, our results suggest that redemption fees can play a useful role in reducing the propensity to run, even if their impact is relatively modest and materializes only after investors have become accustomed to the fee mechanism.

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Appendix

A General Version of the Setup

Consider the setup described in Section 2, with the difference that we do not fix the number of investors, the share of impatient investors, and the liquidation return of the project.

Specifically, we now assume that the fund has some number $N \geq 3$ of investors, among which some (known) number $N_P \geq 2$ will turn out to be patient, while the remaining $N_I = N - N_P$ investors will turn out to be impatient. As before, the fund has just enough cash to pay out all impatient investors in period 1, i.e., the fund has N_I ECUs of cash, and an investment project of size N_P. If let to mature, the investment project pays $N_P R$ ECUs in period 2, with $R > 1$. The fund can liquidate any amount $L \in [0, N_P]$ of the project in period 1 and let the remaining part mature. The liquidation return of the project is given by some $\lambda \in (0, 1)$, which means that liquidating an amount L of the project yields λL ECUs in period 1, while the remaining part of the project yields $(N_P - L)R$ ECUs in period 2. The experimental setup presented in Section 2 corresponds to the parametrization $N = 4$, $N_I = N_P = 2$, and $\lambda = 1/2$.

We make one assumption about the parameters, namely, that the period-1 payout obtained from liquidating the fund's entire portfolio does not exceed $N - 1$ ECUs; the relevance of this assumption becomes clear further below.

Assumption A.1. $N_I + \lambda N_P \leq N - 1$.

The timeline is exactly as described in Section 2. In the morning of period 1, the fund asks the investors in random order whether they want to withdraw 1 ECU. Investors do not know how many other investors have been asked before them, and if they choose to withdraw, they are paid out immediately. Then, in the evening of period 1, investors learn their type (impatient or patient), and all impatient investors who did not withdraw in the morning will withdraw now (assuming that withdrawals are still possible). If multiple impatient investors wish to withdraw in the evening of period 1, then these investors are paid out in random order. Finally, in period 2, the fund distributes the project return equally among the investors who did not withdraw in period 1.

We will now briefly describe the three payout policies—baseline, gates, fees—for the general case. Our three experimental treatments correspond to these payout policies under the parametrization $N = 4$, $N_I = N_P = 2$, and $\lambda = 1/2$.

Baseline. Under the baseline policy, the fund pays 1 ECU to all investors who withdraw in period 1 as long as the fund has any assets left. Define

$$\overline{N} \equiv \max\{n \in \mathbb{N} \,|\, n \leq N_I + \lambda N_p\}, \tag{A.1}$$

where $\mathbb{N}$ is the set of natural numbers. In period 1, the fund is able to pay 1 ECU to a maximum of $\overline{N}$ investors before its assets are depleted. Note that from Assumption A.1, we have $\overline{N} \leq N - 1$. The fund's period-1 payouts under the baseline policy are as follows:

1) Pay 1 ECU to the first $\overline{N}$ investors who withdraw
2) Pay $N_I + \lambda N_P - \overline{N} < 1$ ECUs to the $(\overline{N}+1)$th investor who withdraws.
3) Pay nothing to the remaining investors.

Denoting $Q \geq N_I$ as the number of investors who withdraw in period 1, we then obtain the following period-2 payouts:

$$\text{Period-2 payout} = \begin{cases} R & \text{if } Q = N_I \\ \dfrac{1}{N-Q}\left[N_P - \left(\dfrac{Q-N_I}{\lambda}\right)\right] R & \text{if } N_I + 1 \leq Q \leq \overline{N} \\ 0 & \text{if } Q \geq \overline{N} + 1 \end{cases} \tag{A.2}$$

Note that if $Q > N_I$, the fund will liquidate an amount $(Q - N_I)/\lambda$ of the project to meet period-1 withdrawals. In period 2, the return from the part of the project that is left to mature is then divided equally among the $N - Q$ investors who are still left in the fund, which leads to the payout given in expression (A.2). It is straightforward to show that period-2 payouts are strictly decreasing in Q within $N_1 \leq Q \leq \overline{N} + 1$.

Gates. With gates, the fund pays 1 ECU to the first N_I investors who withdraw in period 1 and then suspends payouts until period 2. This means that the entire investment project is left to mature, which allows the fund to pay R ECUs in period 2 to all investors who do not withdraw in period 1.

Fees. With fees, the fund pays 1 ECU to the first N_I investors who withdraw in period 1, and λ ECUs to the subsequent investors who withdraw in period 1. Since any liquidation losses the fund incurs are fully internalized by the investors who withdraw, the fund can pay R ECUs in period 2 to all investors who stay invested.

Strategies and equilibrium. As in Section 2, a (pure) withdrawal strategy of investor $i \in N$ under payout policy $k \in \{B, G, F\}$ is given by a mapping $w_i^k : \mathbb{X} \mapsto$

$\mathbb{W}$, where $x \in \mathbb{X}$ is the payment offered by the fund and $w \in \mathbb{W} = \{0, 1\}$ is the withdrawal choice. We have $\mathbb{X} = \{1\}$ under the baseline policy and gates, while we have $\mathbb{X} = \{1, \lambda\}$ with fees.

The definition of equilibrium is exactly as in Section 3. It is not hard to see that with fees, withdrawing λ ECUs in the morning of period 1 is strictly dominated, such that we can assume that $w_i^F(\lambda) = 0$ without loss of generality. Thus, we can again focus on the withdrawal choice $w(1)$ under all payout policies. Furthermore, it is straightforward that a no-run equilibrium, where no investor chooses to withdraw in the morning of period 1, is an equilibrium under all policies. Below, we will show that a run equilibrium, where all investors play $w_i(1) = 1$, exists under all payout policies as long as R is not too high. Since withdrawal decisions are strict strategic complements under all policies (see the discussion in footnote 12), the no-run equilibrium and the run equilibrium are again the only pure-strategy equilibria that may exist, apart from knife-edge parametrizations that allow for a partial-run equilibrium.

