

Basic Concepts

players : whoever are making the strategic choices ...(firms, or consumers, or governments, or ...)

payoffs : what the players care about ... (profit, or utility, or prestige, or ...)

actions : what the players choose (output levels, or prices, or consumption levels, or whether to invade other countries, or ...)

the payoff to any player depends on the actions of all the players

Example : Cournot Duopoly

players : 2 of them : the two firms

payoffs : each firm's profits

actions : levels of output of each of the firms

$$\pi_1 = p(q_1 + q_2)q_1 - C(q_1)$$

so that player (firm) 1's payoff (profit) depends both on its own action (q_1) and on the other player's (firm's) action (q_2)

order of play?

firms choose output levels simultaneously

Stackelberg? : that's a game with the same players, actions, and payoff functions — but a different order of play

Strategies versus Actions

no difference between “actions” and “strategies” in a 1–shot, simultaneous–move game (such as the Cournot duopoly game)

if players move sequentially, or if there is more than one move, then there is a difference

Chess example

action (example) : move the queen forward two spaces

strategy (example) : move the queen’s pawn forward 1 space on the first move ; then, on the second move, move the right bishop’s pawn forward 1 move, unless the opponent’s first move was to move her queen’s pawn, in which case move the knight forward 2 and 1 to the right ; on the third move, if the opponent’s first two moves were both to move pawns forward, then move the bishop ...

Strategic Form

works for 2–player games

and 3–player games if you have 3 dimensions

most useful for simultaneous–move games

but can be constructed for any 2–player game, in which each player has a finite number of strategies

the strategic form of a 2–player game is a matrix

each row represents a strategy for player #1 ;
each column a strategy for player #2

entries in the matrix are the payoffs to the 2 players

so if player #1 had 5 strategies from which to choose, and if player #2 had 3 strategies, then the strategic form would be a 5–by–3 matrix ; the entry in (row 2, column 3) would be the payoffs to the two players when player #1 played her 2nd strategy, and player #2 played his 3rd strategy

Important Convention

each entry in the matrix is a pair of numbers :
the payoff to each player

the first number is the payoff to player #1, who
chooses the row

the second number is the payoff to player #2,
who chooses the column

Convention : payoff to row chooser is listed first

(Strictly) Dominant Strategy

Definition : one of a player's strategies is a strictly dominant strategy, if it gives the player a higher payoff than any other strategy, regardless of what strategy the other player chooses

let $\pi^1(i, j)$ be the payoff to player 1, when she chooses strategy i , and when player 2 chooses strategy j

then strategy i is a dominant strategy for player 1 if

$$\pi^1(i, j) > \pi^1(h, j) \quad (1)$$

for any strategy j of player 2, and for all other strategies h of player 1

or : the first entry in each payoff pair in row i is the highest in that column

weak dominance : a strategy is weakly dominant if it gives the player at least as high a payoff as any other strategy, whatever strategy the other player plays

so if you have a strictly dominant strategy, you should play it

and you don't need to know anything about the other player's action to make that decision

example 3 (prisoners' dilemma) : each player has a dominant strategy : t for player 1, and L for player 2

Dominated Strategies

strategy i strictly dominates strategy h , for player 1, if

$$\pi^1(i, j) > \pi^1(h, j) \quad (2)$$

for **all** strategies $j = 1, 2, 3, \dots, J$ of player 2

(replace some of the $>$'s with \geq 's and we have strategy i weakly dominating strategy h)

that is : the first entry of every cell in row i is bigger than the first entry of the corresponding cell in row h

strategy i is a strictly **dominant** strategy only if it strictly **dominates** every other strategy of player 1

in example 6, player 1 does not have a strictly dominant strategy but her strategy b is strictly dominated by the strategy t