

## APPENDIX A. Supporting Information (The effect of networks on the finitely repeated prisoner's dilemma)

### A.1 Instructions manual for players and the experimental framework

#### A.1.1 The simple repeated game

##### Enjoy the Experiment with a Bonus!

##### Welcome to the Experiment!

You are going to participate in an experiment on decision-making. You must read these instructions carefully because the amount of money you earn depends on your decisions. After reading these instructions, you will have to take a quiz to ensure that you understand the instructions. You can also quit the game at any time if you do not want to continue the experiment. The instructions for participants are based on the instructions of [Wang et al. \(2012\)](#).

##### Overview

In this experiment, you will interact with others randomly selected. You will not know who is paired with you in the experiment. This experiment consists of 20 “rounds.” For each round, you will be paired with another person randomly selected, and your partner will be randomly updated each round. For each round, you and others will be able to select a choice. As a result of these selections, you will get a “payoff,” which relies on your choice and your partner’s choice. The total payoff for the game is the sum of your payoffs from each round. For the experiment, your earnings will be reported for the experiment in terms of points, not in terms of dollars and cents.

## Choose "A" or "B"

Time left to complete this page: 0:09

This is Round 1 out of 20. In the previous round, you got 0 points. Your total points accumulated so far is 0.

		The Other Participant	
		A	B
You	I will choose A.	4 points, 4 points	-1 points, 7 points
	I will choose B.	7 points, -1 points	0 points, 0 points

Figure A.1: Screenshot during strategy selection.

### Costs and compensation

You will be compensated for participating in this study. You will get 10 dollars as a participation reward if you finish an experiment. However, you will get 5 dollars if you show up without participating in the experiment. You will earn a bonus based on your profit points at the end of the experiment. One profit point will be converted to 3 cents.

### How to Interact with Others

Please read the following rules carefully. You are going to be tested on your understanding of the instructions and must answer all questions correctly before you can play.

1. For each round, you will see a "Choose "A" or "B" " message (see Figure A.1). There are two strategies you can select between the label "A" and "B." After choosing your strategy, click "I will choose A." or "I will choose B." You will have to make your decision within 45 seconds. If you do not submit your decision within 45 seconds, the system will play the strategy randomly selected.
2. Your choice and your partner's choice determine your payoff in each round. Table A.1) shows the payoff table of two players (you and your partner).

		Your neighbors	
		<i>A</i>	<i>B</i>
You	<i>A</i>	4 points, 4 points	-1 point, 7 points
	<i>B</i>	7 points, -1 point	0 points, 0 points

Table A.1: The payoff table of two players.

In each cell, the first number is the payoff for you, and the second number represents the payoff to your neighbors. You can understand this table as follows:

- (a) If both of your choice and your partner's choice is A, you receive 4 points each [**top-left cell**];
- (b) If your choice is A and your partner chooses B, you earn -1 point and your neighbor receives 7 points [**top-right cell**];
- (c) If your choice is B and your partner chooses A, you receive 7 points and your neighbors receive -1 point [**bottom-left cell**];
- (d) If both of you and your neighbor choose B, you earn 0 points each [**bottom-right cell**].

3. After all the rounds have been completed, your payoffs will be summed over all 20 rounds, and you will get a bonus based on your total payoffs for all 20 rounds.

4. After completing the experiment, you will be asked for a short survey. The survey will include four questions about your demographic information. All information and a combination of information in the game will not be used to identify individuals. We will delete your identifying information before combining responses for statistical analysis.

### A.1.2 The cheap talk repeated game

**Enjoy the Experiment with a Bonus!**

**Welcome to the Experiment!**

You are going to participate in an experiment on decision-making. You must read these instructions carefully because the amount of money you earn depends on your decisions. After reading these instructions, you will have to take a quiz to ensure that you understand the instructions. You can also quit the game at any time if you do not want to continue the experiment. The instructions for participants are based on the instructions of [Wang et al. \(2012\)](#).

### **Overview**

In the experiment, you will interact with others randomly selected. You will not know who is paired with you in the experiment. This experiment consists of 20 “rounds.” For each round, you will be paired with another person randomly selected, and your partner will be randomly updated each round. For each round, you and other participants will be able to select a choice. As a result of these selections, you will get a “payoff,” which relies on your choice and your partner’s choice. The total payoff for the experiment is the sum of your payoffs from each round. From the 1<sup>st</sup> to the 5<sup>th</sup> round, you will not communicate with your partner in the experiment. However, from the 6<sup>th</sup> round, you will be able to do cheap talk with your partner in the experiment before submitting your decision. For the experiment, your earnings will be reported for the experiment in terms of points, not in terms of dollars and cents.

