

Online Appendix for ‘Ten isn’t large! Group size and coordination in a large-scale experiment’*

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Appendix A Equilibrium selection: technical appendix

This section collects the equilibrium outcomes from a wide range of selection criteria in coordination games; see the summary in Table 1. For the purpose of our experiment, we present the generalization to an $n > 2$ -player game. We refer the reader to Kim (1996, Sec. 3–4) for the details of the derivation of the five criteria below with n players. For the sake of clarity, we adopt the same notations. Within the context of our game, the ‘L’ equilibrium is the sub-optimal ‘run’ equilibrium, and the Pareto-optimal equilibrium ‘H’ corresponds to ‘wait’. The payoff of waiting when k players wait and, hence, $n - k$ players withdraw is given by:

$$\pi_k^H = \max \left(0, R \frac{n - r(n - k)}{k} \right) \quad (1)$$

where the subscript denotes the total number of players adopting the strategy ‘H’/‘wait’.¹ Similarly, the payoff of withdrawing when k players withdraw and $n - k$ wait is given by:

$$\pi_k^L = \min \left(r, \frac{n}{k} \right) \quad (2)$$

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¹Note that this notation might differ from the notation in the main text. The reason is that, in line with previous experimental studies, we opted to index by the number of withdrawals in a given period (Arifovic & Jiang 2019), whereas Kim (1996) measures the number of people choosing ‘wait’.

<i>Payoff structure</i>		$r = 1.54$		$r = 1.33$	
		$N = 10$	$N = 100$	$N = 10$	$N = 100$
<i>Group size</i>					
<i>Equilibrium refinement criteria</i>	Security/minmax	‘Run’	‘Run’	‘Run’	‘Run’
	Payoff-dominance	‘Wait’	‘Wait’	‘Wait’	‘Wait’
		(∀N)		(∀N)	
	Risk-dominance	‘Run’	‘Run’	‘Run’	‘Run’
		(for $N > 2$)		(for $N > 3$)	
	Maximization of potential	‘Run’	‘Run’	‘Run’	‘Run’
	Global payoff uncertainty	‘Run’	‘Run’	‘Run’	‘Run’
Dynamic random matching	‘Run’	‘Run’	‘Run’	‘Run’	
		(for $N > 2$)		(for $N > 6$)	
Evolutionary dynamics	‘Run’	‘Run’	‘Wait’	‘Wait’	
		(for $N > 2$)		(∀N)	

Notes: Computations based on Kim (1996) and Monderer & Shapley (1996), see hereafter. This table does not distinguish between the different persistence parameters, as they do not affect the selected equilibria. For simplicity we work with large groups of 100 in theory. However, the results do not differ if we work with $N = 75-90$.

Table 1: Equilibrium refinements in the experimental treatments with respect to N and r

In particular, we have the payoff from waiting when all other players withdraw: $\pi_1^H = 0$ if $r \geq \frac{n}{n-1}$, and $R[n - r(n - 1)]$ otherwise (i.e., $\pi_1^H = \max(0, R[n - r(n - 1)])$). The payoff of withdrawing when all other players wait is $\pi_1^L = r$. The payoff of withdrawing when all players do so as well is given by $\pi_n^L = 1$, and the payoff of waiting when all players do so is given by $\pi_n^H = R$, with $R = 2$ in our experiment.

We present seven criteria and their respective predictions. The first five involve a static selection process, while the final two correspond to a dynamic form of selection. In the generalization to n -player games, it is assumed that every player is repeatedly and randomly matched to play the game with $n - 1$ other players, out of a finite or infinite population of $N \gg n$ players. To stay close to the design of the experiment, we can think of the limit case in which $N \rightarrow \infty$ or is arbitrarily large. We are interested in the effects of n , the size of the game, on the equilibrium selection outcome.

A.1 Security and payoff dominance

The minmax criterion of von Neumann and the payoff-dominance criterion (Harsanyi & Selten 1988) do not depend on the parameters r or N . It is easy to see that ‘run’ is always the secure strategy, i.e., the strategy that maximizes the minimum possible payoff. By ‘running’, a player can ensure a minimum payoff of 1 irrespective of the behavior of the others, while the strategy ‘wait’ exposes players to the risk of a zero payoff. The ‘wait’ equilibrium is clearly payoff-dominant, as it can deliver the maximum return $R = 2 > r$.

A.2 Risk-dominance (Harsanyi & Selten 1988)

The ‘wait’ equilibrium is also more risky since it requires that a large enough fraction of the other players coordinate on ‘wait’. This intuition is translated into the notion of risk-dominance that selects an equilibrium based on the relative profits from each action (Harsanyi & Selten 1988). This notion can be generalized to N -player games, see, e.g., Kim (1996) and Monderer & Shapley (1996).

Here we use the infinite N -case in Kim (1996, Eq. 2) to derive the function Φ that maps the share $y \in (0, 1)$ of players choosing the strategy ‘wait’ onto the payoff difference function $\Phi(y)$:

$$\Phi(y) = \sum_{k=1}^n \binom{n-1}{k-1} y^{k-1} (1-y)^{n-k} \phi_k \quad (3)$$

with $\phi_k \equiv \pi_k^H - \pi_{n-k+1}^L$, as given in Eq. (1) and (2). In particular, we have $\Phi(0) < 0 < \Phi(1)$. Figure 1a represents the function Φ for each of our four treatments. Note that the function is not monotone, due to the non-linear payoff functions.

Kim (1996, Eq. 14) states that if the following relation is true:

$$\Phi(1 - \mu_n) > 0, \text{ with } (1 - \mu_n) \equiv \frac{\phi_n}{\phi_n - \phi_1}, \quad (4)$$

(where $1 - \mu_n$ measures the net gain from coordinating on H rather than on L), then the ‘wait’ equilibrium risk-dominates the ‘run’ equilibrium.

Within the bank-run game, we have:

$$1 - \mu_{n,r} = \frac{\pi_n^H - \pi_1^L}{(\pi_n^H - \pi_1^L) + (\pi_n^L - \pi_1^H)} = 1 - \frac{1 - \max(0, R[n - (n-1)r])}{R + 1 - r - \max(0, R[n - (n-1)r])} \quad (5)$$

As is clear from Eq. 5, $1 - \mu_{n,r} \ll n$ as soon as $r \geq \frac{n}{n-1}$, which is the case in all our experimental treatments. Yet the group size n still influences the shape of the function Φ . Furthermore, $1 - \mu_{n,r}$ is decreasing in $r \in (1, R)$ (we use $R = 2$ in our experiment). As $r \rightarrow R = 2$, $1 - \mu_{n,r} \rightarrow 0$ and $\Phi(0) < 0$. Therefore, when r increases, Condition (4) is less likely to hold, and ‘withdraw’ becomes the risk-dominant equilibrium.

In the experimental treatments, $1 - \mu_{n=10,r=1.54} = 1 - \mu_{n=100,r=1.54} = 1 - \mu_{1.54} = 0.315$, and $1 - \mu_{n=10,r=1.33} = 1 - \mu_{n=100,r=1.33} = 1 - \mu_{1.33} = 0.4012$. Those thresholds are reported in Figure 1a. We have $\Phi(0.315) < 0$ and $\Phi(0.4012) < 0$, hence Condition (4) does not hold in any of our experimental treatments and *the criterion of risk-dominance always selects the ‘run’ equilibrium*.

