Game Theory in economic policy

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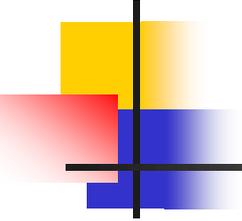
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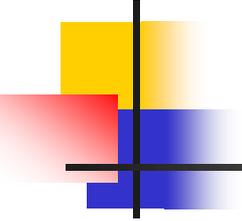
Introductory

✓ Thanks to the University of Cyprus

✓ GT unknown to the people but nevertheless it is used everywhere! (e.g.in the traffic lights, in interpersonal relations - battle of sexes), in inter governmental relations.

✓ GT is a way of thinking and analysis-strategic thinking interrelations – different kind of games different strategies:

  • Zero sum and non zero sum games.

  • Cooperative and non cooperative games.
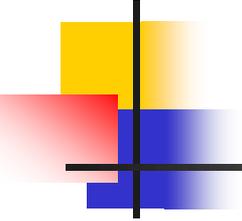
Introductory

Game Theory

Dynamic interaction

⬇

Between different behaviors

⬇

Rational Behavior of players

⬇

Strategic thought to achieve targets
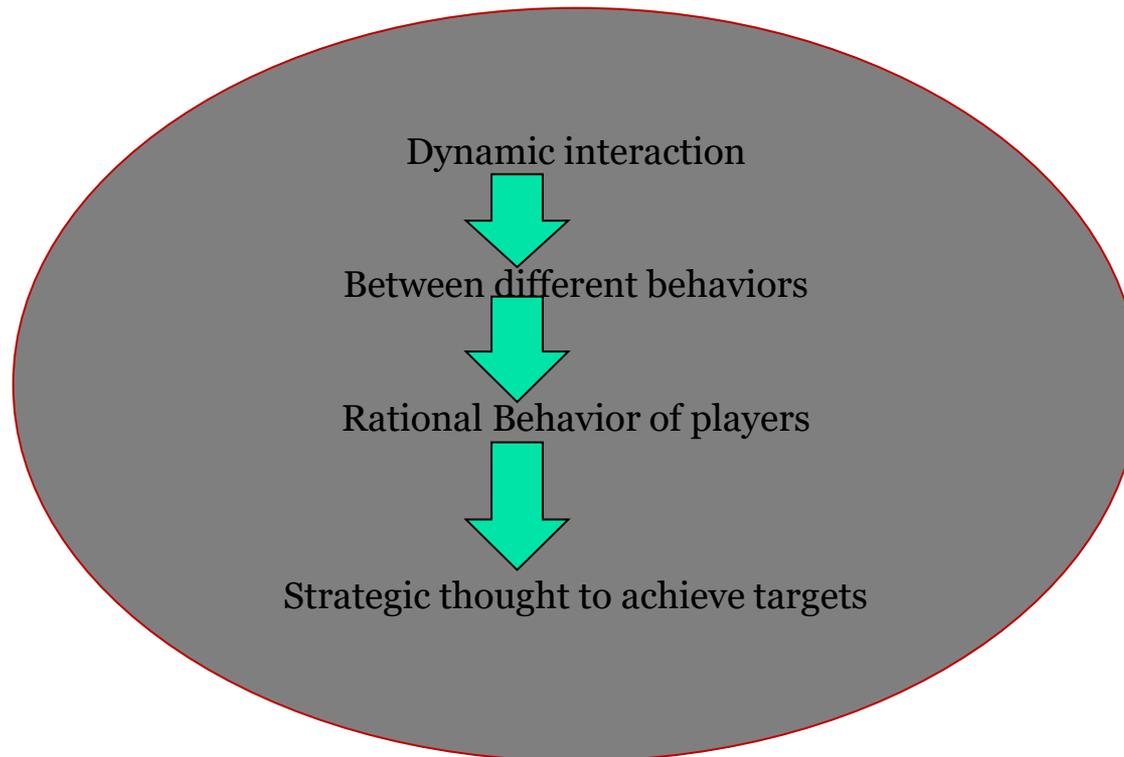
The use of GT
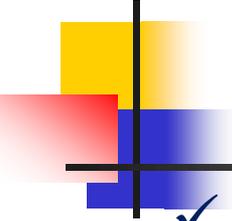
- ✓ GT endeavors a great significance in decision making of critical financial agreements through mathematical economics like fiscal policy formulation, international trade policy, financial agreements and business economics.

- ✓ Degree of complexity concerns the level of parameters you put each game.

- ✓ Increase of variables and unknown factors.
- ✓ Higher number of parameters => greater complexity thereby raising players, variables and strategic option.

