# Is Nash Equilibrium a Good Prediction?

Is the Nash equilibrium really a good prediction about what outcome we should expect to see?

We can use our in-class Prisoners' Dilemma and Oligopoly games as examples, or guides.

If you were the manager of one of the firms in the oligopoly

(a) would you predict the other firms will behave as the NE predicts?
(b) if so, would *you* then behave as the NE predicts -- would you choose the Cournot/Nash $q_i$?

If the answer to both questions is "yes," then the prediction is probably a good one.

The answer to (b) is probably "yes" -- after all, you can't do better, given what the others are doing.

But the answer to (a) is not so clear. We might say that the answer to (a) is … ***It depends!***

So what does it depend on?

The question we asked was:

(a) would you predict that the other players will behave as the NE predicts?

Some of the facts and issues that might affect your answer to (a):

- Is the equilibrium a "good" outcome? Could the players jointly do better at another profile?
- Is this game to be played just once … or a few times … or a great many times, repeatedly?
- How "expert" are the players? For example, how much experience do they have?
- How much do the players know about one another? Have they communicated beforehand?
- How many firms (players) are there?

Note that we're taking a different view of the question, and how to answer it, than Dutta takes in Chapter 5 of the textbook. Dutta provides several arguments that attempt to justify a belief that the equilibrium is a good prediction. Instead, we're asking what factors might make it a good prediction and what factors might make it not such a good prediction.

# Is the equilibrium a good outcome for the players?

- Could the players all do better at some other outcome (obtained by playing some other profile)?

  -- Prisoners' Dilemma
  -- Cournot oligopoly: with n = 2 firms; with n = 4 firms; with many firms.
  -- Coordination games (e.g., Battle of the Sexes)

- If another outcome would be better, then …

  -- communication might help achieve it
  -- sanctions might help (changing the "rules" of the game)
  -- repetition might help … as the following page outlines

# How many times will the game be played?

- If played only once, the players might not be very knowledgeable or expert
  - -- Coordination games
  - -- In-class Prisoners' Dilemma
  - -- In-class oligopoly

- If played many times, the players may "learn" about the others' play and how to play "better"
  - -- Their play might "converge" toward the Nash equilbrium
  - -- Example: Cournot duopoly

- If played many times, the players might be able to sustain "cooperation" if it would be better.
  - -- In-class Prisoners' Dilemma
  - -- In-class oligopoly
  - -- But note that in these games "cooperation" is *not* an equilibrium

- What if there were many firms in the oligopoly? In the Prisoners' Dilemma?

The outcome might be different than if there were only two or three, as the following page outlines.

# How Many Players Are There in the Game?

- If only two players, each one may be able to influence the others' actions by his own actions
  - -- Repetition is critical for this
  - -- Prisoners' Dilemma: each player can, by his own actions, encourage or punish the other
  - -- Oligopoly: each firm can, by its own actions, encourage or punish the other
  - -- Coordination games: easier to coordinate with only two or three players than with many

- With many players, it might be difficult to detect and punish "cheaters"