Lecture Notes
Economics 195, Experimental Economics and Game Theory, Wi 2010, Professor Holian

Nash equilibrium – situation in which economic actors interacting with one another each choose their best strategy given the strategies that all the other actors have chosen.

Dominant Strategy: A strategy that is best for a player in a game regardless of the strategies chosen by the other players

Fool-proof method of solving for Nash Equilibrium:

Start in the lower right box (state 4). Ask yourself, "Does Exxon have an incentive to deviate?"

This means, does Exxon have an incentive to stop playing Low and play instead High, if Chevron is playing Low?

We must compare the payoff Exxon gets from playing Low with what it would get if playing High. It turns out he gets 5 in the first case and 6 in the second, so yes, he has an incentive to deviate. (note: this is holding Chevron 's move – Low – constant.)

Therefore, Low, Low (state 4) cannot be a Nash equilibrium.

Move on to State 3 (the lower left box)

"Does Exxon have an incentive to deviate in State 3?" Yes, b/c 4>3. So Low, High (state 3) cannot be a Nash equilibrium.

Move on to State 2 (upper right box)

Does Exxon have an incentive to deviate? No! 5<6. Does this mean we've found a Nash Equilibrium?

No again. We need to make sure that neither player has an incentive to deviate. So, before concluding that there is no Nash equilibrium in State 2, we must ask if Chevron has an incentive to deviate. It turns out he does, b/c 4>3.

Finally, we must determine whether state 1 is a Nash equilibrium. Does Exxon have an incentive to deviate? No, b/c 4>3. Does Chevron have an incentive to deviate? No again, b/c 4>3.

Neither player has an incentive to deviate, and so we've determined that there is a Nash equilibrium in state 1, where both players play High.

Here's another game, loosely based on a scene from Ron Howard's *A Beautiful Mind*

Each player can ask one girl to dance. Bill can ask either the Blonde or Brunette 1, and John can ask either the Blonde or Brunette2. A girl will dance if asked by one of them, but If both ask the same girl to dance she will not dance with them, because in this case they will "block each other's play" (to use the term from the movie). Can you find a Nash equilibrium (or equilibriums)?

		John: Blonde	John: Brunette 2
Bill	Blonde	0, 0	2, 1
	Brunette 1	1, 2	1, 1

Notice the Nash equilibriums are not the same as the one proposed in the movie.

1. Consider the following situation. One agent, "Player 1," must decide whether to Violate or Not Violate a given law or regulation (say, a violation of antitrust law) knowing that there is a second agent, the "Inspector," who might Inspect him or not (this could be the authorities at the Department of Justice.) The inspector gets a payoff of 2 if player 1 does not violate the law, but incurs a disutility of -1 if inspects. If the inspector catches player 1 violating the law, he gets a payoff of 5 (but still incurs the disutility of 1), but if the inspector does not catch player 1 violating, the inspector gets a payoff of zero (representing a reprimand.)

	Inspect	Not Inspect
Violate	-1, 4	1, 0
Not Violate	0, 1	0, 2

a. Say player 1 violates with probability p, and the inspector inspects with probability q; what is the mixed strategy Nash equilibrium to this game?

Now, say everything is as above, but the inspector gets paid a larger reward for catching a violator. In particular, he gets a payoff of 6. The game can now be rewritten as:

	Inspect	Not Inspect
Violate	-1, 5	1, 0
Not Violate	0, 1	0, 2

b. What happens to the probability the inspector inspects? What is the new equilibrium value of q?)

Finally, say everything is as in the original version of the game, but the punishment for player 1 is increased if he is caught. In particular, player 1 gets a payoff of -2 if he is caught in violation. The game can now be rewritten as:

	Inspect	Not Inspect
Violate	-2, 4	1, 0
Not Violate	0, 1	0, 2

c. What happens to the probability that player 1 violates? What is the new equilibrium value of p?
d. Are the comparative static properties of this model as you would have thought? Describe the intuition behind the results of the model.

Answers

a.

EV1(Violate) = -1q + 1(1-q) = 1-2q
EV1(Not Violate) = 0q + 0 (1-q) = 0

→ 1-2q = 0 → q=1/2

EV2(Inspect) = 4p + 1(1-p) = 1 + 3p
EV2(Not Inspect) = 0p + 2(1-p) = 2-2p

→ 1+3p = 2-2p → p = 1/5

b.

EV1(Violate) = -1q + 1(1-q) = 1-2q
EV1(Not Violate) = 0q + 0 (1-q) = 0

If the expected value of violating is equal to the expected value of not violating, player 1 will be indifferent from his two pure strategies. This occurs when:

1-2q = 0 → q=1/2

EV2(Inspect) = 5p + 1(1-p) = 1 + 4p
EV2(Not Inspect) = 0p + 2(1-p) = 2-2p

If the expected value of inspecting is equal to the expected value of not inspecting, player 2 will be indifferent from his two pure strategies. This occurs when:

1+4p = 2-2p → p = 1/6

c.