For the purpose of illustration, Figure 1b plots the values of Φ with $r = 1.33$ and $r = 1.54$ as a function of the group size n . Black dots represent the experimental treatments that we consider. The values of Φ , and hence the likelihood of ‘wait’ to risk-dominate, are decreasing in n . For fairly small groups ($n < 3$ with $r = 1.54$ and $n < 4$ with $r = 1.33$), the ‘wait’ equilibrium is risk-dominant. However, the ‘run’ equilibrium becomes risk-dominant for any higher group sizes.

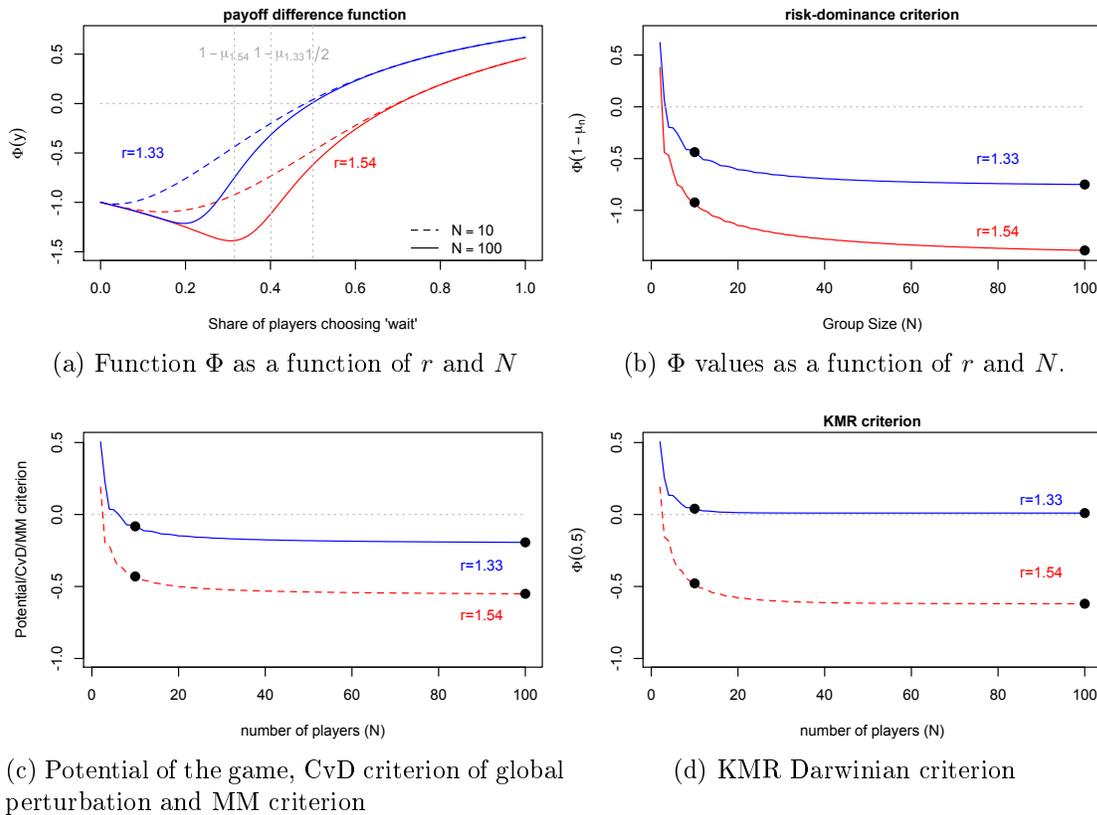


Figure 1: Criteria of equilibrium selection

A.3 Maximization of the potential (Monderer & Shapley 1996)

Another existing equilibrium refinement concept is the maximization of the potential of a game. Monderer & Shapley (1996) show that any congestion game has a potential function, and provide a way of constructing this potential. It is easy to see that our bank-run game is a congestion game, in which players' payoffs only depend on the number of players choosing a given action from a finite set of actions. For our game, the potential function is defined by the following function (isomorph up to a constant):

$$P(A) = \sum_{l=1}^{e_1} \min \left\{ r, \frac{n}{l} \right\} + \sum_{l=1}^{e_2} \max \left\{ 0, \frac{n - (n-l)r}{l} R \right\}, \quad (6)$$

where A denotes an action profile of the players with $a_i \in \{\text{withdraw}, \text{wait}\}$, and e_1 (e_2) is the number of agents withdrawing (waiting) according to A with $e_1 + e_2 = n$. This function is indeed a potential function: if we fix all but 1 player's action and look at how the value of the potential changes by changing the last player's action, we find that this change is exactly the change in the utility of this last player. Thus, $P(A)$ is a potential function of the game. Note that this function is not differentiable everywhere, thus maximization is not straightforward. However, what is most interesting to us is to look at the two pure-strategy equilibria and calculate the potential value in these

equilibria. The equilibrium with the highest potential is the selected one. The potential of the ‘run’ equilibrium is:

$$P(e_1 = n) = \sum_{l=1}^{\lfloor n/r \rfloor} r + \sum_{l=\lceil n/r \rceil}^n \frac{n}{l} = \sum_{k=1}^n \pi_k^L, \quad (7)$$

and the potential of the ‘wait’ equilibrium is:

$$P(e_2 = n) = \sum_{l=1}^{\lfloor n-n/r \rfloor} 0 + \sum_{l=\lceil n-n/r \rceil}^n \frac{n - (n-l)r}{l} R = \sum_{k=1}^n \pi_k^H \quad (8)$$

Therefore, if

$$P(e_2 = n) - P(e_1 = n) > 0 \quad (9)$$

the ‘wait’ equilibrium is selected.

Some algebra shows that (7) is increasing in r , while (8) is decreasing in r (fixing R and n). For (8) this is straightforward: as r increases, we have fewer nonzero elements in the sum, and each element becomes smaller. As for (7), we fix $r' > r$. Then we have $P(e_1 = n) = \sum_{l=1}^{\lfloor n/r' \rfloor} r' + \sum_{l=\lceil n/r' \rceil}^n \frac{n}{l} + \sum_{l=\lceil n/r \rceil}^n \frac{n}{l}$. Since $r' > r$, the number of elements in the first two expressions is exactly the same as in (7), but all of these elements are larger for r' than in (7) with r . Hence, (7) is increasing in r .

Thus, for all group sizes, there is a threshold r^* for which (7) and (8) are equal. For higher short-term rates, Condition (9) is less likely to hold and the ‘run’ equilibrium is more likely to be selected. For smaller values of r , Condition (9) is more likely to hold and the ‘wait’ equilibrium to be selected.

The threshold r^* is also dependent on group size: the higher N , the smaller the region where the ‘wait’ equilibrium is chosen. To see that, Figure 1c displays the LHS of (9) for $n = 2, \dots, 100$ for $r = 1.54$ and $r = 1.33$. The black dots correspond to the experimental treatments. Small population sizes can be relevant here: with $r = 1.54$, ‘wait’ is only selected if $n = 2$, and for $r = 1.33$, ‘wait’ is selected for $n < 7$. However, the threshold values r^* become essentially independent of n as the group size becomes large enough.