### **Costs and compensation**

You will be compensated for participating in this study. You will get 10 dollars as a participation reward if you finish an experiment. However, you will get 5 dollars if you show up without participating in the experiment. You will earn a bonus based on your profit points at the end of the experiment. One profit point will be converted to 3 cents.

### **How to Interact with Others**

Please read the following rules carefully. You will be tested on your understanding of the instructions and must answer all questions correctly.

## Choose "A" or "B"

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This is Round 7 out of 20. In the previous round, you got 4 points points. Your total points accumulated so far is 24 points.

		The Other Participant	
		A	B
You	I will choose A.	4 points, 4 points	-1 points, 7 points
	I will choose B.	7 points, -1 points	0 points, 0 points

Here you can chat with the other participant.

Participant 1 Hi

Participant 2 (Me) Hi

Figure A.2: Screenshot during communication using cheap talk.

1. For each round, you will see a "Choose "A" or "B" " message (see Figure A.2). There are two strategies you can select between the label "A" and "B." After choosing your strategy, click "I will choose A." or "I will choose B." You will have to make your decision within 45 seconds. If you do not submit your decision within 45 seconds, the system will play the strategy randomly selected.
2. From the 1<sup>st</sup> to the 5<sup>th</sup> round, you will not be able to communicate with your partner in the experiment. However, from the 6<sup>th</sup> round, you will be able to do cheap talk with your partner before submitting your decision. Thus, from the 6<sup>th</sup> round, you can exchange free-form messages with your partner (see Figure A.2).
3. Your choice and your partner's choice determine your payoff in each round. Table A.1) shows the payoff table of two players (you and your partner).

In each cell, the first number is the payoff for you, and the second number represents the payoff to your neighbors. You can understand this table as follows:

- (a) If both of your choice and your partner's choice is A, you receive 4 points each [**top-left cell**];
- (b) If your choice is A and your partner chooses B, you earn -1 point and your neighbor receives 7 points [**top-right cell**];
- (c) If your choice is B and your partner chooses A, you receive 7 points and your neighbors receive -1 point [**bottom-left cell**];
- (d) If both of you and your neighbor choose B, you earn 0 points each [**bottom-right cell**].

4. After all the rounds have been completed, your payoffs will be summed over all 20 rounds, and you will get a bonus based on your total payoffs for all 20 rounds.

5. After completing the experiment, you will be asked for a short survey. The survey will include four questions about your demographic information. All information and a combination of information in the game will not be used to identify individuals. We will delete your identifying information before combining responses for statistical analysis.

### A.1.3 The networked repeated game

#### **Enjoy the Experiment with a Bonus!**

**Welcome to the Experiment!** You are going to participate in an experiment on decision-making. You must read these instructions carefully because the amount of money you earn depends on your decisions. After reading these instructions, you will have to take a quiz to ensure that you understand the instructions. You can also quit the game at any time if you do not want to continue the experiment. The instructions for participants are based on the instructions of [Wang et al. \(2012\)](#).

**Overview**

In the experiment, you will interact with others. However, you will only be connected to some of the others, which we call your “neighbors.” It is essential to understand that your payoff from the experiment is determined only by how you interact with these neighbors. This experiment consists of 20 “rounds.” For each round, you and other players will be able to select a choice. As a result of these selections, you will get a “payoff,” which relies on your choice and your neighbors' choices. The total payoff for the game is the sum of your payoffs from each round. From Round 1 to Round 5, you will interact with one randomly chosen. From Round 6, you will “propose” to others you want to be your neighbors, and we will show you useful information for your proposals, such as reputation scores and the histories of all participants' choices. If the participant you proposed “accept(s)” your proposal, you can interact with the participant. For the experiment, your earnings will be reported in terms of points, not in terms of dollars and cents.

**Costs and compensation**

You will be compensated for participating in this study. You will get 10 dollars as a participation reward if you finish an experiment. However, you will get 5 dollars if you show up without participating in the experiment. You will earn a bonus based on your profit points at the end of the experiment. One profit point will be converted to 3 cents.

