INT. TRADE

ECON 464

INT. FINANCE

ECON 666

CLASSICAL THEORY
TRADE
PERFECT COMPETITION
+ VERY LITTLE
OF IMPERFECT
COMPETITION
(IRS MONOP. COMP.)

+ SEE ABSTRACTS FROM: KRUGMAN
& BERNARD ET AL.
GAME
- STRATEGY SET
- DS (DOMINANT STRATEGY)
- BR (BEST RESPONSE)
- NE (NASH EQUILIBRIUM)

EXTENSIVE FORM GAMES
GAME

1 - SET OF PLAYERS
   \( i \in \{ 1, 2, \ldots, I \} \)

2 - SET OF ACTIONS FOR EACH \( i \) : \( S_i \)

3 - PAYOFF FUNCTION FOR EACH \( i \) :
   \[ \pi_i (s_1, s_2, \ldots, s_I) \]

4 - OUTCOMES (SET)
   Ex: 2 players: 1, 2
   \( S_i = \{ H_i, L_i \} \quad i = 1, 2 \)

   SET OF OUTCOMES:
   \[ \{(H_1, H_2), (L_1, L_2), (H_1, L_2), (L_1, H_2)\} \]

STRATEGY SET
IDENTIFIES ACTIONS THAT CAN BE TAKEN AT EVERY SITUATION WHEN A PLAYER CAN MOVE.

REMARK: IN MOST GAMES
STRATEGY SET \( \neq \) SET OF ACTIONS
Dominant Strategy (DS)

$S_i$ is a DS for player $i$ if it maximizes player $i$'s payoffs regardless of the strategies chosen by other players.

Notation:

$S_{-i} = \{S_1, S_2, \ldots, S_{i-1}, S_{i+1}, \ldots, S_N\}$

Using this notation, $S_i$ is a DS for player $i$ if

$\Pi_i(S_i, S_{-i}) \geq \Pi_i(S'_i, S_{-i})$

for all feasible $S'_i, S_{-i}$.

Dominant Strategy Equilibrium (DSE)

$(S^*_1, S^*_2, \ldots, S^*_N)$ is a DSE if

$S^*_i$ is a DS for $i = 1, \ldots, N$.

Best Response (BR or $B()$)

$S_i$ is a BR for player $i$ to $S_{-i}$ if

$\Pi_i(S_i, S_{-i}) \geq \Pi_i(S'_i, S_{-i})$

for all feasible $S'_i$.

Notation:

$S_i = B_i(S_{-i})$
**Nash Equilibrium (NE)**

**Strategy Profile** \((s_1^*, s_2^*, \ldots, s_I^*)\)

Such that each player's strategy is the best response to the NE strategies of all other players.

\[
\pi_i(s_i^*, s_{-i}^*) \geq \pi_i(s_i, s_{-i}^*)
\]

For all feasible \(s_i\)

For \(i = 1, 2, \ldots, I\)

Or

\[
s_i^* = B_i(s_{-i}^*)
\]

**Remarks:**

1. NE strategies are BR to each other.
2. There are "pure" NE.
3. Games could have zero or more NE in pure strategies.
4. Every dominant strategy equilibrium is a NE (the reverse is not true).
5. Idea of "no incentive to deviate" once at a NE.

**How to calculate?**

- **I. Best responses & find "intersection/fixed points"**
- **II. Discrete cases: inspect every outcome.**
Ex 1 / Ex 2 / Ex 3
- Static game once
- Simultaneous moves
Payoffs: in each cell

\[ \begin{array}{c}
\text{Row Player} \\
\text{Payoff} \\
\text{Col Player} \\
\text{Payoff}
\end{array} \]

Ex: \( \pi_R (R_2, C_1) = 2 \); \( \pi_C (R_2, C_1) = 1 \)

Set or outcomes:
\[ \{ (R_1, C_1), (R_1, C_2), (R_1, C_3), \ldots, (R_3, C_3) \} \]

Best responses:

<table>
<thead>
<tr>
<th>Row Player</th>
<th>Col Player</th>
</tr>
</thead>
<tbody>
<tr>
<td>( B_R (C_1) = R_1 )</td>
<td>( B_C (R_1) = C_3 )</td>
</tr>
<tr>
<td>( B_R (C_2) = R_1 )</td>
<td>( B_C (R_2) = C_3 )</td>
</tr>
<tr>
<td>( B_R (C_3) = R_2 )</td>
<td>( B_C (R_3) = C_3 )</td>
</tr>
</tbody>
</table>

DS Equil: \( (R_1, C_3) \) is an NE.

Payoffs at DS Equil:
\( \pi_R (R_1, C_3) = 6 \)
\( \pi_C (R_1, C_3) = 4 \)
**Ex 1:**

<table>
<thead>
<tr>
<th>Row</th>
<th>Col</th>
<th>C</th>
<th>O</th>
<th>L</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>C₁</td>
<td>C₂</td>
<td>C₃</td>
</tr>
<tr>
<td>R</td>
<td>R₁</td>
<td>4, 3</td>
<td>5, 1</td>
<td>6, 4</td>
</tr>
<tr>
<td>O</td>
<td>R₂</td>
<td>2, 1</td>
<td>3, 4</td>
<td>3, 6</td>
</tr>
<tr>
<td>W</td>
<td>R₃</td>
<td>3, 0</td>
<td>4, 6</td>
<td>2, 8</td>
</tr>
</tbody>
</table>

Action / Strategies (Expanded)

\[ S_R = \{ R_1, R_2, R_3 \} ; \quad S_C = \{ C_1, C_2, C_3 \} \]
## Ex 2:

<table>
<thead>
<tr>
<th>Row</th>
<th>C</th>
<th>O</th>
<th>L</th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
<td>1,7</td>
<td>C₂</td>
<td>4,5</td>
</tr>
<tr>
<td>O</td>
<td>5,2</td>
<td>5,6</td>
<td>6,3</td>
</tr>
<tr>
<td>W</td>
<td>0,0</td>
<td>3,1</td>
<td>7,7</td>
</tr>
</tbody>
</table>

### Player Row
- \( B_R(C_1) = R_2 \)
- \( B_R(C_2) = R_2 \)
- \( B_R(C_3) = R_3 \)

### Player Column
- \( B_C(R_1) = C_1 \)
- \( B_C(R_2) = C_2 \)
- \( B_C(R_3) = C_3 \)

**Two NE:**
- \( (R_2, C_2) \) & \( (R_3, C_3) \)

### Payoffs
- \( \pi_R(R_2, C_2) = 5 \)
- \( \pi_R(R_3, C_3) = 7 \)
- \( \pi_C(R_2, C_3) = 6 \)
- \( \pi_C(R_3, C_3) = 7 \)
\[
\begin{array}{|c|c|c|}
\hline
& \text{Player 1} & \text{Player 2} \\
\hline
1 & H & 5,10 \\
& B & 0,0 \\
\hline
2 & B & 10,5 \\
\hline
\end{array}
\]

**BR Player 1**

\[
\begin{align*}
B_1(H_2) &= H_1 \\
B_1(B_2) &= B_1
\end{align*}
\]

**BR Player 2**

\[
\begin{align*}
B_2(H_1) &= H_2 \\
B_2(B_1) &= B_2
\end{align*}
\]

Two NE: \((H_1, H_2) \) & \((B_1, B_2)\)