Online Appendix for:

Infinitely Repeated Games in the Laboratory:
Four Perspectives on Discounting and Random Termination

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CONTENTS

STRATEGY FREQUENCY ESTIMATION METHOD (SFEM)

This strategy estimation procedure was introduced in Dal Bó & Fréchette (2011).

We denote the choice made by subject i in round r of match m by c_{imr} and the choice that a strategy k indicates to make in round r of match m for subject i when matched with subject j by $s_{imr}^k \left(c_{jm1}, ..., c_{jm(r-1)}; \ c_{im1}^k, ..., c_{im(r-1)}^k \right)$ if $r > 1$, while the strategy does not depend on previous choices in round one. Finally, the indicator variable I takes value one if the choice corresponds to the strategy in that round of a given match and zero otherwise: $I_{imr}^k = 1 \left\{ c_{imr} = s_{imr}^k \left(\cdot \right) \right\}$. The probability that a choice corresponds to the one prescribed by a given strategy is modeled as $Pr \left(I_{imr}^k \right) = \frac{1}{1 + \exp\left(\frac{-1}{\gamma} \right)} \equiv \beta$, where γ is a parameter to be estimated. This can be motivated from a model in which subjects follow a strategy but make mistakes, as in $c_{imr}' = 1 \left\{ s_{imr}' \left(\cdot \right) + \gamma \varepsilon_{imr} \geq 0 \right\}$, where c_{imr}' takes value 0 and 1, s_{imr}' is coded as 1 when the choice should be 1 and -1 when it should be 0 and ε has a logistic distribution. When reporting results, we will report β, as it gives an indication of the quality of the fit, something difficult to read from γ; random choices imply a β of $\frac{1}{2}$, and choices exactly as predicted imply a β of 1. The likelihood that the observed choices for subject i were generated by strategy k are given by

$$prob_i(s^k) = \prod_{M_i} \prod_{R_{im}} \left(\frac{1}{1 + \exp(-1/\gamma)} \right)^{I_{imr}^k} \left(\frac{1}{1 + \exp(1/\gamma)} \right)^{\left(1 - I_{imr}^k \right)}$$

where M is the set of matches and R the number of rounds in each match. Combining this across subjects and allowing for multiple strategies, each present in a different frequency, ϕ^k, we obtain the following loglikelihood:

$$\sum_I \ln \left(\sum_K \phi^k prob_i(s^k) \right)$$

for the set of strategy K and of subjects I. The parameters of interest ϕ^k give the probability of observing each strategy.

References

Dal Bó, P. & Fréchette, G. R. (2011), 'The evolution of cooperation in infinitely repeated games: Experimental evidence', *The American Economic Review* **101**(1), 411–429.

INSTRUCTIONS FOR RT TREATMENT

Welcome

You are about to participate in an experiment on decision-making. What you earn depends partly on your decisions, partly on the decisions of others, and partly on chance. Please turn off cell phones and similar devices now. Please do not talk or in any way try to communicate with other participants.

We will start with a brief instruction period. During the instruction period you will be given a description of the main features of the experiment. If you have any questions during this period, raise your hand and your question will be answered so everyone can hear.

This experiment has two parts; these instructions are for the first part. Once this part is over, instructions for the second part will be given to you. Your decisions in this part have no influence on the other part.

General Instructions

1. In this experiment you will be repeatedly matched with a person in the room. During each match, you will be asked to make decisions over a sequence of rounds.

2. The length of a match, i.e. the number of rounds in a match, is randomly determined as follows:

   After each round, there is a 75% probability that the match will continue for at least another round. Specifically, after each round, whether the match continues for another round will be determined by a random number between 1 and 100 generated by the computer. If the number is lower than or equal to 75 the match will continue for at least another round, otherwise it will end. For example, if you are in round 2, the probability that there will be a third round is 75% and if you are in round 9, the probability that there will be a tenth round is also 75%. That is, at any point in a match, the probability that the match will continue is 75%.

3. Once a match ends, you will be randomly paired with someone for a new match. You will not be able to identify who you've interacted with in previous or future matches.