**How to Interact with Others**

Please read the following rules carefully. You will be tested on your understanding of the instructions and must answer all questions correctly.

1. For each round, you will see a “Choose “A” or “B” ” message (see Figure [A.1](#)). There are two strategies you can select between the label “A” and “B.” After choosing your strategy, click “I will choose A.” or “I will choose B.” You will have to make your

decision within 45 seconds. If you do not submit your decision within 45 seconds, the system will play the strategy randomly selected.

2. From Round 1 to Round 5, you will interact with one randomly chosen. Your decision and your partner's decision determine your payoff. Table A.1) shows the payoff table of two players (you and your partner).

In each cell, the first number is the payoff for you, and the second number represents the payoff to your neighbors. You can understand this table as follows:

(a) If both of your choice and your partner's choice is A, you receive 4 points each [**top-left cell**];

(b) If your choice is A and your partner chooses B, you earn -1 point and your neighbor receives 7 points [**top-right cell**];

(c) If your choice is B and your partner chooses A, you receive 7 points and your neighbors receive -1 point [**bottom-left cell**];

(d) If both of you and your neighbor choose B, you earn 0 points each [**bottom-right cell**].

3. From Round 6, you will be able to see the reputation scores of all other participants and the history of all participants' choices up to 5 rounds. The reputation score is calculated by the average of the past number of choices to give a mutual benefit. Using the information, you would have the chance to "form" connections to make your neighbors before making your decision. Each chance will be shown by the title "Link Formation." You can then form your connections by following the two phases described below:

**(a)Phase 1:**

You can "Propose" links with other participants you want to interact with (see Figure A.3). You can form a connection if a proposal is accepted by the other participants, as



## Link Formation: Phase 1

Time left to complete this page: 1:08

Hello, P1!

Please, check the participants you want to PROPOSE A LINK to in the list:

You: 1.00, [AAAAA]

- P2: 0.40, [AABBB]
- P3: 1.00, [AAAAA]
- P4: 0.60, [AABAB]
- P5: 0.80, [AAABA]
- P6: 1.00, [AAAAA]
- P7: 0.40, [ABBBA]
- P8: 0.80, [AAAAB]
- P9: 0.80, [ABAAA]
- P10: 0.60, [ABABA]
- P11: 0.60, [ABBAA]
- P12: 1.00, [AAAAA]
- P13: 0.60, [AABAB]
- P14: 0.60, [ABAAB]

The number on the right side of the participant number denotes the reputation score, and the letters in the bracket show the history of choices for each participant up to 5 rounds.

This is Round 6 out of 20.

Figure A.3: Screenshot during proposing links.

will be explained in Phase 2 below. You will get 30 seconds to make all your forming decisions. If you do not submit all your choices before the phase ends, you will be automatically redirected to the next phase.

### (b)Phase 2:

You can “Accept” as many link proposals as you want from others (see Figure A.4). After that, you will be connected to them. You will have 30 seconds in Phase 2. If you do not submit before the phase ends, you will not form links with anyone. After completing forming networks (see Figure A.5), you will interact with your neighbors.

## Link Formation: Phase 2

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Please, check the participants you want to ACCEPT in the list(YOU:P1):

You: 1.00, [AAAAA]

P2: 0.40, [AABBB]

P3: 1.00, [AAAAA]

P4: 0.60, [AABAB]

P5: 0.80, [AAABA]

P6: 1.00, [AAAAA]

P8: 0.80, [AAAAB]

P9: 0.80, [ABAAA]

P10: 0.60, [ABABA]

P12: 1.00, [AAAAA]

P13: 0.60, [AABAB]

The number on the right side of the participant number denotes the reputation score, and the letters in the bracket show the history of choices for each participant up to 5 rounds.

This is Round 6 out of 20.

Figure A.4: Screenshot during accepting proposals.

4. Your payoff from Round 6 is a summation over your payoff by interacting with your neighbors under the payoff (see the above table). To explain, consider the following five examples:

**EXAMPLE 1:** Suppose you select A and you have three neighbors, N1, N2, and N3. They have made the following choices: N1 chooses A, N2 chooses B and N3 chooses A.

Your total payoff will be  $4 - 1 + 4 = 7$ .

**EXAMPLE 2:** Now suppose that in EXAMPLE 1 (i.e., you have the same three neighbors who have the same choices as above) you had selected B instead of A.

