

444 Lecture 5.7 - Rationalizable Strategies

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Plan

To introduce the idea of rationalizable strategies.

Bonanno, section 6.4

Playing Best Responses

	Left	Right
Up	3, 0	0, 1
Middle	1, 1	1, 0
Down	0, 0	3, 1

In this game, the best responses are:

- Row can play Up (best response to Left) or Down (best response to Right);
- Column can play Left (best response to Middle) or Right (best response to either Up or Down).

Playing Best Responses

	Left	Right
Up	3, 0	0, 1
Middle	1, 1	1, 0
Down	0, 0	3, 1

- But Middle is not a best response.
- It is dominated by the 50/50 mixture of Left and Right.

Iterated Best Responses

	Left	Right
Up	3, 0	0, 1
Middle	1, 1	1, 0
Down	0, 0	3, 1

- So while Left is a best response...
- It is not a best response to a best response.

Iterated Best Responses

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- I could build more complicated examples, where we had cases that are best responses to best responses, but not best responses to best responses to best responses.
- Actually we've already seen such a case.
- In the Ice Cream game, 2 is a best response to 1, which is a best response to 0.
- But 2 is not a best response to any best response to a best response.

Iterated Best Responses

- Some strategies are at the start of an infinite chain S_1, S_2, \dots where each strategy is a best response to the one that comes after it.
- Call these the **rationalizable** strategies.

Infinite Chains

Here is one way to get an infinite chain like this.

- If the pair $\langle S_1, S_2 \rangle$ is a Nash equilibrium, ...
- Then S_1 is a best response to S_2 , which is a best response to S_1 , which is a best response to S_2 , which ...

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- Then S_1 is a best response to S_2 , which is a best response to S_1 , which is a best response to S_2 , which ...
- But you don't only need to use Nash equilibria.
- Think about Rock, Paper, Scissors.
- Rock is a best response to Scissors, which is a best response to Paper, which is a best response to Rock, which is...
- But Rock is not part of a Nash equilibrium.

I'm not going to prove this, but the following turns out to be true.

- The strategies that can be at the start of these infinite chains ...
- Are exactly those strategies that survive iterated deletion of strongly dominated strategies ...
- Provided we include dominance by mixtures when we're doing the deleting.

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- Note that this view is more permissive than the view that rational players will choose Nash equilibria.
- All Nash equilibria are rationalizable, but some rationalizable strategies (e.g., Rock!), are not Nash equilibria.
- Most economists think that if there is a key notion in game theory, it is **less permissive** than Nash equilibrium.

For Next Time

- We'll close this out by going back to Nash, and asking why Nash equilibrium is philosophically significant.