EV1(Violate) = -2q + 1(1-q) = 1-3q
EV1(Not Violate) = 0q + 0 (1-q) = 0

→ 1-3q = 0 → q=1/3

EV2(Inspect) = 4p + 1(1-p) = 1 + 3p
EV2(Not Inspect) = 0p + 2(1-p) = 2-2p

→ 1+3p = 2-2p → p = 1/5

Experimental Methodology I (outline of Holt, Ch 1, Sec III)

Treatments

- Set of procedures (instructions, incentives, rules of play, etc.)
- One should be a baseline, and should be calibrated to see how subjects play
- “2x2” design with treatments is common

Treatment Structure: “Between-Subjects” Versus “Within-Subjects” Designs

- With two treatments, one must decide whether to assign all subjects to both treatments, or to assign half the subjects to each treatment
- The former (within subject design) allows for:
  - Puts more people into each treatment
  - Individual differences are controlled for by letting each person serve as their own control
- The latter (between subjects design) allows for:
  - Generates the most observations per treatment
  - Avoids **“sequence effects”**

Incentives

- Most economists are suspicious of results of experiments done with hypothetical incentives

Replication

- A major advantage of experimental analysis is the ability to repeat the same setup numerous times in order to determine average tendencies
- Replication requires that instructions and procedures be carefully documented

Control

- A second major advantage of experimental analysis is the ability to control for extraneous factors
- Loss of control can result when more than more factor is changed across treatments
- Loss of control can also result when procedures are unclear
  - Example: nonmonetary rewards (but these are useful in determining endowment effects)

Fatal Errors

- Inappropriate incentives
- Nonstandarized instructions and procedures
- Loss of control due to failure to provide a calibrated bseline treatment
- Loss of control due to changes in more than one design factor at a time

Experimental Methodology II (outline of Camerer, Ch 1, Appendix II)

Control, Measure, Assume
Instructions
Anonymity

- "Anonymity is obviously not used because it is lifelike. It is used to establish a benchmark against which the effects of knowing who you are playing can be measured, if those effects are of interest."

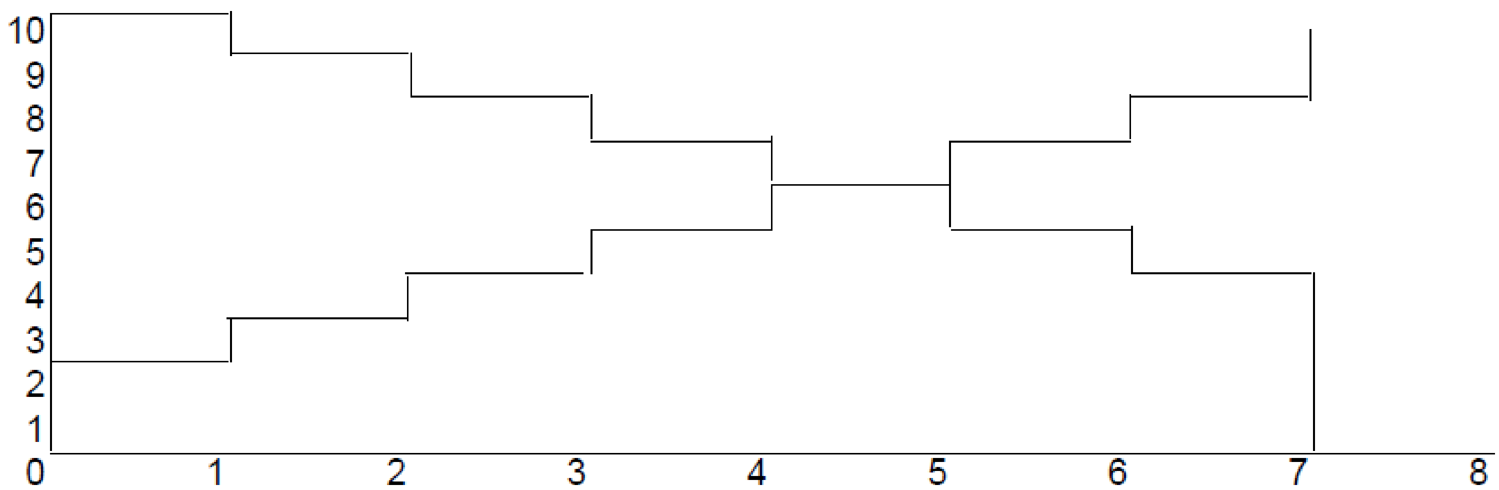
Matching Protocals & Reputation Building
Incentives
Order Effects

- "[These are] easily controlled by running some sessions in the reverse order BA and including an order dummy variable in statistical analyses."

Controlling Risk Tastes
Within Subjects and Between Subjects

- "There is a curious bias against within-subjects designs…I don't know why…"

Experimetrics



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