The use of GT
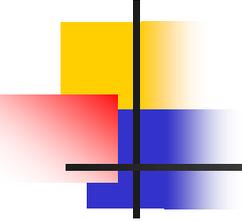
- ✓ In private enterprises for profit maximization and increase their market share to form alternative strategic options (oligopolies, monopolistic competition).

- ✓ In international relations to resolve long lasting political problems, e.g. Cyprus issue and the Palestinian affair.

- ✓ In political parties, in political decision making.

- ✓ Determination of energy products prices.

The use of GT
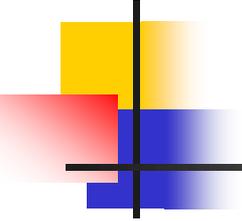
- ✓ In markets structure e.g. oligopolies under imperfect competition
    - ✓ Cournot duopoly game, Bernard game, Stackenberg imperfect competition game.
    - ✓ Asymmetric information inserts in the analysis...
    - ✓ Provide advantages to enterprises with better information.
- ✓ The GT can better explain more efficiently the behavior where market power can determine possible outcomes of competition through prices and quantities.
- ✓ Price plays a lesser role and other factors enter (dominant strategy, price determination via price leadership).
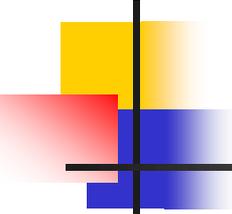
GT and its role in economic policy formulation

- ✓ Large private firms e.g. (banks, financial organizations, private enterprises of energy products).

- ✓ Negotiations between enterprises to form coalitions and create cartels via collusions, multinational enterprises aiming to control the market and monopolize the market under oligopolistic conditions e.g. OPEC in world oil market.

- ✓ In market reforms serving to probabilities appraisal and estimation of probabilities for implementation and the formation of alternative scenario to anticipate possible resistance.

- ✓ Reform examples are privatizations, the implementation of a new health care system, educational reform, wages determination in the private and the public sector, investment policy, tax policy, social policy etc.

GT and its role in economic policy formulation
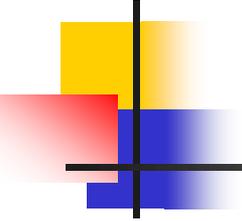
✓ Nuclear weapons competition consists of a non-explicit game theory example (USA, Israel, Russia, China, U.K, India, Pakistan, Japan, France, Germany).

✓ No country wishes to step back in nuclear technology …but no country wishes to pursue a nuclear war option. This can activate a harsh competition in R&D and to innovation technology…

✓ Nuclear energy: empty threats or "balance of terror?". North Korea example!

✓ Why does nobody wish to pursue a nuclear war option? Everybody is worse off (worst case scenario) and everybody knows that comparing it with the status quo.

✓ Maintaining status quo (best case scenario)-Nash equilibrium?

✓ All the abovementioned influence global economy through different channels like finding new cancer treatments, financing large funds in the war industry instead of investing in health and education.
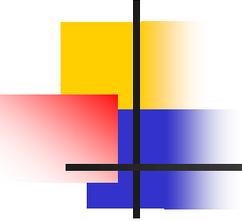
GT and its role in economic policy formulation

NUCLEAR WAR THREAT

I NUCLEAR WAR

	COUNTRY A	COUNTRY B
COUNTRY A	(-1,0)	(0,-1)
COUNTRY B	(0,-1)	(-1,0)

II STATUS QUO

An example from the Labour Market

- ✓ **Labour dispute** to determine wage increases in the private sector.

- ✓ **Employers vs Employees.**

- ✓ Is it a zero sum or a non zero sum game?

- ✓ Common interest to cooperate or not?

- ✓ Keep **flexible or rigid strategy**? What strategy each player would pursue?

- ✓ They all know the **best case and the worst case** scenario.

- ✓ There is always **uncertainty** for **bargaining in good faith**, which may lead to either a solution or deadlock.

- ✓ Effort to avoid **extreme solutions** such as working pause, strikes, firing threats and strike threats.

An example from the Labour Market

✓ Different strategic targets of players to achieve, either profit maximization or loss minimization **(maximin or minimax).**

✓ <u>Free negotiations</u> employees – employers and Strategy I= flexible stance, Strategy II= rigid stance.

✓ If free negotiations conclude in a deadlock then the state intervenes as a mediator with the scope to achieve a consensus assuming that the state would negotiate <u>in good faith.</u>

EMPLOYEES

- Higher salaries in current year
- Indexation of nominal wage to
- retain real wage purchasing power. higher other rights (days off, pensions increase, overtime payment)
- Fewer hours worked

EMPLOYERS

- Profits to maximize and production to continue without any interruption of the production line
- Maintain/reduce labour cost thereby increase in hours worked
- Reduce other rights and benefits.