From Figure 1c, it is clear that in neither of our treatments does the Condition (9) hold, as the values of the function are all negative. Hence, in our game, *the maximum-potential criterion selects the ‘run’ equilibrium in all our experimental treatments.*

A.4 Global payoff uncertainty (Carlsson & van Damme 1993)

In the global payoff uncertainty approach developed by Carlsson & van Damme (1993), each player observes the payoff matrix with some (small) noise before selecting a strategy. This refinement approach (denoted henceforth by CvD) states that an equilibrium is selected if it is robust with respect to global perturbation. In a two-player game, Carlsson & van Damme (1993) show that the iterated dominance principle selects the risk-dominant equilibrium.²

²Note that the equivalence between the selected equilibrium under the global payoff uncertainty approach and the dynamic random matching framework on the one hand, and the risk-dominant

Following Kim (1996), in our n -player game, the ‘wait’ equilibrium is selected by the CvD criterion if:

$$\frac{1}{n} \sum_{k=1}^n [\pi_k^H - \pi_k^L] > 0 \Leftrightarrow \sum_{k=1}^n \pi_k^H > \sum_{k=1}^n \pi_k^L \quad (10)$$

By noticing that

$$\sum_{k=1}^n \pi_k^L = \sum_{l=1}^{\lfloor n/r \rfloor} r + \sum_{l=\lceil n/r \rceil}^n \frac{n}{l} \quad (11)$$

and

$$\sum_{k=1}^n \pi_k^H = \sum_{l=1}^{\lfloor n-n/r \rfloor} 0 + \sum_{l=\lceil n-n/r \rceil}^n \frac{n - (n-l)r}{l} R \quad (12)$$

it is easy to see that Condition (10) is the same as Condition (9) discussed above. Hence, in our n -player game, the CvD criterion still selects the risk-dominant equilibrium, and *the ‘run’ equilibrium is always selected.*

A.5 Dynamic random matching (Matsui & Matsuyama 1995)

Matsui & Matsuyama (1995) consider a dynamic random matching framework, in which players are rational and maximize their expected future discounted payoffs, but cannot switch strategies at will due to friction. A selected equilibrium is called uniquely absorbing. As shown in Kim (1996), in an n -player game, the ‘wait’ equilibrium is selected if Condition (10) holds. Therefore, in our n -players framework, the equivalence between risk-dominance and equilibrium selection in Matsui & Matsuyama (1995) survives, and this criterion *selects the ‘run’-equilibrium in all our treatments.*

A.6 The evolutionary criterion of Kandori et al. (1993) (KMR hereafter)

The literature on evolutionary game theory provides predictions about the long-run outcome of the repeated version of the game. Kandori et al. (1993) consider an evolutionary criterion in discrete time with a finite population size, guided by the Darwinian principle that the strategy with the highest payoff propagates in the population of strategies at the expense of the worst-performing one. This environment corresponds to the limiting case of Matsui & Matsuyama (1995) where there is no friction and players are myopic – i.e., the best-response myopic dynamics. In this case, each player adopts a best response against the current configuration of the society as a whole: given a proportion y_t of players committed to ‘wait’, a player chooses the ‘wait’ strategy if

equilibrium on the other, is established in a two-player game but does not necessarily hold with $N > 2$ players. The evolutionary criterion of Foster & Young (1990) also always selects ‘run’ but applies only to the limiting case of an infinite population and continuous time and is therefore not directly applicable to our experimental setting, especially in small groups. We report its outcomes here for the sake of completeness.

$\Phi(y_t) > 0$ and the ‘run’ strategy if $\Phi(y_t) < 0$ (and is indifferent between the two in case of strict equality).

Under this evolutionary process, a selected equilibrium is the long-run equilibrium of the game. Following Kim (1996), the ‘wait’ equilibrium is selected if:

$$\Phi\left(\frac{1}{2}\right) = \sum_{k=1}^n \binom{n-1}{k-1} \left(\frac{1}{2}\right)^{n-1} \phi_k > 0 \quad (13)$$

Along the same line of reasoning as in Section A.3, as r increases, ‘withdraw’ is more likely to be selected, and the effect of n is milder as soon as the population size is large enough.

Looking at Figure 1a for 0.5 on the x-axis, Condition (13) holds when $r = 1.33$ and $N = 10$ or 100 ($\Phi(0.5) > 0$), but does not for $r = 1.54$ and $n = 10$ or 100 ($\Phi(0.5) < 0$). Figure 1d displays the values of (13) for the two chosen levels of r and n varying from 2 to 100, with the dots corresponding to our treatments. For $r = 1.54$, (13) is positive and the ‘wait’ equilibrium prevails only for $n = 2$. For $r = 1.33$, the values of (13) are all positive. Independently of r , these values become essentially flat once $n > 20$.

Hence, ‘wait’ is the long-run equilibrium if $r = 1.33$, irrespective of the group size n , and ‘run’ is the long-run equilibrium if $r = 1.54$ as soon as $n > 2$.

A.7 Evolutionary dynamics à la Foster & Young (1990)

The selected equilibrium is the stochastically stable equilibrium. The share of players committed to the ‘wait’ strategy in time t , y_t , evolves according to a deterministic replicator dynamic as: $dy_t = y_t(1 - y_t)\Phi(y_t)dt$. The equilibrium is selected by minimizing the corresponding potential function U defined by:

$$U(y) = - \int_0^y x(1 - x)\Phi(x)dx \quad (14)$$

with $y \in (0, 1)$ indicating as above the share of players choosing to wait. Kim (1996, p. 223) shows that, if $U(1) > 0$, then the ‘run’ equilibrium is stochastically stable. The same holds true for the ‘wait’ equilibrium when $U(1) < 0$. With our payoff functions, with $r = 1.54$, we have $U(1) = 0.076 > 0$ for $n = 10$ and $U(1) = 0.102 > 0$ for $n = 100$, and with $r = 1.33$, we have $U(1) = 0.008 > 0$ with $n = 10$ and $U(1) = 0.028 > 0$ with $n = 100$. Hence, *the ‘run’ equilibrium is always selected.*

Appendix B Participants' characteristics across treatments

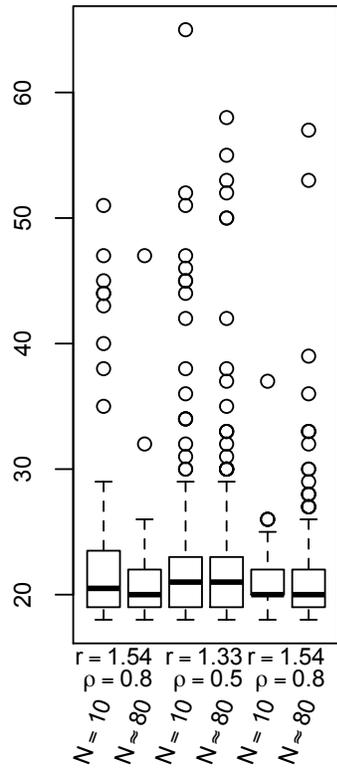
As the sample of participants did not only include students and participants were from different countries, this section reports on the distribution of participants' characteristics across treatments.

Most subjects took part in the experiment in the Valencia lab (about 75%). In compliance with the lab rules at the CREED laboratory (in Amsterdam) and in Valencia, we could collect information about age, gender, field of study (if any) and citizenship. Figure 2 below summarizes the distribution of these four individual characteristics across treatments. We collect nationalities per geographic zone (Latin America, Western Europe including the two US citizens who participated, Eastern Europe, Africa and Asia) and consider the following fields of study: Law and Humanities, Science, Economics and Business, Other or No student.