Run equilibria. Following the notation introduced in Section 3, we denote U_{NR}^k as an investor's expected payoff under policy k from playing $w^k(1) = 0$ when all other investors play $w^k(1) = 1$. A run equilibrium exists under policy k if and only if $U_{NR}^k \leq u(1)$. From Assumption A.1, it follows that $U_{NR}^B = 0$, such that a run equilibrium exists under the baseline policy. For gates, we have

$$U_{NR}^G = \frac{N_I}{N} u(0) + \frac{N_P}{N} u(R).$$

Using Jensen's inequality, we therefore obtain that a sufficient condition for a run equilibrium to exist under gates is $R \leq 1 + N_I/N_P$. Finally, for fees, we have

$$U_{NR}^F = \frac{N_I}{N} u(\lambda) + \frac{N_P}{N} u(R),$$

which, by Jensen's inequality, means that a sufficient condition for a run equilibrium to exist under fees is $R \leq 1 + (1 - \lambda) * (N_I/N_P)$. Thus, if R satisfies this latter condition, then a run equilibrium exists under all three payout policies.

Risk factor. The definition of the risk factor of the no-run equilibrium is exactly as in (6)-(7), except that the loss from "mistakenly" choosing to run when the other investors stay invested now equals $L_R \equiv (N_P/N)[u(R) - u(1)]$. Since $U_{NR}^B < U_{NR}^G < U_{NR}^F$, we have $L_{NR}^B > L_{NR}^G > L_{NR}^F$, meaning that the risk factor is highest under the baseline policy and lowest under fees.

B Randomization

Table B.1: *Summary statistics of questionnaire items*

Variable	Categories	Frequency	Percent
Female	0 (Male or other)	156	47.81
	1 (Female)	164	51.25
	Total	320	100.00
Age	17	1	0.31
	18	50	15.62
	19	76	23.75
	20	55	17.19
	21	41	12.81
	22	41	12.81
	23	21	6.56
	24	13	4.06
	25	9	2.81
	26	4	1.25
	27	3	0.94
	29-36	5	1.56
	Total	320	100.00
Risk Tolerance	0	2	0.62
	1	12	3.75
	2	18	5.62
	3	20	6.25
	4	15	4.69
	5	38	11.88
	6	46	14.38
	7	71	22.19
	8	65	20.31
	9	23	7.19
	10	10	3.12
	Total	320	100.00
Cognitive	0	158	49.38
	1	70	21.88
	2	50	15.62
	3	42	13.12
	Total	320	100.00
Financial Trust	0	14	4.38
	1	19	5.94
	2	30	9.38
	3	38	11.88
	4	35	10.94
	5	55	17.19
	6	43	13.44
	7	41	12.81
	8	21	6.56
	9	18	5.62
	10	6	1.88
	Total	320	100.00

Table B.2: *Pairwise correlations between questionnaire items*

Variable	Female	Age	Risk Tol.	Cognitive	Fin. Trust
Female	1.000				
Age	-0.112*	1.000			
	(0.047)				
Risk Tol.	-0.104*	-0.003	1.000		
	(0.064)	(0.958)			
Cognitive	-0.315***	-0.068	0.037	1.000	
	(0.000)	(0.227)	(0.510)		
Fin. Trust	-0.082	-0.175**	0.151**	0.023	1.000
	(0.144)	(0.002)	(0.007)	(0.680)	

P-values shown in parentheses, *p<0.1, **p<0.05, ***p<0.01.

Table B.3: *Descriptive statistics by constellation*

Variable	Base–Fees	Base–Gates	Fees–Gates	Gates–Fees
Female (%)	57.5	59.5	52.6	37.5
Age (mean)	20.33	20.59	21.44	20.46
Risk Tolerance (mean)	6.65	5.76	5.91	6.15
Cognitive (mean)	0.70	0.91	0.99	1.10
Fin. Trust (mean)	4.41	4.50	4.95	5.43

Table B.4: *P-values from pairwise comparisons between constellations*

Variable	BF vs BG	BF vs FG	BF vs GF	BG vs FG	BG vs GF	FG vs GF
Female (%)	0.799	0.533	0.011	0.382	0.006	0.057
Age (mean)	0.618	0.013	0.726	0.061	0.429	0.008
Risk Tolerance (mean)	0.008	0.030	0.177	0.654	0.214	0.431
Cognitive (mean)	0.277	0.073	0.032	0.519	0.315	0.652
Fin. Trust (mean)	0.846	0.146	0.012	0.171	0.014	0.260

Gender was compared using a test of proportions; for all other variables, Wilcoxon–Mann–Whitney tests were used.