4. The choices and the payoffs in each round are as follows:

your choice	the other's choice	
	1	2
1	40, 40	12, 48
2	48, 12	20, 20

The first entry in each cell represents your payoff, while the second entry represents the payoff of the person you are matched with.

- As you can see, this shows the payoff associated with each choice. Once you and the person you are paired with have made your choices, those choices will be highlighted and your payoff for the round will appear.

- That is, if:
  - (1,1): You select 1 and the other selects 1, you each make 40.
  - (1,2): You select 1 and the other selects 2, you make 12 while the other makes 48.
  - (2,1): You select 2 and the other selects 1, you make 48 while the other makes 12.
  - (2,2): You select 2 and the other selects 2, you each make 20.

- Each round, the match continues for another round with probability 75%. Note that expected payoffs in the next round for each possible combination of your choice and the choice of the person you are matched with are the same throughout the match. The expected payoffs before you know whether or not the next round will take place is:

$$\textit{Probability that next round takes place} \quad \times \quad \textit{Payoffs in the current round}$$

This means that the expected payoffs for next round are 75% × payoffs in the current round.

- Total payoffs for each match will be the sum of payoffs obtained from each round of that match. Total payoffs for the experiment will be the sum of payoffs for all matches played.

5. The experiment will end after 18 matches have been played. This part will last for 12 matches. Your total payoffs will be converted to dollars at the rate

of 0.01$ for every point earned.

Are there any questions?

Now please take a look at the screen in front of the room.

Before we start, let me remind you that:

- The length of a match is randomly determined. After every round there is a 75% probability that the match will continue for another round. Expected payoffs for the next round (75% × payoffs in current round) are the same in all rounds of a match. You will interact with the same person for the entire match.

- After a match is finished, you will be randomly paired with someone for a new match.

General Instructions for Part 2

The basic structure of this part is very similar to part 1. The length of each match is determined in the same way. Choices for each round of a match are the same as well, but payoffs per round change in the following way.

The choices and the payoffs in each round are as follows:

your choice	the other's choice	
	1	2
1	24, 24	12, 48
2	48, 12	20, 20

As before, the first entry in each cell represents your payoff, while the second entry represents the payoff of the person you are matched with.
- That is, if:
  - (1,1): You select 1 and the other selects 1, you each make 24.
  - (1,2): You select 1 and the other selects 2, you make 12 while the other makes 48.
  - (2,1): You select 2 and the other selects 1, you make 48 while the other makes 12.
  - (2,2): You select 2 and the other selects 2, you each make 20.

- This part will last for 6 matches. As before, your total payoffs will be converted to dollars at the rate of 0.01$ for every point earned.

Are there any questions?

Before we start, let me remind you that as in part 1:

- The length of a match is randomly determined. After every round there is a 75% probability that the match will continue for at least another round. Expected payoffs for the next round (75% × payoffs in current round) are the same in all rounds of a match. You will interact with the same person for the entire match.

- After a match is finished, you will be randomly paired with someone for a new match.

INSTRUCTIONS FOR D+RT TREATMENT (PART 1)

Welcome

You are about to participate in an experiment on decision-making. What you earn depends partly on your decisions, partly on the decisions of others, and partly on chance. Please turn off cell phones and similar devices now. Please do not talk or in any way try to communicate with other participants.

We will start with a brief instruction period. During the instruction period you will be given a description of the main features of the experiment. If you have any questions during this period, raise your hand and your question will be answered so everyone can hear.

This experiment has two parts; these instructions are for the first part. Once this part is over, instructions for the second part will be given to you. Your decisions in this part have no influence on the other part.

General Instructions

6. In this experiment you will be repeatedly matched with a person in the room. During each match, you will be asked to make decisions over a sequence of rounds.

7. The length of a match, i.e. the number of rounds in a match, is randomly determined as follows:

    There are 4 rounds for sure in each match. In each round after round 4, there is a 75% probability that the match will continue for at least another round. Specifically, after round 4, whether the match continues for another round will be determined by a random number between 1 and 100 generated by the computer. If the number is lower than or equal to 75 the match will continue for at least another round, otherwise it will end. For example, if you are in round 4, the probability that there will be a fifth round is 75% and if you are in round 9, the probability that there will be a tenth round is also 75%. That is, at any point in a match, the probability that the match will continue is 75%.