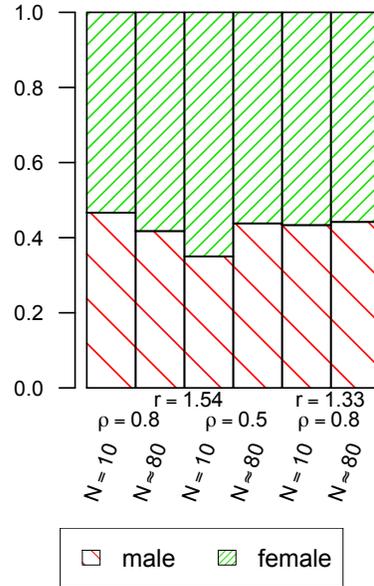
Regarding the age, paired two-sided K-S tests do not reveal any significant differences of age across the 6 treatments (the lowest p-value is 0.19). The minimum age requirement for participation was 18 (the age of majority in Europe) and the vast majority of them were below 25-year-old as the majority of subjects was students. There is no significant difference in the proportion of males and females (the p-value of the Chi-squared 6-sample test for equality of proportions is 0.79). The geographic origin of participants was not significantly different across Amsterdam and Valencia (the p-value of the Chi-squared 6-sample test for equality of proportions is 0.21 for participants of African origin, 0.14 for participants of Asian origin, 0.61 for participants of Eastern European origin and 0.88 for participants of Latin American origin). The majority of the subjects were of Western European origin.

As for the field of study, if any, there is no significant differences in the distribution of subjects across our two locations. The p-value of the Chi-squared test for the proportion of non-students across the two locations is 0.19, 0.34 for the proportion of Economics and Business students, 0.22 for the proportions of Sciences and Medical Sciences students and 0.74 for other fields. The only statistically significant difference concerns the proportion of students in Law, Humanities and Social Sciences where the p-value of the chi-squared test is 0.03. Breaking down further the background of the students, the difference concerns the proportion of Law students. An explanation may be that in Valencia, the Law faculty is on the same campus as the experimental lab, while in Amsterdam the Law faculty is located downtown, which is relatively far from the lab.

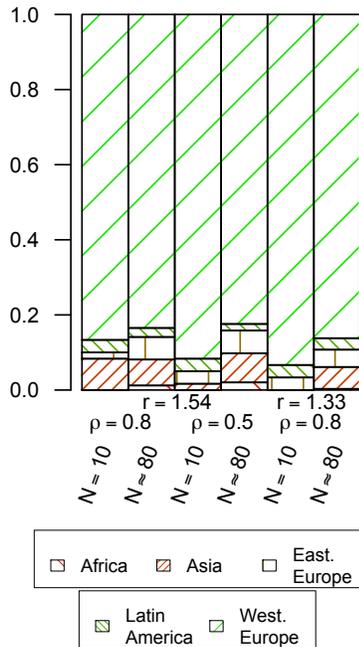
Age distribution of the subjects across treatments



Distribution of participants per gender across treatments



Distribution of the subjects per geographical origin across treatments



Distribution of the subjects per field of study across treatments

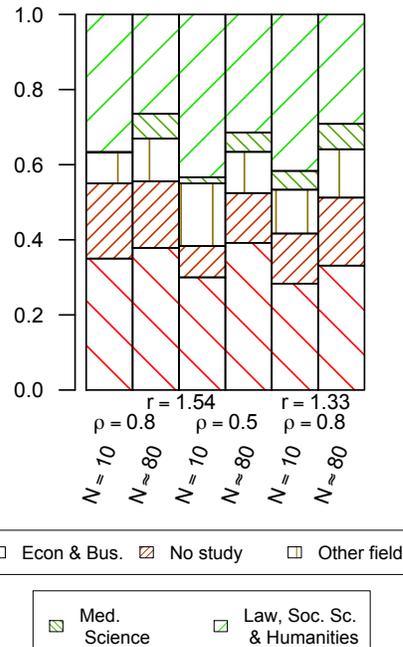


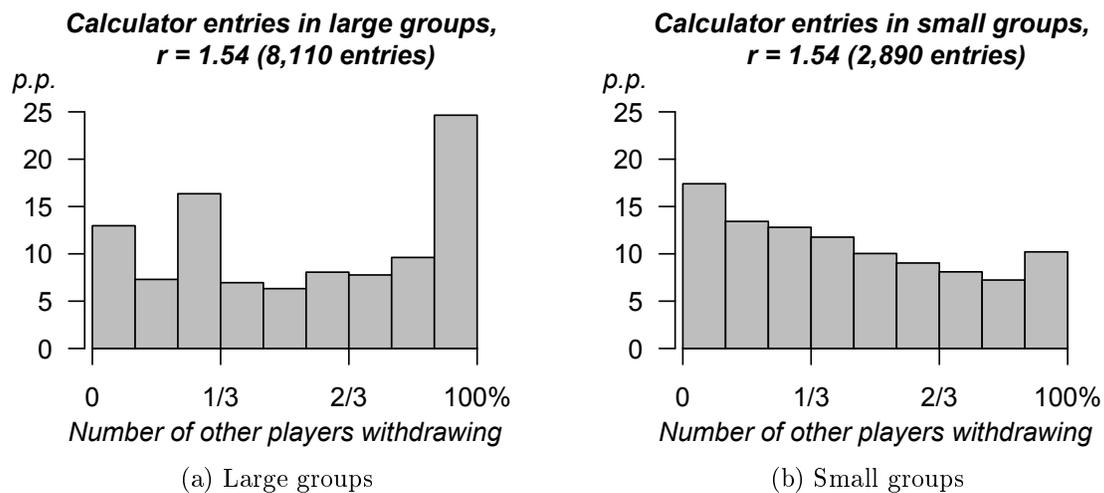
Figure 2: Distribution of individual characteristics of the subjects across treatments

Appendix C Additional results

	(I)	(II)	(III)	(IV)
<i>Dependent variable: withdrawal decision in:</i>				
	<i>period 10</i>	<i>period 10</i>	<i>period 11</i>	<i>period 12</i>
ownWithdrawal _{t-1}	1.43*** (0.15)	1.43*** (0.15)	0.82*** (0.21)	0.98*** (0.16)
withdrawalRate _{t-1}	3.80*** (1.30)	4.16*** (1.23)	5.24*** (1.07)	6.43*** (1.47)
large	0.55* (0.32)	0.69 (1.10)	0.29 (0.81)	0.21 (0.96)
$\rho = 0.8$	-0.68* (0.35)	-0.67 (0.41)	0.06 (0.16)	-0.02 (0.21)
$r = 1.33$	-0.59 (0.62)	-0.61 (0.93)	-0.60 (0.58)	-0.18 (0.91)
large \times withdrawalRate _{t-1}		-0.42 (2.34)	-0.28 (1.38)	-1.42 (1.70)
constant	-1.83 (3.63)	-1.94 (3.05)	-2.14 (2.37)	-2.60 (4.73)
# of observations	1182	1182	1183	1183
-LogLikelihood	537.27	537.22	465.35	420.80
Control	YES	YES	YES	YES

Notes: ***: significant at the 1% level, **: significant at the 5% level and *: significant at the 10% level. Standard errors, reported below the coefficients in parentheses, are clustered by groups and obtained using bootstrapping to account for the small numbers of clusters (Cameron et al. 2008). The dependent variable is the withdrawal dummy (1 for 'withdraw', 0 for 'wait') in period 10 (first 2 columns), in period 11 (column III) and in period 12 (last column). Timed-out decisions are excluded. Independent variables are the subject's own decision in the previous period, the fraction of withdrawals in the previous period, a group size dummy (1 for large), a dummy for the sequence of announcements (1 for $\rho = 0.8$), and a payoff dummy (1 for $r = 1.33$). Data include all six treatments. The control variables are the age, gender, field of study (if any), and citizenship per geographical area of each participant, as well as the location of the lab they were present at (Amsterdam or Valencia).