C Additional Figures and Tables

C.1 Treatment Effect

Table C.1: *Withdrawal rates by periods across treatments (first session halves only), with p-values based on the Mann–Whitney test*

Periods	**Baseline**	**Gates**	**Fees**	**Baseline vs Gates**	**Baseline vs Fees**	**Gates vs Fees**
All	0.303	0.317	0.276	0.414	0.088	0.029
1–5	0.285	0.318	0.333	0.245	0.091	0.651
6–10	0.303	0.320	0.275	0.536	0.324	0.164
11–15	0.323	0.313	0.22	0.726	<0.001	0.003
Period 1	0.206	0.213	0.313	0.911	0.071	0.208
Period 2	0.325	0.375	0.300	0.442	0.695	0.403
Period 3	0.275	0.313	0.300	0.546	0.686	0.864
Period 4	0.319	0.375	0.388	0.386	0.291	0.871
Period 5	0.300	0.313	0.363	0.843	0.329	0.616
Period 6	0.300	0.275	0.288	0.689	0.842	0.861
Period 7	0.288	0.363	0.263	0.238	0.685	0.174
Period 8	0.338	0.350	0.300	0.848	0.560	0.501
Period 9	0.313	0.325	0.225	0.845	0.157	0.158
Period 10	0.275	0.288	0.300	0.839	0.686	0.863
Period 11	0.313	0.288	0.213	0.692	0.104	0.275
Period 12	0.288	0.350	0.225	0.324	0.303	0.082
Period 13	0.325	0.263	0.250	0.322	0.233	0.857
Period 14	0.363	0.338	0.200	0.703	0.010	0.074
Period 15	0.325	0.325	0.213	1.000	0.070	0.011

Table C.2: *Linear probability model of withdrawals (first session halves only)*

	Dependent Variable: Withdraw (0/1)			
	(1)	(2)	(3)	(4)
Gates	0.013	0.044	0.033	0.032
	(0.058)	(0.048)	(0.039)	(0.040)
Fees	-0.028	0.083**	0.068*	0.052
	(0.049)	(0.040)	(0.038)	(0.045)
Period		0.004	-0.007**	-0.006**
		(0.004)	(0.003)	(0.003)
Fees×Period		-0.014***	-0.011***	-0.011**
		(0.005)	(0.004)	(0.004)
Gates×Period		-0.004	-0.003	-0.003
		(0.005)	(0.004)	(0.004)
Avg. Withdr. Req. (1 to t-2)			0.031***	0.029***
			(0.010)	(0.009)
Withdr. Req. (t-1)			0.098***	0.091***
			(0.012)	(0.011)
Female				-0.042
				(0.026)
Age				-0.002
				(0.005)
Risk Tolerance				-0.034***
				(0.008)
Cognitive				-0.033**
				(0.013)
Fin. Trust				-0.001
				(0.006)
Constant	0.303***	0.269***	0.052	0.377***
	(0.040)	(0.026)	(0.032)	(0.122)
Observations	4,800	4,800	4,800	4,755
R^2	0.001	0.004	0.050	0.083

Standard errors clustered at the session-matching group level are reported in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table C.3: *Random-effects panel logit model estimated using data from the first halves of sessions only*

	Dependent Variable: Withdraw (0/1)			
	Marginal Effects Reported			
	(1)	(2)	(3)	(4)
Gates	0.062	0.278	0.239	0.225
	(0.401)	(0.340)	(0.315)	(0.318)
Fees	-0.138	0.621**	0.574**	0.468
	(0.345)	(0.288)	(0.283)	(0.320)
Period		0.030	0.005	0.004
		(0.025)	(0.022)	(0.022)
Fees×Period		-0.097***	-0.088***	-0.086***
		(0.032)	(0.031)	(0.032)
Gates×Period		-0.027	-0.022	-0.022
		(0.032)	(0.029)	(0.029)
Avg. Withdr. Req. (1 to t-2)			-0.002	-0.001
			(0.057)	(0.056)
Withdr. Req. (t-1)			0.341***	0.341***
			(0.065)	(0.065)
Female				-0.277
				(0.206)
Age				-0.023
				(0.032)
Risk Tolerance				-0.241***
				(0.065)
Cognitive				-0.287***
				(0.110)
Fin. Trust				0.000
				(0.047)
Constant	-1.248***	-1.490***	-2.112***	0.264
	(0.284)	(0.211)	(0.246)	(0.840)
Observations	4,800	4,800	4,800	4,755
Number of Participants	320	320	320	317

Standard errors clustered at the session-matching group level are reported in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table C.4: *Random-effects panel linear probability model, using the data from both session halves*

	Dependent Variable: Withdraw (0/1)			
	(1)	(2)	(3)	(4)
Gates	0.008	0.013	-0.012	-0.014
	(0.024)	(0.035)	(0.031)	(0.032)
Fees	-0.014	0.085***	0.050*	0.048
	(0.021)	(0.033)	(0.029)	(0.030)
Period		0.004	-0.000	-0.000
		(0.004)	(0.003)	(0.003)
Fees×Period		-0.012***	-0.009***	-0.009***
		(0.004)	(0.003)	(0.003)
Gates×Period		-0.001	0.002	0.002
		(0.004)	(0.004)	(0.004)
Avg. Withdr. Req. (1 to t-2)			-0.001	-0.001
			(0.001)	(0.001)
Withdr. Req. (t-1)			0.060***	0.060***
			(0.008)	(0.008)
Female				-0.039*
				(0.023)
Age				-0.003
				(0.004)
Risk Tolerance				-0.039***
				(0.008)
Cognitive				-0.034***
				(0.012)
Fin. Trust				0.002
				(0.006)
Constant	0.299***	0.265***	0.157***	0.509***
	(0.028)	(0.025)	(0.027)	(0.104)
Observations	9,600	9,600	9,600	9,510
Number of Participants	320	320	320	317

Standard errors clustered at the session-matching group level are reported in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

C.2 Switching Regimes

Table C.5: *Withdrawal rates and one-sided p-values (H1: Baseline > Gates) by period in the Baseline–Gates constellation*

