EQUILIBRIUM PLAY AND BEST RESPONSE TO (STATED) BELIEFS IN CONSTANT SUM GAMES

Pedro Rey Biel
UFAE, Universidad Autónoma de Barcelona
Campus Bellaterra, 08193 Barcelona (Spain)
E-mail: pedro.rey@uab.es
URL: http://pareto.uab.es/prey/

Pedro Rey Biel
Universidad Autónoma de Barcelona

1.Main Question

WHICH ARE THE TYPES OF GAMES FOR WHICH GAME THEORY PREDICTS WELL?

We ask:

1. Do Subjects Play Nash Equilibrium?

2. Do Subjects Believe Opponents Play Nash Equilibrium?

3. Do Subjects Best Respond to their (stated) Beliefs?

We Study Behaviour in **Experiments** with:

- 2 Players
- 3x3 Constant Sum Games
- Unique Equilibrium in Pure Strategies
- Belief Elicitation

Experimental Setting:

- Subjects Play 10, 3x3 Constant Sum Games
- Different anonymous matching in each game
- 2 Tasks:
  - Own **Action**
  - **Beliefs** on Action frequencies by opponents
- Rewards paid for both tasks
- 80 Subjects

Important Characteristics:

- Non- Economists
- One Shot: No Feedback / No Learning
- Simple Numbers
- Controls for Social Preferences
- Belief Elicitation on Frequencies

2. Design of the Games

1) Unique Pure Strategy Nash Equilibria **(NE)**

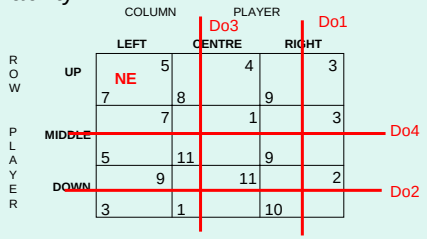
2) Maximum Discrimination between Different Models´ Predictions

COLUMN PLAYER

ROW PLAYER	Left	Center	Right	
Up	11 / 1	F L3 5 / 7	9 / 3	11
Med	8 / 4	L2 8 / 4	NE 8 / 4	12
Down	Max 4 / 8	10 / 2	L1 9 / D1 3	13
	23	23	26	

- **L1:** Best response to opponent playing randomly
- **L2:** Best response to opponent playing L1
- **L3:** Best response to opponent playing L3
- **D1:** Best response to opponent playing randomly among non-dominated actions
- **Max:** Choosing strategy containing maximum payoff

3) Different Levels of Strict Dominance Solvability



4) Fair / Unfair Treatments without changing Dominance or Models´ Predictions

=> Equal Splits (6,6) were feasible in "Fair" Treatment

3. Results

1). **Nash Equilibrium Explained behaviour** better than previously succesful Bounded Rationality models

	NE	L1	L2	L3	D1	Max
%	79.6	50.2	66.4	66.8	70.3	25.1

2) Number of rounds of **dominance solvability** was **not** a good measure of **how complex games were** for subjects

Game	Row Subjects	Column Subjects	All Subjects	Nº Rounds Iterated Dominance (R,C)
1R	80	72.5	76.25	1,2
1C	60	90	75	2,1
2R	95	70	82.5	2,3
2C	75	87.5	81.25	3,2
3R	92.5	72.5	82.5	3,3
3C	87.5	87.5	86.25	3,3
4R	87.5	87.5	87.5	4,3
4C	67.5	90	78.75	3,4
NR	92.5	52.5	72.5	No
NC	72.5	75	73.75	No
Average	81	78.5	79.625	

3) **Behaviour** was **not affected** by whether **Equal splits** were feasible or not

4) Subjects **best responded** to their stated beliefs in **73%** of the cases

5) Subjects were good predicting opponents´ choices, although **beliefs** were **"conservative"**

6) **Asking for beliefs** before subjects played games **did not affect** behaviour

7) Subjects **who played Nash Equilibrium** were **more accurate in their predictions** of opponents´ behavior

4. Conclusions

- **IN SIMPLE GAMES, SUBJECTS PLAY ACCORDING TO NASH EQUILIBRIUM PREDICTION**
- **EQUILIBRIUM REASONING IS FEASIBLE IN SIMPLE GAMES WHEN:**
  - **CONTROLLING FOR SOCIAL PREFERENCES**
  - **PAYOFFS NOT ARTIFICIALLY COMPLEX**
- **EQUILIBRIUM BELIEFS ARE THE MOST FREQUENT**
- **SUBJECTS BEST RESPONDED TO STATED BELIEFS**

BUT:

- **WHAT IS THE REAL REASONING PROCESS?**

5. What Would You Play?

A	8 / 4	5 / 7	2 / 10
B	5 / 7	5 / 7	5 / 7
C	1 / 11	5 / 7	6 / 6

PLEASE PUT A CROSS ON YOUR CHOICE