Refinements of Nash equilibria

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Outline

1.   Yesterday on Nash equilibria

2.   Imperfect and incomplete information:

Bayes Nash equilibrium with incomplete

information

3.   Subgame-perfect Nash equilibrium

4.   Perfect Bayesian equilibrium

1. Yesterday on Nash equilibria

If there is unique solution (e.g. in the Cournot duopoly), how do you get to equilibrium?
(i) *mass-action interpretation*: arrive by trial and error giving more weight to strategies that give higher payoffs, boundedly rational players (replicator dynamics)
[hybrid case: best-response dynamics, players know model but "solve" it wrong (adaptive expectations)]
(ii) *idealizing and rationalistic interpretation*: jump to equilibrium with rational players who know model (rational expectations)

If multiple equilibria (*rendez-vous* or poverty trap):

(i) *mass-action interpretation*: replicator dynamics leads away from mixed-strategy equilibria to one of pure strategy equilibria

(ii) *idealizing and rationalistic interpretation*: could use heuristic reasons to select an equilibrium, e.g., the Thomas Schelling idea of focal points

Alternative to equilibrium selection is equilibrium refinement: impose additional constraints on equilibria, look at this

2. Imperfect and incomplete information: Bayes Nash equilibrium with incomplete information

(i) Imperfect information:
- not know what action the other players are chosing;
- in normal form decisions are simultaneous

(ii) Incomplete information:
- not know what payoffs the other players have (not know the other's type)
- include the different types as potential players to derive the equilibrium of the game

Example from models of pre-electoral politics

-    Downs spatial model of political competition: there is imperfect information about choice of party platforms, but there is complete information about identity of median voter: one party (monopoly of power) versus two parties

-    Probabilistic voting model: not know the identity of median voter, have Bayes Nash equilibrium

3. Subgame-perfect Nash equilibria

- Sequential games: look at extensive form, there can be subgames
- Subgame-perfect equilibrium: Nash in game, Nash in subgames (i.e., strategies must be equilibrium when restricted to any subgame)
- Idea from Selten: avoid incredible threats off the equilibrium path (see example)
- Myerson links motivation credible threats and promises in Schelling: burning the bridges behind us is commitment, not mere words ("talk is cheap while moves are not"

Ansolabehere: Downsian model fifty years later

- Fiorina: where is the median voter? No convergence of policies because of several reasons

- entrance of third party (Palfrey)

- probabilistic voting and valence issues (Donald Stokes)

- agency issues: discretionary policy (Alesina)

4. Perfect Bayesian equilibria

- games of incomplete information where actions (signals) are available

- Nash, Nash, Nash: strategies have to be Nash equilibria in game, Nash equilibria in subgames and Nash equilibria in continuation games

- specific case of signaling games: cheap-talk games where messages are payoff-irrelevant

References

Alesina, Alberto, and Howard Rosenthal. 1995. *Partisan politics, divided government and the economy.* Cambridge University Press.

Ansolabehere, Stephen. 2006, Voters, candidates, and parties. In Barry Weingast and D. Wittman (eds.), *The Oxford handbook of political economy*, chapter 2. New York, Oxford University Press.

Downs, Anthony. 1957. *An economic theory of democracy.* Boston: Addison Wesley. [chapters 1, 2, 3 and 8]

Gibbons, Robert. 1992. *Game theory for applied economists.* Princeton, NJ, Princeton University Press.

Schumpeter, Joseph A. 1942. *Capitalism, socialism and democracy*, New York: Harper and Row. [chapter 22]