Periods	**Baseline**	**Gates**	**P-value (One-sided)**
All	0.398	0.408	0.676
1–5	0.340	0.375	0.849
6–10	0.403	0.433	0.440
11–15	0.453	0.415	0.142
Period 1	0.275	0.300	0.637
Period 2	0.388	0.363	0.372
Period 3	0.338	0.388	0.745
Period 4	0.400	0.425	0.626
Period 5	0.300	0.400	0.908
Period 6	0.400	0.425	0.626
Period 7	0.400	0.425	0.626
Period 8	0.425	0.400	0.374
Period 9	0.413	0.425	0.564
Period 10	0.375	0.488	0.925
Period 11	0.450	0.450	0.500
Period 12	0.388	0.450	0.789
Period 13	0.475	0.413	0.213
Period 14	0.488	0.438	0.263
Period 15	0.463	0.325	0.038

Table C.6: *Withdrawal rates and one-sided p-values (H1: Baseline > Fees) by periods in the Baseline–Fees constellation*

Periods	**Baseline**	**Fees**	**P-value (One-sided)**
All	0.208	0.194	0.193
1–5	0.230	0.248	0.719
6–10	0.203	0.198	0.430
11–15	0.193	0.138	0.018
Period 1	0.138	0.313	0.996
Period 2	0.263	0.263	0.500
Period 3	0.213	0.200	0.423
Period 4	0.238	0.225	0.426
Period 5	0.300	0.238	0.186
Period 6	0.200	0.200	0.500
Period 7	0.175	0.175	0.500
Period 8	0.250	0.250	0.500
Period 9	0.213	0.175	0.274
Period 10	0.175	0.188	0.581
Period 11	0.175	0.113	0.130
Period 12	0.188	0.125	0.138
Period 13	0.175	0.150	0.334
Period 14	0.238	0.175	0.164
Period 15	0.188	0.125	0.138

Table C.7: *Withdrawal rates and one-sided p-values (H1: Gates > Fees) by periods in the Gates-Fees constellation*

Periods	**Gates**	**Fees**	**P-value (One-sided)**
All	0.317	0.291	0.084
1–5	0.318	0.325	0.590
6–10	0.320	0.278	0.095
11–15	0.313	0.270	0.093
Period 1	0.213	0.350	0.974
Period 2	0.375	0.338	0.310
Period 3	0.313	0.363	0.748
Period 4	0.375	0.300	0.158
Period 5	0.313	0.275	0.301
Period 6	0.275	0.263	0.429
Period 7	0.363	0.250	0.061
Period 8	0.350	0.250	0.084
Period 9	0.325	0.300	0.367
Period 10	0.288	0.325	0.697
Period 11	0.288	0.313	0.635
Period 12	0.350	0.188	0.010
Period 13	0.263	0.275	0.571
Period 14	0.338	0.263	0.150
Period 15	0.325	0.313	0.433

Table C.8: *Withdrawal rates and one-sided p-values (H1: Gates > Fees) by periods in the Fees–Gates constellation*

Periods	**Fees**	**Gates**	**P-value (One-sided)**
All	0.276	0.278	0.446
1–5	0.333	0.250	0.995
6–10	0.275	0.275	0.500
11–15	0.220	0.310	0.002
Period 1	0.313	0.213	0.925
Period 2	0.300	0.238	0.814
Period 3	0.300	0.238	0.814
Period 4	0.388	0.275	0.935
Period 5	0.363	0.288	0.844
Period 6	0.288	0.263	0.638
Period 7	0.263	0.275	0.429
Period 8	0.300	0.263	0.701
Period 9	0.225	0.300	0.141
Period 10	0.300	0.275	0.637
Period 11	0.213	0.338	0.038
Period 12	0.225	0.250	0.355
Period 13	0.250	0.325	0.147
Period 14	0.200	0.338	0.025
Period 15	0.213	0.300	0.103

Table C.9: *Random-effects panel linear probability models of withdrawals: Baseline–Gates*

	Dependent Variable: Withdraw (0/1)			
	(1)	(2)	(3)	(4)
Gates	0.009	0.001	0.088	0.084
	(0.034)	(0.047)	(0.060)	(0.063)
Period		0.011*	0.004	0.004
		(0.006)	(0.005)	(0.005)
Gates×Period		-0.007	-0.006	-0.006
		(0.006)	(0.005)	(0.005)
Avg. Withdr. Req. (1 to t-2)			0.007	0.006
			(0.010)	(0.010)
Withdr. Req. (t-1)			0.062***	0.061***
			(0.018)	(0.018)
Female				-0.006
				(0.047)
Age				0.007
				(0.017)
Risk Tolerance				-0.045***
				(0.011)
Cognitive				-0.024
				(0.034)
Fin. Trust				0.016
				(0.010)
Constant	0.398***	0.314***	0.186***	0.271
	(0.048)	(0.035)	(0.056)	(0.328)
Observations	2,400	2,400	2,400	2,370
Number of Participants	80	80	80	79

Standard errors clustered at the session-matching group level are reported in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table C.10: *Random-effects panel linear probability models of withdrawals: Baseline–Fees*

	Dependent Variable: Withdraw (0/1)			
	(1)	(2)	(3)	(4)
Fees	-0.014	0.207***	0.280***	0.277***
	(0.027)	(0.070)	(0.092)	(0.092)
Period		-0.002	-0.007***	-0.007***
		(0.003)	(0.002)	(0.002)
Fees×Period		-0.008**	-0.007**	-0.007**
		(0.003)	(0.003)	(0.003)
Avg. Withdr. Req. (1 to t-2)			0.020	0.019
			(0.018)	(0.018)
Withdr. Req. (t-1)			0.047***	0.045***
			(0.013)	(0.013)
Female				-0.048
				(0.053)
Age				-0.004
				(0.015)
Risk Tolerance				-0.024*
				(0.013)
Cognitive				-0.060***
				(0.021)
Fin. Trust				0.009
				(0.009)
Constant	0.208***	0.225***	0.119***	0.397
	(0.050)	(0.028)	(0.035)	(0.349)
Observations	2,400	2,400	2,400	2,400
Number of Participants	80	80	80	80