8. Once a match ends, you will be randomly paired with someone for a new match. You will not be able to identify who you've interacted with in previous or future matches.

9. The choices and the payoffs in each Round 1 are as follows:

your choice	the other's choice	
	1	2
1	40, 40	12, 48
2	48, 12	20, 20

The first entry in each cell represents your payoff in Round 1, while the second entry represents the payoff of the person you are matched with in Round 1.

- As you can see, this shows the payoff associated with each choice. Once you and the person you are paired with have made your choices, those choices will be highlighted and your payoff for the round will appear.

- That is, in Round 1, if:

  - (1,1): You select 1 and the other selects 1, you each make 40.
  - (1,2): You select 1 and the other selects 2, you make 12 while the other makes 48.
  - (2,1): You select 2 and the other selects 1, you make 48 while the other makes 12.
  - (2,2): You select 2 and the other selects 2, you each make 20.

- In rounds two and onwards, the choices are the same, but the payoff values shrink by 75% every round for the first 4 rounds. After round 4 they remain constant for the rest of the match. You can refer to the table below for a summary of how payoffs per round change within a match.

Round	Your payoff after (Your choice, Other's choice)			
	(1,1)	(1,2)	(2,1)	(2,2)
1	40.0	12.0	48.0	20.0
2	30.0	9.0	36.0	15.0
3	22.5	6.8	27.0	11.3
4 onwards	16.9	5.1	20.3	8.4

Payoffs displayed are rounded to the first decimal point. Actual payoffs depend on exact values determined according to the formula given above.

- In the first 4 rounds, where the match continues with certainty, payoffs shrink by 75%. In rounds 4 and onwards, the payoffs don't shrink, but the match continues for another round with probability 75%. Note that expected payoffs in the next round for each possible combination of your choice and the choice of the person you are matched with are the same throughout the match. In rounds 1 through 3, the expected payoffs for next round are 75% × payoffs in current round. In rounds 4 and above the expected payoffs before you know whether or not the next round will take place is:

  Probability that next round takes place   ×   *Payoff in the current round*

  This means that in rounds 4 and above, the expected payoffs for next round are 75% × payoffs in the current round. In other words, for all rounds of the match before and after Round 4, the expected payoffs for next round are 75% × payoffs in the current round..

- Total payoffs for each match will be the sum of payoffs obtained from each round of that match. Total payoffs for the experiment will be the sum of payoffs for all matches played.

10. The experiment will end after 18 matches have been played. This part will last for 12 matches. Your total payoffs will be converted to dollars at the rate of 0.01$ for every point earned.

Are there any questions?

Now please take a look at the screen in front of the room.

Before we start, let me remind you that:

- The length of a match is randomly determined. The first 4 rounds will be played with certainty, but your payoffs in each new round will be 75% of what they were in the previous round. After round 4, payoffs do not shrink but there is a 75% probability that the match will continue for another round. Expected payoffs for the next round (75% × payoffs in current round) are the same in all rounds of a match. You will interact with the same person for the entire match.

- After a match is finished, you will be randomly paired with someone for a new match.

INSTRUCTIONS FOR BRT TREATMENT (PART 1)

Welcome

You are about to participate in an experiment on decision-making. What you earn depends partly on your decisions, partly on the decisions of others, and partly on chance. Please turn off cell phones and similar devices now. Please do not talk or in any way try to communicate with other participants.

We will start with a brief instruction period. During the instruction period you will be given a description of the main features of the experiment. If you have any questions during this period, raise your hand and your question will be answered so everyone can hear.

This experiment has two parts; these instructions are for the first part. Once this part is over, instructions for the second part will be given to you. Your decisions in this part have no influence on the other part.

General Instructions

11. In this experiment you will be repeatedly matched with a person in the room. During each match, you will be asked to make decisions over a sequence of rounds.

