

Session 4.4

Iterative Dominance defined

This session is the third in triplet on the concept of dominance:

1. Dominant strategies
2. Dominated strategies
3. **Iterative dominance.**

It shows what iterative dominance means. Then we tie the three parts of dominance together.

Iterative dominance is a strategic concept

- ◆ The concepts of a **dominant strategy** and a **dominated strategy** apply to **individual players**.
- ◆ In both cases no strategic issues are involved: what the other players do may affect your payoffs but not whether any of your strategies are dominated or dominant.
- ◆ The concept of **iterative dominance**, can only be defined by checking inequalities that relate to the payoffs of **multiple players**.

A dominated strategy

◆ Suppose R2 is **dominated** by R1:

- $r_{11} > r_{21}$
- and $r_{12} > r_{22}$
- and $r_{13} > r_{23}$
- and at least one inequality is strict.

◆ Then selecting R2 is not rational.

◆ Assume **column knows** R2 is dominated (for the row player). This requires **column** to have some knowledge of **row's** payoffs.

◆ If **column** believes **row** is rational, she ignores outcomes that can only be reached by **row** playing R2.

◆ This simplifies the problem facing **column**.

	c1	c2	c3
R1	r11	r12	r13
R2	r21	r22	r23
R3	r31	r32	r33

Upon seeing a rival's dominated strategy

- ◆ Suppose **column** recognizes R2 is **dominated** by R1 and believes **row** is rational.
- ◆ **Column** deduces **row** will not play R2, and so **column** ignores c22 and c23.
- ◆ Supposing in addition:
 - $c_{12} > c_{13}$
 - and $c_{32} > c_{33}$,
 - ⇒ C2 **iteratively** dominates C3.
- ◆ Even if $c_{22} \ll c_{23}$, **column** should not select C3 because selecting R2 is not rational for **row**.

	C1	C2	C3
R1	r11	r12	r13
R2	r21	r22	r23
R3	r31	r32	r33

The reduced game

◆ Removing:

- R2 because it is dominated
 - C3 because it is iteratively dominated
- simplifies the game to a 2×2 bi-matrix game.

◆ We can go further. Also assume, say:

- $r_{11} > r_{31}$
 - and $r_{12} > r_{32}$,
- ⇒ R1 is an **iteratively dominant strategy**.

	C1	C2
R1	r11	r12
R2		
R3	r31	r32

◆ Thus if **row** is rational, and thinks **column** is rational, and knows the inequalities used in the arguments laid out in the previous two slides then **row** will play R1.

◆ In this case **column** picks the strategy corresponding to the maximum of c_{11} and c_{12} .

Rationalizable strategies versus NE

- ◆ When a game can be solved by iterative dominance, we say it is **rationalizable**.
- ◆ All rationalizable strategy profiles are NE, but not all NE are rationalizable.
- ◆ Indeed there might be multiple NE, but except in hairline cases, rationalizable strategy profiles are unique.
- ◆ Thus no coordination between players is required, just some knowledge of rival payoffs.
- ◆ Thus rationalizable strategy profiles (when they exist) are more convincing than NE that are not rationalizable.

How sophisticated are the players?

- ◆ Applying **iterative dominance** assumes players are more sophisticated than only applying **dominance**.
- ◆ Dominant strategies are **unilateral**.
- ◆ Iteratively removing dominated strategies are **multilateral**. A player applying iterative dominance does so because s/he believes the other players do too.
- ◆ That is each player recognizes the dominated strategies of the other players, reduces the strategy space of the game appropriately, and then repeats the process.
- ◆ When every player thinks logically about strategic interaction, iterative dominance is also very persuasive.