Table 2: Logit model on withdrawal decision in periods 10, 11 and 12



Notes: the entries are normalized by the number of other players ($N - 1$).

Figure 3: Distribution of calculator entries normalized by $N - 1$ with $r = 1.54$

Appendix D Individual Evolutionary Learning

The Individual Evolutionary Learning algorithm

Initialization ($t = 1$)

1. Set the parameter values: number of agents $N = \{10, 100\}$, length of the simulation $T = 50$, short- and long-run interest rate $r = \{1.33, 1.54\}$ and $R = 2$, number of strategies per agent $J = 40$, probability of experimentation $p^{\text{ex}} = 10\%$, intensity of choice $\beta = 5$, memory $m = 15$, initial probability of choosing 'run' $p_1^{\text{run}} = 0.3$.
2. Create a population of N agents, each endowed with a pool of J strategies $\{s_{j,i,1}\}_{\{i=1,\dots,N; j=1,\dots,J\}}$ as follow: each component $s_{j,i,1}$ takes the value '0' (i.e., 'wait') with probability $1 - p_1^{\text{run}}$, and '1' (i.e., 'run') otherwise.
3. For each agent i , select randomly with uniform probability over J a strategy j^* and select 'wait' if $s_{j^*,i,1} = 0$ and 'run' if $s_{j^*,i,1} = 1$.
4. Compute the total number of withdrawals e_1 .
5. For each agent i , compute the number $e_{-i,1}$ of other agents that chose to withdraw as: if agent i withdraws in 1 ($s_{j^*,i,1} = 1$), $e_{-i,1} = e_1 - 1$ and $e_{-i,1} = e_1$ otherwise.

Execution (for each period $t = 2, \dots, T$):

6. *Experimentation*: For each agent i and each strategy j , flip each component $s_{j,i,t}$ from 0 to 1 or 1 to 0 with probability p^{ex} ; leave unchanged otherwise.
7. *Computation of the foregone payoff* for each agent i :
 - (a) for the strategy 'wait': $UWait_{i,t} = \sum_{\tau=t-m}^{t-1} \max\left(0, \frac{N - re_{-i,t}}{N - e_{-i,t}} R\right)$,
 - (b) for the strategy 'run': $URun_{i,t} = \sum_{\tau=t-m}^{t-1} \min\left(r, \frac{N}{e_{-i,t} + 1}\right)$.
8. For each agent i , compute the relative fitness of each strategy as:
 - $p_{i,t}^{\text{wait}} \equiv \frac{\exp(\beta UWait_{i,t})}{\exp(\beta UWait_{i,t}) + \exp(\beta URun_{i,t})}$ for strategy 'wait',
 - $p_t^{\text{run}} \equiv \frac{\exp(\beta URun_{i,t})}{\exp(\beta UWait_{i,t}) + \exp(\beta URun_{i,t})}$ for strategy 'run', where $p_t^{\text{wait}} + p_t^{\text{run}} = 1$.
9. *Reproduction* for each agent i and each strategy $j \in J$: with probability $p_{i,t}^{\text{wait}}$, set $s_{j,i,t} = 0$ (i.e., wait), otherwise set $s_{j,i,t} = 1$ and 'run'.
10. *Selection* for each agent i , randomly with uniform probability over J , draw a strategy j^* and select 'wait' if $s_{j^*,i,t} = 0$ and 'run' if $s_{j^*,i,t} = 1$.
11. Compute the total number of withdrawals e_t .
12. For each agent i , compute the number $e_{-i,t}$ of other agents that chose to withdraw: if agent i withdraws in t ($s_{j^*,i,t} = 1$), $e_{-i,t} = e_t - 1$ and $e_{-i,t} = e_t$ otherwise.

Appendix E Experimental instructions

Below are the experimental instructions presented to participants. The treatment-specific information is denoted by italics and put in brackets. The numbers are calculated for the specific group sizes by the program, denoted by *XX*. All the instructions and screens were translated to Spanish as well, and participants had the opportunity to choose their language at the beginning of the experiment.

INSTRUCTIONS

Today you will participate in an experiment in economic decision making. You will be paid for your participation. There is a participation fee of 5 euros. The additional amount of cash that you earn will depend upon your decisions and the decisions of other participants. You will be earning experimental currency. At the end of the experiment, you will be paid in euros at the exchange rate of 4 experimental currency units = 1 euro.

Since your earnings depend on the decisions that you will make during the experiment, it is important to understand the instructions. Read them carefully. If you have any questions, raise your hand and an experimenter will come to your desk and provide answers.

Your Task

*(You and the other **XX participants** in the session, play together in a group of *XX*. / During the experiment, you will be matched with 9 other participants, and you will play together in a group of 10. The group composition will not change during the experiment.)* Each of you starts each period with 1 experimental euro (EE) deposited in the experimental bank. You must decide **whether to withdraw your 1 EE or wait** and leave it deposited in the bank. The bank promises to pay **1.54 / 1.33** EEs to each withdrawer. After the bank pays the withdrawers, the money that remains in the bank will be doubled, and the proceeds will be divided evenly among people who choose to wait. Note that if too many people desire to withdraw, the bank may not be able to fulfill the promise to pay **1.54 / 1.33** to each withdrawer. In that case, the bank will divide the *XX* EEs evenly among all withdrawers and those who choose to wait will get nothing.

Your payoff depends on your own decision and the decisions of the other *XX* people in the group. Specifically, how much you receive if you make a withdrawal request or how much you earn by waiting depends on how many people in the group place withdrawal requests.

Note that you are not allowed to ask other participants what they will choose. You must **guess** what other people will do - how many of the other *XX* people will withdraw - and act accordingly. The graph below shows your payoff for withdrawing or waiting depending on the number of **other** withdrawers in your group. During the experiment you will see the same graph, and a calculator on your screen. The calculator returns your payoff for each action when you enter how many **other** participants

hypothetically withdraw. Note that everybody earns about the same amount if exactly XX people decide to withdraw their money. Let's look at two examples:

Example 1.

Suppose 2 subjects choose to withdraw. If you choose to withdraw, your payoff is XX, and if you choose to wait, your payoff is XX.

Example 2.

Suppose XX subjects choose to withdraw. If you choose to withdraw, your payoff is XX, and if you choose to wait, your payoff is 0.

In each period you have **one** minute to make your decision. If you do not submit a decision on time, you do not earn any money for that period. Your last decision will be duplicated for the given period, and that will be taken into account for the others' earnings. (If you do not make a decision on time in the first period, your action will be randomly determined with equal probabilities.) A timer on the top left part of the screen will show you the remaining time for each period.

Announcement

In each period, an announcement will show up on the screen to forecast the number of withdrawers for this period.

The announcement will be either

- “The forecast is that XX or more people will choose to withdraw”, or
- “The forecast is that XX or fewer people will choose to withdraw”.

Everybody receives the **same** message. The announcements are randomly generated. (*There is a possibility of seeing either announcement, but the chance of seeing the same message that you saw in the previous period is higher than the chance of seeing a different announcement. / There is an equal chance of seeing either announcement in each period.*) These announcements are forecasts, which can be right or wrong. The experimenter does not know better than you how many people will choose to withdraw (or wait) in each period. The actual number of withdrawals is determined by the decisions of all participants. Your actual payoff depends only on your own choice and the choices of other participants.