12. The length of a match, i.e. the number of rounds in a match, is randomly determined as follows:

    After each round, there is a 75% probability that the match will continue for at least another round. Specifically, after each round, whether the match continues for another round will be determined by a random number between 1 and 100 generated by the computer. If the number is lower than or equal to 75 the match will continue for at least another round, otherwise it will end. For example, if you are in round 2, the probability that there will be a third round is 75% and if you are in round 9, the probability that there will be a tenth round is also 75%. That is, at any point in a match, the probability that the match will continue is 75%.

    However, you will play every match in blocks of 4 rounds. At the end of each block you will learn if the match ended in the previous block of 4 rounds or not. If it has not, you will play another block of 4 rounds. If the match has ended in this block, you will see in which round it had actually ended. In particular, you will be informed of the random numbers generated by the computer for each round at the end of every 4 rounds. The final round of the match will be the first round where the random number generated by the computer was greater than 75.

13. Once a match ends, you will be randomly paired with someone for a new match. You will not be able to identify who you've interacted with in previous or future matches.

14. The choices and the payoffs in each round are as follows:

	the other's choice	
your choice	1	2
1	40, 40	12, 48
2	48, 12	20, 20

The first entry in each cell represents your payoff, while the second entry represents the payoff of the person you are matched with.

- As you can see, this shows the payoff associated with each choice. Once you and the person you are paired with have made your choices, those choices will be highlighted and your payoff for the round will appear.

- That is, if:
    - (1,1): You select 1 and the other selects 1, you each make 40.
    - (1,2): You select 1 and the other selects 2, you make 12 while the other makes 48.
    - (2,1): You select 2 and the other selects 1, you make 48 while the other makes 12.
    - (2,2): You select 2 and the other selects 2, you each make 20.

- Each round, the match continues for another round with probability 75%. Note that expected payoffs in the next round for each possible combination of your choice and the choice of the person you are matched with are the same throughout the match. The expected payoffs before you know whether or not the next round will take place is:

    Probability that next round takes place × *Payoffs in the current round*

    This means that the expected payoffs for next round are 75% × payoffs in the current round.

- Total payoffs for each match will be the sum of payoffs obtained from each round of that match. You will NOT receive any payoff from rounds you've played within a block after the match had ended. Total payoffs for the experiment will be the sum of payoffs for all matches played.

15. The experiment will end after 18 matches have been played. This part will last for 12 matches. Your total payoffs will be converted to dollars at the rate of 0.01$ for every point earned.

Are there any questions?

Now please take a look at the screen in front of the room.

Before we start, let me remind you that:

- The length of a match is randomly determined. After every round there is a 75% probability that the match will continue for another round. Expected payoffs for the next round (75% × payoffs in current round) are the same in all rounds of a match. However, you will play each match in blocks of 4 rounds; and will be informed of whether the match had ended during the block at the end of these rounds. You will NOT receive any payoff from rounds you've played within a block after the match had ended. You will interact with the same person for the entire match.

- After a match is finished, you will be randomly paired with someone for a new match.

INSTRUCTIONS FOR D+C TREATMENT (PART 1)

Welcome

You are about to participate in an experiment on decision-making. What you earn depends partly on your decisions, partly on the decisions of others, and partly on chance. Please turn off cell phones and similar devices now. Please do not talk or in any way try to communicate with other participants.

We will start with a brief instruction period. During the instruction period you will be given a description of the main features of the experiment. If you have any questions during this period, raise your hand and your question will be answered so everyone can hear.

This experiment has two parts; these instructions are for the first part. Once this part is over, instructions for the second part will be given to you. Your decisions in this part have no influence on the other parts.

General Instructions

16. In this experiment you will be repeatedly matched with a person in the room. During each match, you will be asked to make decisions over a sequence of rounds.

17. Each match will last for 5 rounds.

18. Once a match ends, you will be randomly paired with someone for a new match. You will not be able to identify who you've interacted with in previous or future matches.

19. The choices and the payoffs in each Round 1 are as follows:

	the other's choice	
your choice	1	2
1	40, 40	12, 48
2	48, 12	20, 20

The first entry in each cell represents your payoff in Round 1, while the second entry represents the payoff of the person you are matched with in Round 1.

- As you can see, this shows the payoff associated with each choice.