Standard errors clustered at the session-matching group level are reported in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table C.11: *Random-effects panel linear probability models of withdrawals: Gates–Fees*

	Dependent Variable: Withdraw (0/1)			
	(1)	(2)	(3)	(4)
Fees	-0.026	0.086*	0.183***	0.185***
	(0.034)	(0.050)	(0.064)	(0.065)
Period		0.000	-0.005*	-0.005*
		(0.003)	(0.003)	(0.003)
Fees×Period		-0.005**	-0.004**	-0.004**
		(0.002)	(0.002)	(0.002)
Avg. Withdr. Req. (1 to t-2)			0.028*	0.029*
			(0.016)	(0.017)
Withdr. Req. (t-1)			0.026**	0.026**
			(0.011)	(0.011)
Female				-0.037
				(0.039)
Age				0.000
				(0.007)
Risk Tolerance				-0.042***
				(0.016)
Cognitive				-0.035**
				(0.018)
Fin. Trust				-0.012
				(0.013)
Constant	0.317***	0.313***	0.229***	0.600***
	(0.044)	(0.042)	(0.044)	(0.151)
Observations	2,400	2,400	2,400	2,400
Number of Participants	80	80	80	80

Standard errors clustered at the session-matching group level are reported in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table C.12: *Random-effects panel linear probability models of withdrawals: Fees–Gates*

	Dependent Variable: Withdraw (0/1)			
	(1)	(2)	(3)	(4)
Gates	0.003	-0.217***	-0.098	-0.108
	(0.037)	(0.080)	(0.076)	(0.076)
Period		-0.010***	-0.015***	-0.014***
		(0.003)	(0.003)	(0.004)
Gates×Period		0.016***	0.016***	0.016***
		(0.003)	(0.003)	(0.003)
Avg. Withdr. Req. (1 to t-2)			0.025	0.024
			(0.016)	(0.016)
Withdr. Req. (t-1)			0.040***	0.043***
			(0.014)	(0.015)
Female				-0.074
				(0.053)
Age				-0.010**
				(0.004)
Risk Tolerance				-0.026
				(0.021)
Cognitive				-0.046*
				(0.024)
Fin. Trust				-0.003
				(0.009)
Constant	0.276***	0.352***	0.241***	0.693***
	(0.029)	(0.031)	(0.040)	(0.205)
Observations	2,400	2,400	2,400	2,340
Number of Participants	80	80	80	78

Standard errors clustered at the session-matching group level are reported in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

C.3 Convergence

Table C.13: *Change in withdrawal rates over time by treatment, estimated using random-effects panel linear probability models of withdrawals*

	Dependent Variable: Withdraw (0/1)			
	(1)	(2)	(3)	(4)
Baseline				
Period	0.004	0.004	-0.000	0.000
	(0.004)	(0.004)	(0.003)	(0.003)
Gates				
Period	0.004*	0.004*	0.002	0.002
	(0.002)	(0.002)	(0.002)	(0.002)
Fees				
Period	-0.008***	-0.008***	-0.009***	-0.009***
	(0.002)	(0.002)	(0.002)	(0.002)
Controls				
Constellations	No	Yes	Yes	Yes
Sessions	No	Yes	Yes	Yes
Ind. History	No	No	Yes	Yes
Ind. Characteristics	No	No	No	Yes

Standard errors clustered at the session-matching group level are reported in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

D Instructions

D.1 Instructions for the Baseline Treatment

Welcome to this experiment!

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

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

Remember that all the decisions that you make during the experiment are anonymous and will not be linked to you. If you have any doubts or questions during the experiment, please raise your hand, and we will come to you. Also, please switch off your mobile phone and refrain from speaking during the experiment.

What is the experiment about?

The mutual fund and its investment project

You will be paired randomly with three other participants in this room. All of you receive 1 ECU that will be automatically invested in a mutual fund. The fund thus has four investors and a total capital of 4 ECUs.

Of the total capital of 4 ECUs, the fund keeps 2 ECUs as a cash reserve, and it invests the other 2 ECUs in a profitable investment project. The project has no risk and will yield a sure positive return that the fund pays to its investors. However, time is needed to obtain this return. If too many investors withdraw their money early from the fund, the fund needs to liquidate the project at a loss.

Timing and decisions

There are two periods: period 1 and period 2.

Remember that the fund invests 2 ECUs in the investment project, while it keeps the other 2 ECUs as a cash reserve.

The fund can either liquidate the investment project in period 1, or it can let the project continue until period 2. If the project is liquidated in period 1, then the project pays 1 ECU in period 1 and nothing in period 2. If the project is continued until period 2, then it pays 3 ECUs in period 2.

The timing in period 1 is as follows:

1. **At the start of period 1,** all four investors (including yourself) have to choose between withdrawing their money (1 ECU) from the fund or keeping it invested. The order in which investors are asked (that is, who is asked first, second, third and fourth) is determined randomly by the computer. At some point, you will be called to decide. When you are asked, the fund does not disclose how many of the other investors were asked before you and how they decided. If you decide to withdraw, the fund pays you 1 ECU immediately, and the round ends for you.

2. **At the end of period 1,** two of the four investors will be randomly selected by the computer, and these investors will experience an urgent need for money. If an investor with an urgent need for money chose to remain invested at the start of period 1, then this investor will be forced to withdraw from the fund now. If both investors with an urgent need for money chose to remain invested in the fund, the computer determines randomly which one is paid out first. Importantly, at the start of period 1 when investors decide whether to withdraw, they do not yet know who will have an urgent need for money at the end of period 1.