Training Periods

This experimental session consists of 56 periods. The **first 6 periods** are training periods, and **do not count** towards your earnings. This is an opportunity for you to become familiar with the task you will perform during the experiment. During the training period, you **are not playing** with your peers from this experiment. Instead, you are playing with XX robot players, whose decisions were generated **before** the experiment. All of your peers are also playing with the **same** XX robot players. None of your decisions have an influence on the behavior of the robot players. After the 6 training periods, the formal experiment starts. There are no robots any more, and you

will only play with other participants from this experimental session.

Earnings

We will pay you in cash at the end of the experiment based on the points you earned in the 50 periods. You earn 1 euro for each XX points you make plus an additional 5 euros of participation fee.

On the next screen you are asked to answer some understanding questions.

Control questions:

Before the experiment starts, please answer some questions. You can return to the instructions by clicking on the menu at the top of this page. If you need help, please raise your hand.

1. How many other participants are you playing with in the formal experimental periods?
2. In which period do you start playing with your fellow participants?
3. Do you know how your partners decide when you are making your decision?
4. Do the announcements have a direct effect on your payoffs?
 - a. Yes, always.
 - b. No, it might only influence the decision of others that determines my payoff.
5. Suppose that all of your group-members decide to wait. What is your payoff if you wait as well?
6. Suppose that you do not make a decision on time, and your last decision was to withdraw. In this period, 8 other players decided to withdraw. What is your payoff for this period?

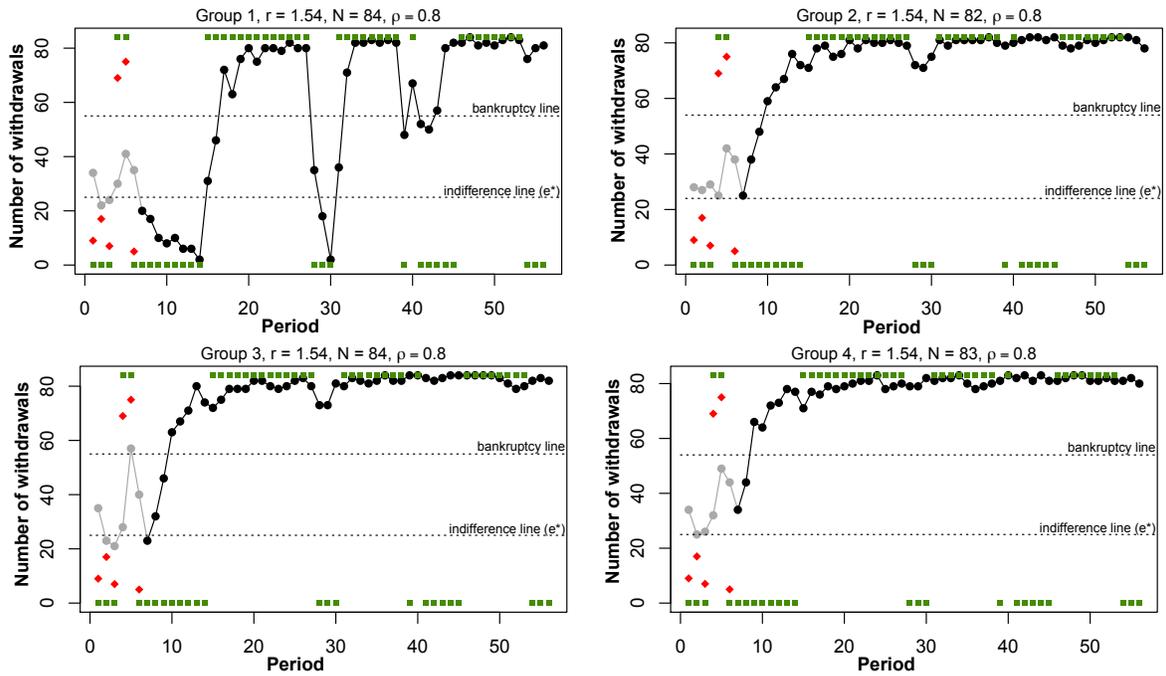
Post-Experimental Questionnaire:

Please answer the following questions seriously. **Your answers will help us understanding the findings of this study.** The questionnaire is anonymous. Unless otherwise specified, please answer the following questions on a five-point scale where **“1” indicates that you strongly disagree** with the statement, **“3” means neutral**, and **“5” means strongly agree**.

1. When I made my decision, I thought carefully about what the others were doing.
2. When I saw an announcement I tried to follow it.
3. When I saw that the announcement changed, I did not follow immediately, but waited to see what others were doing.
4. I found safer not to follow the announcement.

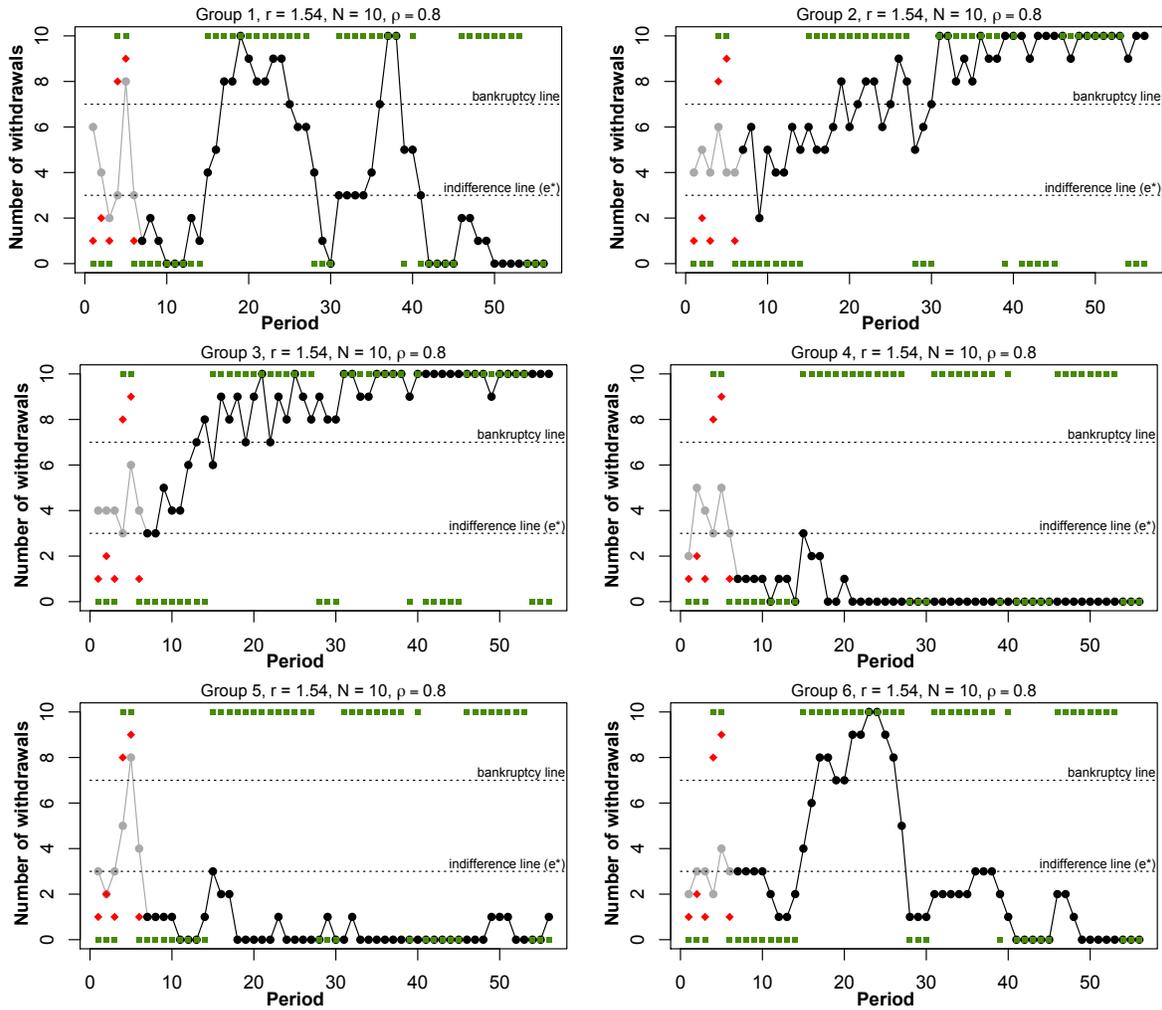
5. I found it difficult to think about what others would do in a group with XX other people.
6. If you followed a specific decision rule, please explain it here.