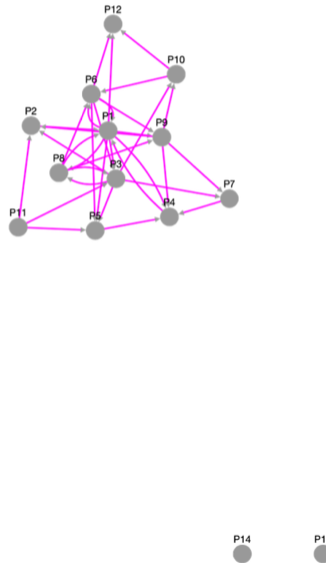
Your payoff will be  $7 + 0 + 7 = 14$ .

**EXAMPLE 3:** Next, suppose that you have selected A and your three neighbors have made the following choices: N1 chooses A, N2 chooses A and N3 selects A.

Your payoff will be  $4 + 4 + 4 = 12$ .

## Resulting link formation(YOU:P1)

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'A->B' means that A has accepted the proposal from B.

Next

Figure A.5: Screenshot while providing network information.

**EXAMPLE 4:** Suppose that you have selected B and your three neighbors have made the following choices: N1 chooses B, N2 chooses B and N3 chooses B.

Your payoff would be  $0 + 0 + 0 = 0$ .

**EXAMPLE 5:** If you do not have neighbors in a given round, your payoff will be 0 regardless of your strategy.

5. Your total payoff is summed over all 20 rounds. All participant' payoffs are calculated in the same way. Notice that you can get a negative payoff in some rounds. If your total payoff is negative at the end, you will simply receive a zero bonus.

6. After all the rounds have been completed, your payoffs will be summed over all 20 rounds, and you will get a bonus based on your total payoffs earned for all 20 rounds.

7. After completing this experiment, you will be asked for a short survey. The survey will include four questions about your demographic information. All information and a combination of information in the game will not be used to identify individuals. We will delete your identifying information before combining responses for statistical analysis.

## A.2 Participant Quiz

### A.2.1 The simple and cheap talk repeated games

To make sure your understanding of the instructions is correct, you have to answer the following questions correctly.

1. If you choose B and your partner chooses A, what will your payoff be?
2. If everyone chooses B, what will your payoff be?
3. If everyone chooses A, what will your payoff be?
4. What will be your bonus if you have a negative total payoff in the end?

### A.2.2 The networked repeated games

To make sure your understanding of the instructions is correct, you have to answer the following questions correctly.

1. Suppose you have three neighbors if you play B and everyone else plays A, what will your payoff be?
2. Suppose you have three neighbors if everyone including you plays B, what will your payoff be?
3. Suppose you have three neighbors if everyone including plays A, what will your payoff be?
4. What will your bonus be if you have a total negative payoff in points in the end?

### A.3 Short Survey

This is a very short survey about your demographic information. Your information will be de-identified after completing games and compensation. All information and a combination of information in the game will not be used to identify individuals. You can quit the survey at any time if you do not want to continue it.

1. What is your gender?

A.Male

B.Female

C.Non-binary

D.Prefer not to say

2. How old are you? If you prefer not to say, you don't have to.

### A.4 Demographics and compensations of participants

#### A.4.1 The simple repeated games

58 students participated in 29 experiments with 2 players in the simple repeated games. 35 male, 21 female, and 2 non-binary students participated in the experiments. Figure [A.6](#) shows the distributions of the participants' ages and compensation per player in the simple repeated games. Students who were from 18 to 39 years old participated. The average age of participants is 20.24 years. The compensation per player is from 10 dollars to 13.45 dollars. The average compensation per player is 11.40 dollars.

#### A.4.2 The cheap talk repeated games

46 students participated in 23 experiments with 2 players in the simple repeated games. 20 male and 26 female students participated in the experiments. Figure [A.7](#) shows the distributions

of the participants' ages and compensation per player in the cheap talk repeated games. Students who were from 18 to 42 years old participated. The average age of participants is 21.63 years. The compensation per player is from 10 dollars to 13.69 dollars. The average compensation per player is 11.53 dollars.

#### **A.4.3 The networked repeated games**

112 students participated in 8 experiments with 14 players in the network repeated games. 56 male, 55 female, and 1 non-binary students participated in the experiments. Figure [A.8](#) shows the distributions of the participants' ages and compensation per player in the networked repeated games. Students who were from 18 to 28 years old participated. The average age of participants is 20.07 years. The compensation per player is from 11.89 dollars to 25.3 dollars. The average compensation per player is 17.37 dollars.