Payouts in period 1

The fund uses its cash reserve of 2 ECUs to pay out the first two investors who withdraw in period 1. If a third investor withdraws in period 1, the fund liquidates its project in order to pay out 1 ECU to the third investor. Once the project is liquidated, the fund has nothing left to pay to the fourth investor. If three investors withdraw during period 1, the fund therefore pays 1 ECU to these three investors and nothing to the fourth investor.

The following table summarizes the fund's payouts in period 1:

Period 1 Payouts		
First investor who withdraws	1 ECU	Cash reserve
Second investor who withdraws	1 ECU	Cash reserve
Third investor who withdraws	1 ECU	Project liquidated
Fourth investor	0 ECU	-

Payouts in period 2

If only the two investors with an urgent need for money withdraw in period 1, then the fund can pay them out using its cash reserve of 2 ECUs, without having to liquidate its investment project. The fund then receives 3 ECUs from the investment project in period 2, and the two investors who did not withdraw in period 1 each receive 1.5 ECUs in period 2.

If three investors withdraw in period 1, then the fund liquidates the investment project and pays out nothing in period 2. This happens if at least one investor without an urgent need for money chose to withdraw at the start of period 1.

An example

To ensure that you understand the situation in which you have to decide, here, we present an example.

There are four investors in the fund: Ann, Bob, Chris, and Dora. At the start of period 1, the computer randomly determines the order in which the investors are asked to decide whether they want to withdraw their money. Suppose that Ann is asked first, Bob second, Chris third and Dora last:

Order of Withdrawal Decisions at the Start of Period 1			
First	**Second**	**Third**	**Fourth**
Ann	Bob	Chris	Dora

Remember that when the investors decide whether to withdraw their money at the start of period 1, they do not yet know which two investors will experience an urgent need for money at the end of period 1.

Suppose Ann and Bob choose to stay invested, while Chris and Dora choose to withdraw. The fund will then pay out 1 ECU to Chris and Dora at the start of period 1, using its cash reserve of 2 ECUs. What happens next depends on which two investors experience an urgent money need at the end of period 1. Consider the following three cases:

1. *Case 1: Chris and Dora turn out to be the ones with urgent money needs.* In this case, no further withdrawals occur at the end of period 1 since Chris and Dora have already withdrawn. The fund does not need to liquidate the project, and Ann and Bob both receive 1.5 ECUs in period 2. In this case, the payoffs are: Ann – 1.5, Bob – 1.5, Chris – 1, Dora – 1.

2. *Case 2: Ann and Dora turn out to be the ones with urgent money needs.* Since Ann did not withdraw at the start of period 1, she is forced to withdraw at the end of period 1. Since the fund has already paid out its entire cash reserve to Chris and Dora, the fund needs to liquidate the project to pay out Ann. The fund therefore has nothing left to pay to Bob, who decided to remain invested. In this case, the payoffs are: Ann – 1, Bob – 0, Chris – 1, Dora – 1.

3. *Case 3: Ann and Bob turn out to be the ones with urgent money needs.* In this case, both Ann and Bob will be forced to withdraw at the end of period 1, since none of them withdrew at the start of period 1. However, the fund has already used its cash reserve to pay out Chris and Dora. The fund can therefore pay out only one more investor at the end of period 1 by liquidating the project. The computer then determines randomly whether Ann or Bob is paid out. Suppose Bob is paid out. In this case, the payoffs are: Ann – 0, Bob – 1, Chris -1, Dora – 1.

Control questions

1. You are asked whether you want to withdraw 1 ECU from the fund at the start of period 1. What are the possible payoffs you can receive if you decide not to withdraw?

   A. 0 or 1

   B. 1 or 1.5

   C. 0, 1 or 1.5

   D. exactly 1

2. Suppose you choose to remain invested at the start of period 1, and you do not experience an urgent need for money at the end of period 1. If only the two investors with an urgent money need withdraw in period 1, what is your payoff?

   A. 1

   B. 1.5

   C. 0

   D. none of the previous

3. Suppose you are the only investor who chooses not to withdraw at the start of period 1. What is your payoff?

   A. 1

   B. 1.5

   C. 0

   D. none of the previous

4. Suppose you have an urgent need for money at the end of period 1. What are your possible payoffs?

A. 0 or 1

B. 1 or 1.5

C. 0 or 1.5

D. 0, 1 or 1.5

5. Suppose you do not have an urgent need for money at the end of period 1. What is your maximum possible payoff?

   A. 1

   B. 1.5

   C. 0

   D. none of the previous

D.2 Instructions for the Fees Treatment

Welcome to this experiment!

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

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

Remember that all the decisions that you make during the experiment are anonymous and will not be linked to you. If you have any doubts or questions during the experiment, please raise your hand, and we will come to you. Also, please switch off your mobile phone and refrain from speaking during the experiment.

What is the experiment about?

The mutual fund and its investment project

You will be paired randomly with three other participants in this room. All of you receive 1 ECU that will be automatically invested in a mutual fund. The fund thus has four investors and a total capital of 4 ECUs.

Of the total capital of 4 ECUs, the fund keeps 2 ECUs as a cash reserve, and it invests the other 2 ECUs in a profitable investment project. The project has no risk and will yield a sure positive return that the fund pays to its investors. However, time is needed to obtain this return. If too many investors withdraw their money early from the fund, the fund needs to liquidate the project at a loss.

Timing and decisions

There are two periods: period 1 and period 2.

Remember that the fund invests 2 ECUs in the investment project, while it keeps the other 2 ECUs as a cash reserve. The fund can either liquidate the investment project in period 1, or it can let the project continue until period 2.