Appendix F Additional figures



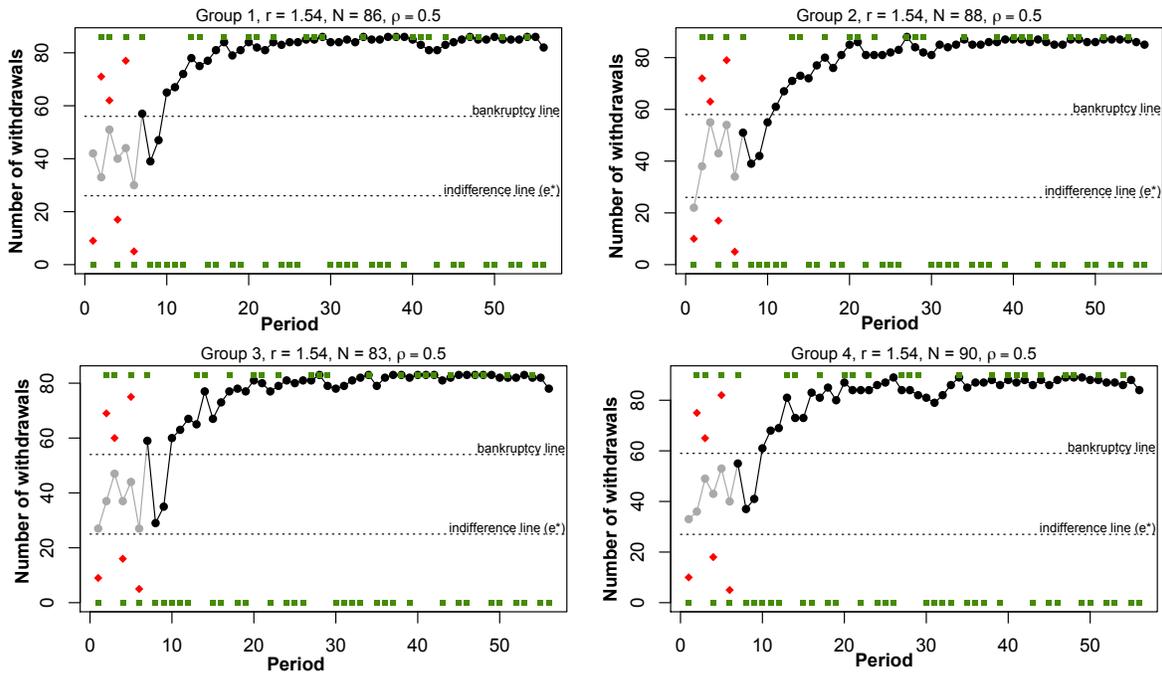
Notes: See the legend on Figure 3 in the main text.

Figure 4: Withdrawals in large groups with $r = 1.54$ and $\rho = 0.8$



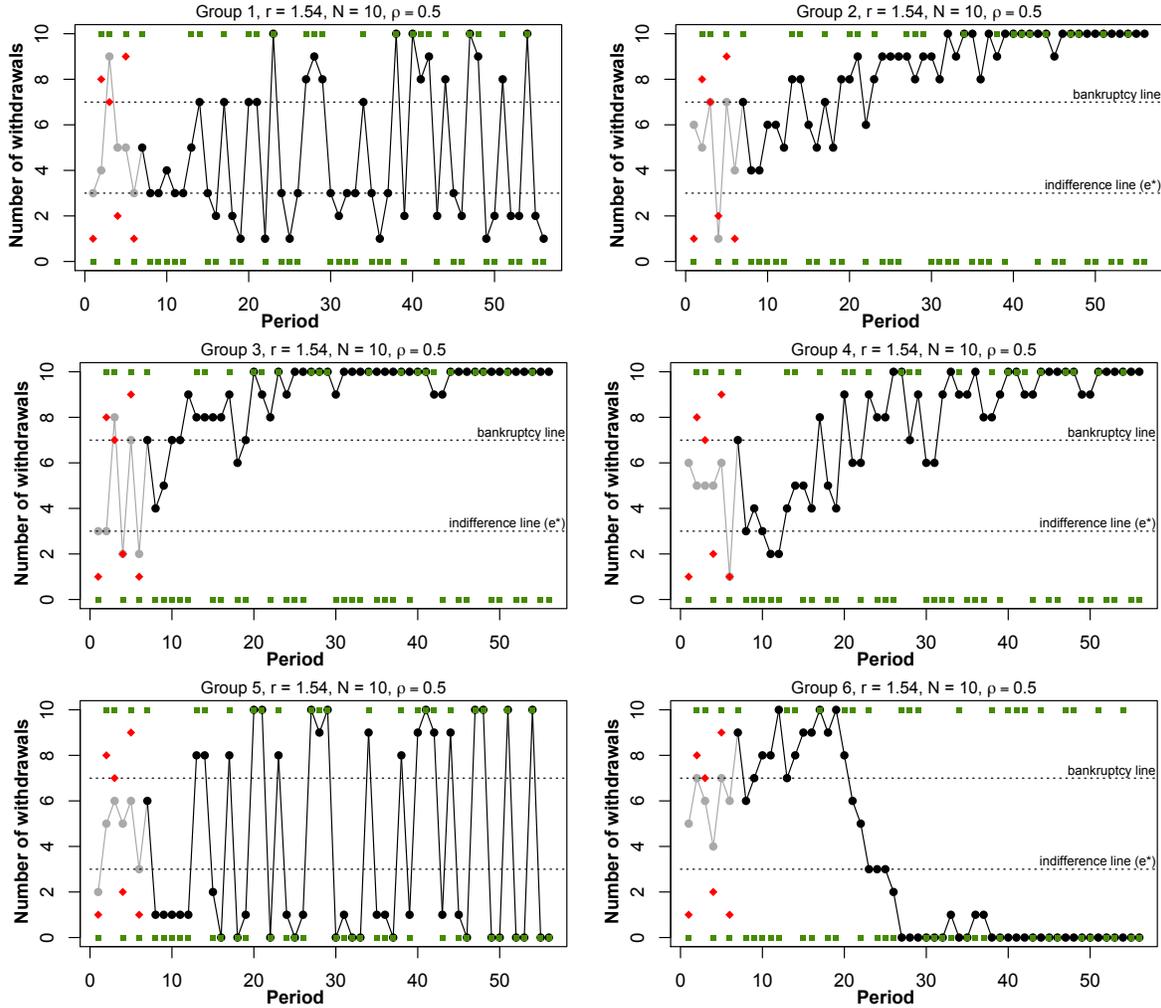
Notes: See the legend on Figure 3 in the main text.