Once you and the person you are paired with have made your choices, those choices will be highlighted and your payoff for the round will appear.

- That is, in Round 1, if:
    - (1,1): You select 1 and the other selects 1, you each make 40.
    - (1,2): You select 1 and the other selects 2, you make 12 while the other makes 48.
    - (2,1): You select 2 and the other selects 1, you make 48 while the other makes 12.
    - (2,2): You select 2 and the other selects 2, you each make 20.

- In Rounds 2-4, the choices are the same, but the payoff values shrink by 75% every round.

- In the last round of a match (Round 5), the payoffs associated with each choice changes as follows:

	the other's choice	
your choice	1	2
1	50.6, 50.6	22.8, 34.2
2	34.2, 22.8	25.3, 25.3

As before, the first entry in each cell represents your payoff, while the second entry represents the payoff of the person you are matched with.

- You can refer to the table below for a summary of how payoffs per round change within a match.

	Your payoff after (Your choice, Your partners choice)			
Round	(1,1)	(1,2)	(2,1)	(2,2)
1	40.0	12.0	48.0	20.0
2	30.0	9.0	36.0	15.0
3	22.5	6.8	27.0	11.3
4	16.9	5.1	20.3	8.4
5	50.6	22.8	34.2	25.3

Payoffs displayed are rounded to the first decimal point. Actual payoffs depend on exact values determined according to the formula given above.

- In the first 4 Rounds, payoffs shrink by 75%. In Round 5, payoffs change entirely. Note that expected payoffs in the next round for each

possible combination of your choice and the choice of the person you are matched with are the same for the first three rounds. In Rounds 1 through 3, the expected payoffs for next round are 75% × payoffs in the current round. In Round 4, expected payoffs are equal to the payoff values given in the second table.

- Total payoffs for each match will be the sum of payoffs obtained from each round of that match. Total payoffs for the experiment will be the sum of payoffs for all matches played.

20. The experiment will end after 18 matches have been played. This part will last for 12 matches. Your total payoffs will be converted to dollars at the rate of 0.01$ for every point earned.

Are there any questions?

Before we start, let me remind you that:

- Each match will last for 5 rounds. In the first 4 rounds payoffs will shrink by 75% every round. In the 5th round, payoffs will change to the values specified in the second table. Expected payoffs for the next round (75% × payoffs in current round) are computed in the same way in rounds 1-3. In Round 4, expected payoffs are equal to the payoff values given in the second table. You will interact with the same person for the entire match.

- After a match is finished, you will be randomly paired with someone for a new match.

SCREEN SHOTS FROM RT TREATMENT

The following script was read to the subjects after the instructions while showing screen shots of the computer interface:

This is the first screen you will observe in each round of a match. As you can see, on the top left you will find the match and round number.

Below that there is a history table that will allow you to look up history of choices within the current match, as well as in previous matches you were in. To look at history for previous matches, specify the match number the box next to History for Match and click show.

On the right hand side you see the payoff table for the round.

Below the payoff table there are reminders on the probability that the match will continue for another round, the payoffs for next round, and expected payoffs for the next round.

To make a choice, click on one of the rows. Once a row is selected, it will change color and a red submit button will appear. Your choice will be finalized once you click on the submit button.

Once you submit your choice, you will see a similar screen where your choice and the other person's choice you're matched with is highlighted.

After that you will see a screen similar to this one. Here the computer generated random number for this round is displayed. In this case since the random number is less than 75, the match will continue for another round. In case it is larger than 75, the match will end, and you will be randomly paired with someone in the room for a new match.

SCREEN SHOTS FROM RT TREATMENT

Remaining time [sec]:   23

Match: 1   Round: 3

History for Match: [1]

[Show]

Match	Round	Your Choice	Other's Choice
1	1		
1	2		

Please select a row

The Other's Choice

Your Choice		1	2
		1	2
1		40.0, 40.0	12.0, 48.0
2		48.0, 12.0	20.0, 20.0

Reminders:
The probability that the match continues: 75%
Payoffs next round will be the same.
Expected payoffs for next round are 75% x current payoffs.

Computer generated random number   **is Lower than**

7   **75**

The match will continue for another round.