If the entire project is liquidated in period 1, then the project pays 1 ECU in period 1 and nothing in period 2. If the entire project is continued until period 2, then it pays 3 ECUs in period 2.

The fund can also choose to liquidate half of the project in period 1 and continue the other half of the project until period 2. In this case, the fund receives 0.5 ECUs in period 1 from the liquidated part of the project and 1.5 ECUs in period 2 from the part that is continued.

The timing in period 1 is as follows:

1. **At the start of period 1,** all four investors (including yourself) have to choose between withdrawing their money from the fund or keep it invested. The order in which investors are asked (that is, who is asked first, second, third and fourth) is determined randomly by the computer. At some point, you will be called to decide.

   When you are asked, the fund tells you how much you receive if you decide to withdraw. The fund does *not* disclose how many of the other investors were asked before you and how they decided. If you decide to withdraw, the fund pays you out immediately, and the round ends for you.

2. **At the end of period 1,** two of the four investors will be randomly selected by the computer, and these investors will experience an urgent need for money. If an investor with an urgent need for money chose to remain invested at the start of period 1, then this investor will be forced to withdraw from the fund now. Importantly, at the start of period 1 when investors decide whether to withdraw, they do not yet know who will have an urgent need for money at the end of period 1.

Payouts in period 1

The fund pays out 1 ECU to the first two investors who withdraw in period 1, using its cash reserve of 2 ECUs. If a third investor withdraws in period 1, the fund liquidates half of the project and pays out 0.5 ECUs to the third investor. If the fourth investor also withdraws, the fund liquidates the other half of the project and pays 0.5 ECUs to the fourth investor.

The following table summarizes the fund's payouts in period 1:

Period 1 Payouts		
First investor who withdraws	1 ECU	Cash reserve
Second investor who withdraws	1 ECU	Cash reserve
Third investor who withdraws	0.5 ECU	Half of the project liquidated
Fourth investor	0.5 ECU	Half of the project liquidated

Payouts in period 2

Due to the return obtained from the investment project, the fund can pay 1.5 ECUs in period 2 to any investor who remains invested until period 2.

An example

To ensure that you understand the situation in which you have to decide, here, we present an example.

There are four investors in the fund: Ann, Bob, Chris, and Dora. At the start of period 1, the computer randomly determines the order in which the investors are asked to decide whether they want to withdraw their money. Suppose Ann is asked first, Bob second, Chris third and Dora last:

Order of Withdrawal Decisions at the Start of Period 1			
First	**Second**	**Third**	**Fourth**
Ann	Bob	Chris	Dora

Remember that, when the investors decide whether to withdraw their money at the start of period 1, they do not yet know which two investors will experience an urgent need for money at the end of period 1.

Suppose Ann and Bob choose to stay invested, while Chris and Dora choose to withdraw. The fund will then pay out 1 ECU to Chris and Dora at the start of period 1, using its cash reserve of 2 ECUs. What happens next depends on which two investors experience an urgent money need at the end of period 1. Consider the following three cases:

1. *Case 1: Chris and Dora turn out to be the ones with urgent money needs.* In this case, no further withdrawals occur at the end of period 1 since Chris and Dora have already withdrawn. The fund can continue the entire investment project until period 2. In this case, the payoffs are: Ann – 1.5, Bob – 1.5, Chris – 1, Dora – 1.

2. *Case 2: Ann and Dora turn out to be the ones with urgent money needs.* Since Ann did not withdraw at the start of period 1, she is forced to withdraw at

the end of period 1. Since the fund has already paid out its entire cash reserve to Chris and Dora, the fund needs to liquidate half the project and pays out 0.5 ECUs to Ann. In this case, the payoffs are: Ann – 0.5, Bob – 1.5, Chris – 1, Dora – 1.

3. *Case 3: Ann and Bob turn out to be the ones with urgent money needs.* In this case, both Ann and Bob will be forced to withdraw at the end of period 1 since none of them withdrew at the start of period 1. Since the fund has already used its cash reserve to pay out Chris and Dora, the fund needs to liquidate the entire investment project in period 1 to pay 0.5 ECUs to Ann and Bob. In this case, the payoffs are: Ann – 0.5, Bob – 0.5, Chris -1, Dora – 1.

Control questions

1. You are asked whether you want to withdraw 1 ECU from the fund at the start of period 1. What are the possible payoffs you can receive if you decide not to withdraw?

   A. 0.5 or 1

   B. 1 or 1.5

   C. 0.5 or 1.5

   D. 0.5, 1 or 1.5

2. You are asked whether you want to withdraw at the start of period 1, and the fund tells you that you receive 0.5 ECUs if you withdraw. How many other investors have withdrawn before you?

   A. 1 or 2

   B. 2 or 3

   C. 1,2 or 3

   D. none of the previous

3. Suppose you choose not to withdraw at the start of period 1, and you do not experience an urgent need for money at the end of period 1. What is your payoff?

   A. 1

   B. 1.5

   C. 0

D. none of the previous

4. Suppose you are the only investor who chooses not to withdraw at the start of period 1. What are your possible payoffs?

    A. 0.5 or 1

    B. 1 or 1.5

    C. 0.5 or 1.5

    D. 0.5, 1 or 1.5

5. Suppose you choose not to withdraw at the start of period 1 and you experience an urgent need for money at the end of period 1. What are your possible payoffs?

    A. 0.5 or 1

    B. 1 or 1.5

    C. 0.5 or 1.5

    D. 0.5, 1 or 1.5

D.3 Instructions for the Gates Treatment

Welcome to this experiment!

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

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

Remember that all the decisions that you make during the experiment are anonymous and will not be linked to you. If you have any doubts or questions during the experiment, please raise your hand, and we will come to you. Also, please switch off your mobile phone and refrain from speaking during the experiment.