An example from the Labour Market

✓ Nash equilibrium is not achieved once both players keep on either flexible or rigid strategy. In both cases both players get nothing as their payoff.

✓ If the employer keeps a rigid strategy and the employees keep a flexible one then the employer ends up with a loss and if the opposite occurs then employees end up with a loss.

✓ Both players opt to remain firm at their initial strategy and thus, there has been no equilibrium achieved.

E

	I	II
I	(0,0)	(-1 ,1)
II	(1,-1)	(0,0)
	No Nash equilibrium achieved	

L

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An example from the Labour Market

- ✓ If both players opt to play strategy I then both get zero payoff.
- ✓ If both players play strategy II, then again get zero payoff.
- ✓ If employers select to play strategy I and employees strategy II, then employers payoff is less than employees and if the employees select to play I and employers to play II then employees payoff is less than what employers get.
- ✓ Under these assumptions no Nash equilibrium is achieved and both players opt to remain at their initial strategies.
- ✓ Nonetheless, the state needs to intervene as a mediator to reconcile the players since through a possible settlement it can be in the interest of all 3 players.
- ✓ The state should attempt to identify the second best scenario where all could be better off.

An example from the Labour Market

- ✓ The state aims in a mediator role to find an ultimate solution which could fulfill all actors and at the same retain fiscal balance and retain macroeconomic stability.
- ✓ Relevant power of each player could form the final outcome…but still it might not be the best outcome for all players.
- ✓ Time factor may play a significant role to the whole game.
- ✓ State intervention differentiates expected payoffs.

STATE
- Retain Fiscal balance
- Avoid measures-labour disputes, strikes, hours lost due to strikes
- productivity increase + employment growth to achieve GDP upswing.

An example from the Labour Market

✓ The economy is at a steady state position.

✓ dY/y= Y* potential growth rate, u%=nairu, dp/p=core inflation.

✓ The state intervention can change payoffs for each player in each scenario.

✓ There is Nash equilibrium if only both players keep a flexible strategy (II, II) whereas if they keep a rigid stance (I, I), that pays zero profit to both. Each player has a higher payoff if it keeps a rigid stance while the opponent keeps a flexible stance (I, II) και (II, I) but this is not a Nash equilibrium.

✓ If both opt a rigid strategy then they both end up with empty hands. If both play a flexible strategy the both end up with a higher payoff and this is a **Nash equilibrium.**

E

L		I	II
I		(0,0)	(1,-1)
II		(-1,1)	**(1,1)**
			Nash equilibrium

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An example from the Labour Market
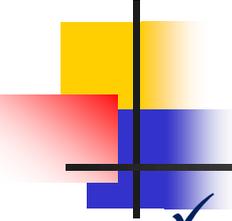
✓ Deviations from Nash equilibrium:

  ✓ A change in negotiating position due to different economic conditions of the economy (slump, recovery).
  ✓ Strategies differentiate due to the fact that both players can change their strategies because of relevant change in their bargaining power.
  ✓ In a recovery era employees may be willing higher compensation while during a downturn on the economic cycle employers maintain the upper hand in negotiations contrasted to a steady state position.
  ✓ In mathematical terms, this problem may have multiple equilibria due to an infinite number of combinations leading to a solution that could be accepted by all players.

✓E.g. Lower wage increases in the current year and higher increases for the next years, gradual increase of employers contribution into the pension fund, increase of employers contribution in the provident fund and gradual increase of the days off.

Concluding remarks
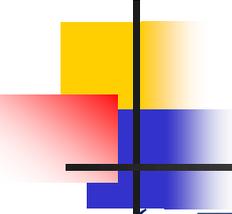
- ✓ The GT can be used to resolve different kind of contrasting problems in the economy, in politics etc.

- ✓ The labour market game could have been expanded to a repeated game as an intermediate option (repeated game) to serve as a pressure measure of the state, before the definite solution is achieved for both players and until Nash equilibrium is reached.

- ✓ However, such an action increases the cost incurred by both players and thus the final agreement could be delayed until the catalytic state intervention.

- ✓ Think of the Cyprus problem as a repeated game theory problem and elaborate if it can be resolved under current circumstances-Nash equilibrium?

- ✓ Under the current status quo is it possible the two sides to reach a permanent and durable solution?

- ✓ «Beautiful mind movie-Nash life, 2001».

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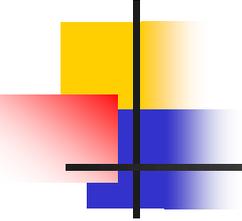
Thank you for your attention!

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