## **A.5 References**

Wang, J., Suri, S., and Watts, D. J. (2012). Cooperation and assortativity with dynamic partner updating. *Proceedings of the National Academy of Sciences*, 109(36):14363–14368.

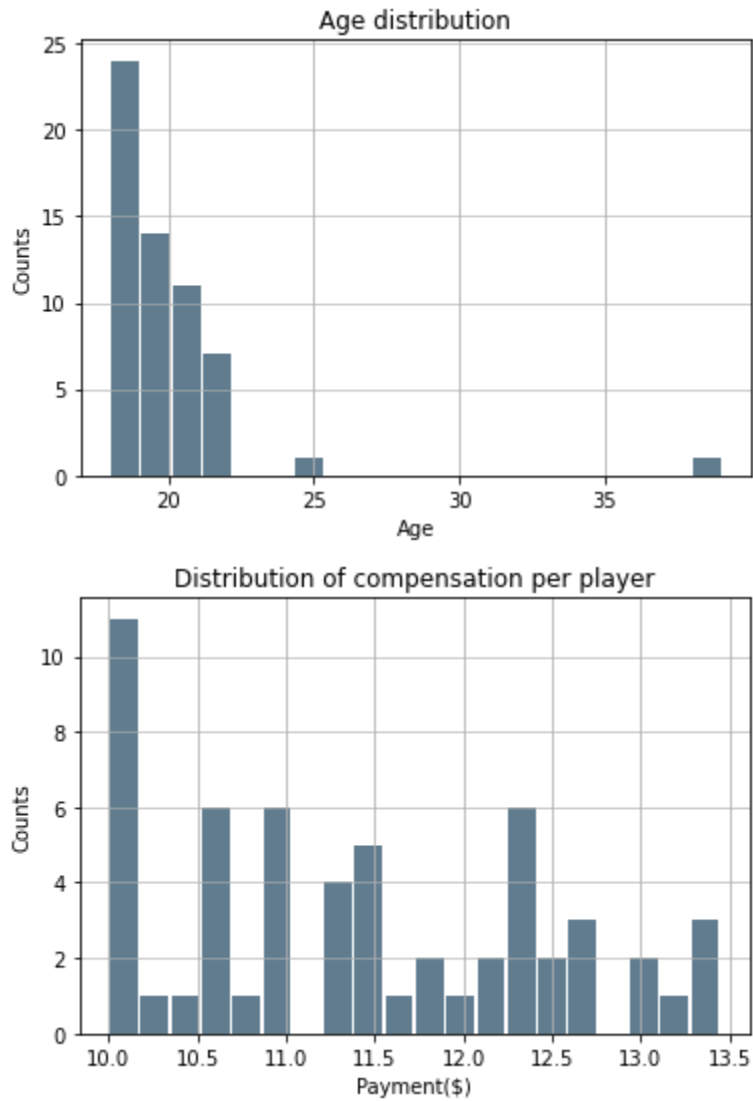


Figure A.6: The distributions of the participants' ages and compensation per player in the simple repeated games.