What is the experiment about?

The mutual fund and its investment project

You will be paired randomly with three other participants in this room. All of you receive 1 ECU that will be automatically invested in a mutual fund. The fund thus has four investors and a total capital of 4 ECUs.

Of the total capital of 4 ECUs, the fund keeps 2 ECUs as a cash reserve, and it invests the other 2 ECUs in a profitable investment project. The project has no risk and will yield a sure positive return that the fund pays to its investors. However, time is needed to obtain this return.

Timing and decisions

There are two periods: period 1 and period 2.

Remember that the fund invests 2 ECUs in the investment project, while it keeps the other 2 ECUs as a cash reserve. The project pays a return of 3 ECUs in period 2, and it does not pay anything in period 1.

The timing in period 1 is as follows:

1. **At the start of period 1,** all four investors (including yourself) have to choose between withdrawing their money (1 ECU) from the fund or keep it invested. The order in which investors are asked (that is, who is asked first, second, third and fourth) is determined randomly by the computer. At some point, you will be called to decide. When you are asked, the fund does not disclose how many of the other investors were asked before you and how they decided. If you decide to withdraw, the fund pays you 1 ECU immediately, and the round ends for you.

2. **At the end of period 1,** two of the four investors will be randomly selected by the computer, and these investors will experience an urgent need for money. If an investor with an urgent need for money chose to remain invested at the start of period 1, then this investor will be forced to withdraw from the fund now. If both investors with an urgent need for money chose to remain invested in the fund, the computer determines randomly which one is paid out first. Importantly, at the start of period 1 when investors decide whether to withdraw, they do not yet know who will have an urgent need for money at the end of period 1.

Payouts in period 1

The fund uses its cash reserve of 2 ECUs to pay out the first two investors who withdraw in period 1. After two investors have been paid out in period 1, the fund has no cash left and does not allow any further withdrawals in period 1.

The following table summarizes the fund's payouts in period 1:

Period 1 Payouts		
First investor who withdraws	1 ECU	Cash reserve
Second investor who withdraws	1 ECU	Cash reserve
After two investors have withdrawn, no further withdrawals are allowed in period 1.		

Payouts in period 2

Due to the return obtained from the investment project, the fund can pay 1.5 ECUs in period 2 to any investor who remains invested until period 2. However, investors who experience an urgent need for money at the end of period 1 absolutely need money in period 1, and a payment in period 2 is worthless for them.

If an investor who chose not to withdraw at the start of period 1 experiences an urgent money need at the end of period 1, but the fund no longer allows withdrawals in period 1 (because two other investors have already withdrawn in period 1), then this investor receives a payoff of zero.

If an investor decides not to withdraw at the start of period 1 and the investor does not experience an urgent need for money at the end of period 1, then this investor receives a payoff of 1.5 ECUs in period 2.

An example

To ensure that you understand the situation in which you have to decide, here we present an example.

There are four investors in the fund: Ann, Bob, Chris, and Dora. At the start of period 1, the computer determines randomly the order in which the investors are asked to decide whether they want to withdraw their money. Suppose Ann is asked first, Bob second, Chris third and Dora last:

Order of Withdrawal Decisions at the Start of Period 1			
First	**Second**	**Third**	**Fourth**
Ann	Bob	Chris	Dora

Remember that, when the investors decide whether to withdraw their money at the start of period 1, they do not yet know which two investors will experience an urgent need for money at the end of period 1.

Suppose Ann chooses to withdraw while Bob, Chris and Dora choose to remain invested. The fund will then pay out 1 ECU to Ann at the start of period 1, using its cash reserve of 2 ECUs. What happens next depends on which two investors experience an urgent money need at the end of period 1. Consider the following two cases:

1. *Case 1: Ann and Bob turn out to be the ones with urgent money needs.* Since Bob did not withdraw at the start of period 1, he is forced to withdraw at the end of period 1. Since only one investor (Ann) has withdrawn at the start of period 1, the fund still has 1 ECU in cash reserves that the fund pays out to Bob. Chris and Dora are paid 1.5 ECUs in period 2. In this case, the payoffs are: Ann – 1, Bob – 1, Chris – 1.5, Dora – 1.5.

2. *Case 2: Chris and Dora turn out to be the ones with urgent money needs.* In this case, both Chris and Dora will be forced to withdraw at the end of period 1 since none of them withdrew at the start of period 1. However, the fund only has 1 ECU in cash reserves since Ann has withdrawn at the start of period 1. The computer chooses randomly whether Chris or Dora will receive the payout at the end of period 1. Suppose that Chris receives the payout. In this case, the payoffs are: Ann – 1, Bob – 1.5, Chris – 1, Dora – 0.

Control questions

1. You are asked whether you want to withdraw 1 ECU from the fund at the start of period 1. What are the possible payoffs you can receive if you decide not to withdraw?

   A. 0 or 1

   B. 1 or 1.5

   C. 0, 1, or 1.5

   D. exactly 1

2. Suppose you choose not to withdraw at the start of period 1, and you do not experience an urgent need for money at the end of period 1. What is your payoff?

   A. 1

   B. 1.5

   C. 0

   D. none of the previous

3. Suppose you choose not to withdraw at the start of period 1 and two other investors choose to withdraw. You then experience an urgent need for money at the end of period 1. What is your payoff?

   A. 1

B. 1.5

C. 0

D. none of the previous

4. Suppose you have an urgent need for money at the end of period 1. What are your possible payoffs?

   A. 0 or 1

   B. 1 or 1.5

   C. 0 or 1.5

   D. 0, 1 or 1.5

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