Figure 5: Withdrawals in small groups ($n = 10$) with $r = 1.54$ and $\rho = 0.8$



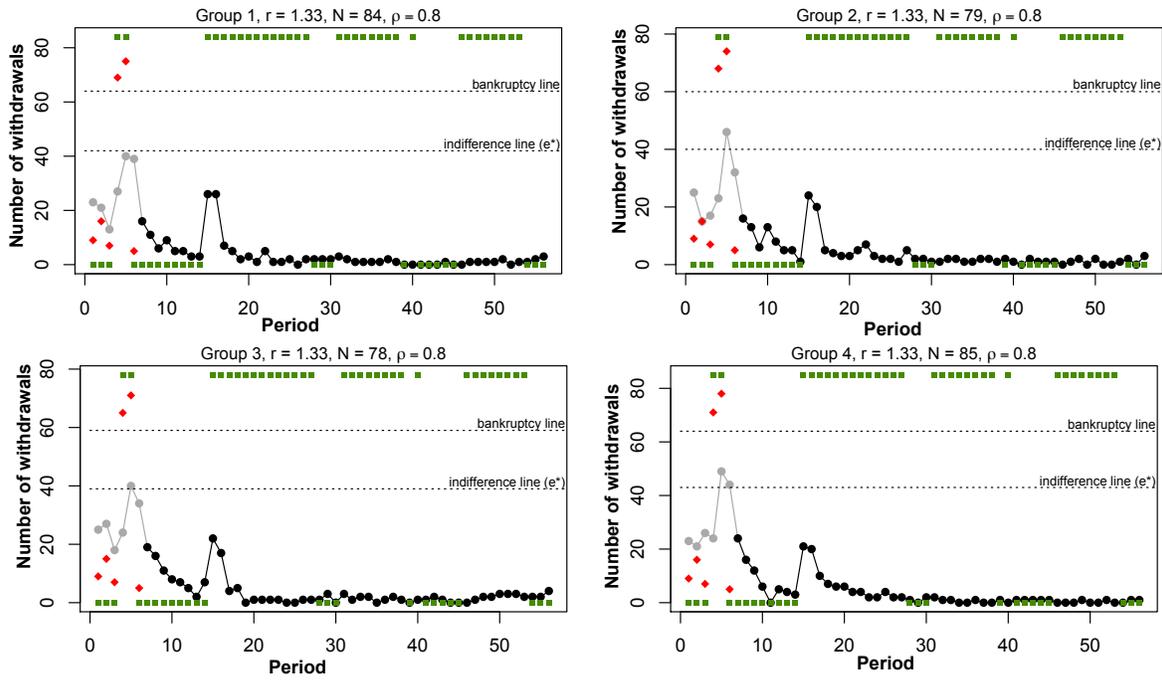
Notes: See the legend on Figure 3 in the main text.

Figure 6: Withdrawals in large groups with $r = 1.54$ and $\rho = 0.5$ (no persistence)



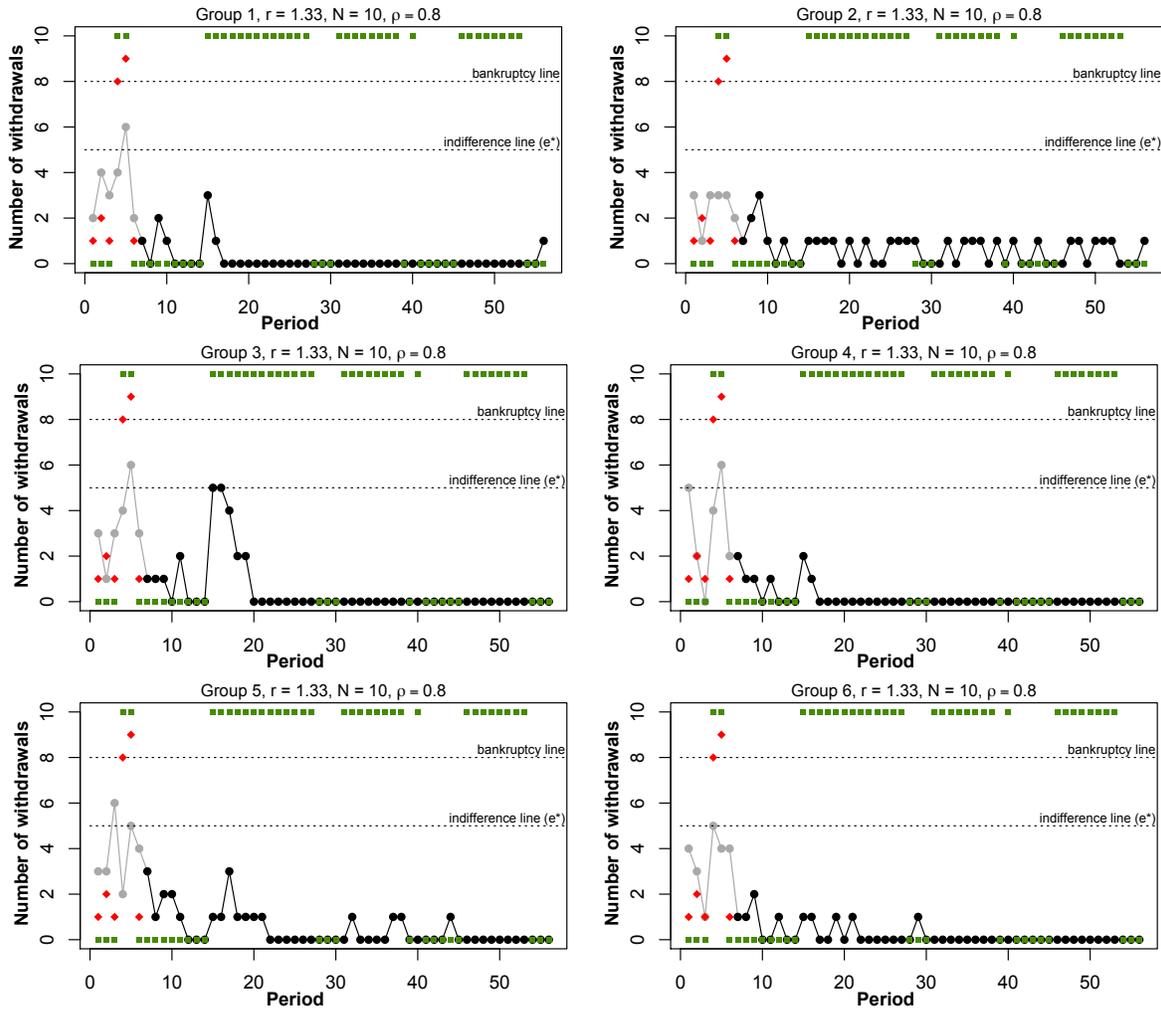
Notes: See the legend on Figure 3 in the main text.

Figure 7: Withdrawals in small groups ($n = 10$) with $r = 1.54$ and $\rho = 0.5$ (no persistence)



Notes: See the legend on Figure 3 in the main text.

Figure 8: Withdrawals in large groups with $r = 1.33$



Notes: See the legend on Figure 3 in the main text.

Figure 9: Withdrawals in small groups ($n = 10$) with $r = 1.33$

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