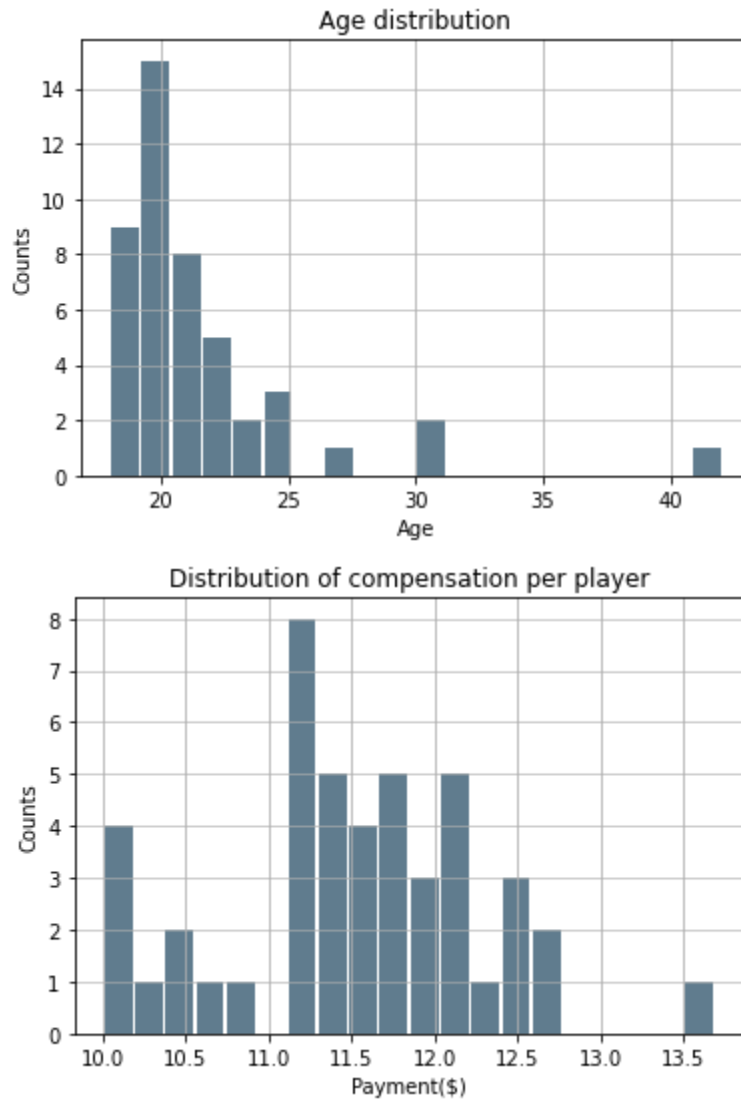


Figure A.7: The distributions of the participants' ages and compensation per player in the cheap talk repeated games.



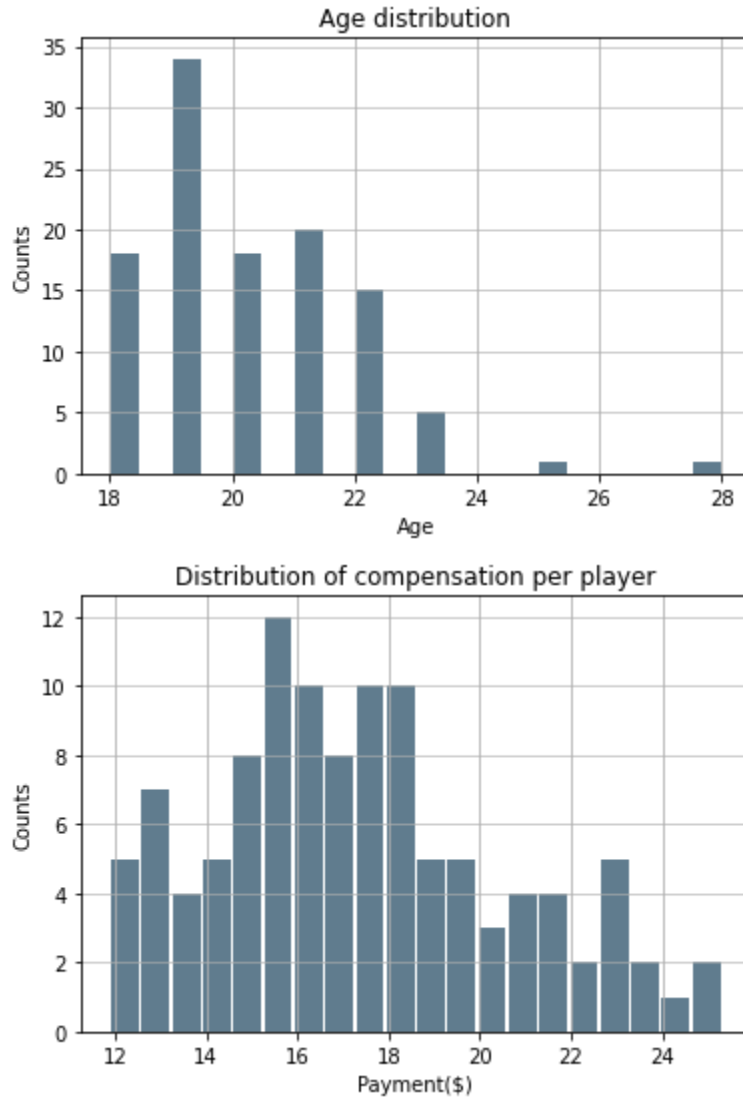


Figure A.8: The distributions of the participants' ages and compensation per player in the networked repeated games.