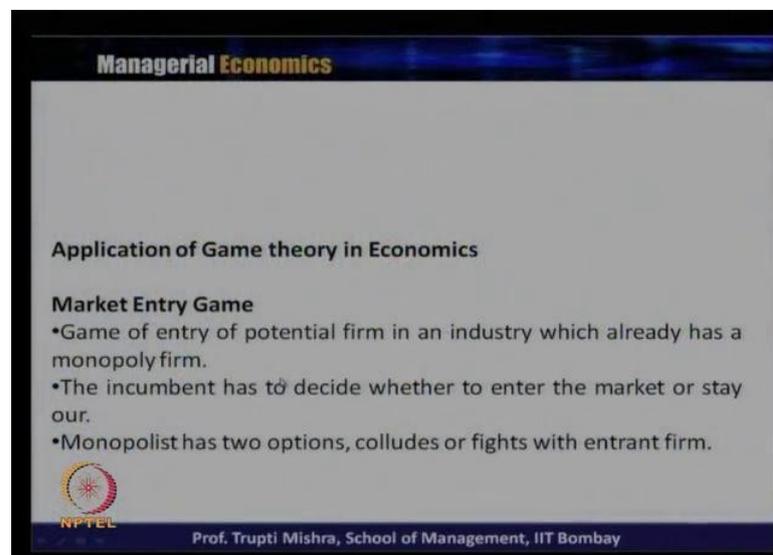


Managerial Economics
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Lecture - 73
Game Theory Product Pricing

We will continue our discussion on the theory of game and particular its application on economic analysis. So, last class if you remember we discussed about different types of game. And, we will pick up specifically few types of game which is more which is more applicability in the case of the economic analysis. So, in the in that context the first discussion will be on the market entry game

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And, here we will analyze that how the when the firm plans to enter into the market. Generally how he uses the game theory and from the other points of view the existing firms who those who are there in the market. How they use game theory to create a barrier to or to if the firm is coming into the market. How they are going to maximize the profit.

So, game of entry of potential firm in industry which is already a monopoly firm. So, we will take a case where the existing industry setup is there is only one monopoly firm. And, there is potential firm who is entered try to enter into the market and compete with the monopolist firm to maximize the profit or get the market share. The incumbent has to decide whether to enter the market or stay out. So, incumbent has 2 choices or the 2 options. At this point of time whether he has to enter the market or he will stay out he will not enter into the market. And, in the other hand the existing firm typically the monopolist firm has also 2 options

whether to collude. If the firm is entering into the market, whether to collude with the entrant firm or whether to fight with the entrant firm.

So, there are 4 options. That is there with the taking to the incumbent firm of the existing firm. For the incumbent firm the options are whether to enter into the market or stay out. And to existing firm whether to, whether to fight or collude with the new entrant in the market. So, on that basis now we will try to do a pay off matrix for on the basis of the options available to the existing firm and also to the incumbent firm.

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The image shows a handwritten pay-off matrix on a whiteboard. The title is 'Incumbent Existing Monopolist'. The columns are labeled 'Collude' and 'fight'. The rows are labeled 'Entrant' and 'Stay out.'. The pay-off pairs are: (40, 50) for (Enter, Collude), (-10, 90) for (Enter, fight), (0, 100) for (Stay out., Collude), and (0, 100) for (Stay out., fight). A hand is pointing to the 'Stay out.' row, and another hand is holding a blue marker. The NPTEL logo is visible in the bottom left corner.

		Incumbent Existing Monopolist	
		Collude	fight
Entrant	Enter	40, 50	-10, 90
	Stay out.	0, 100	0, 100

Outcome - Market Share

So, to draw this pay off matrix we need the pay off for the all this 4 options. So, here we will take this is the case of the entrant. And, the 2 options are either to enter or to stay out. This is for the incumbent and what is the option for them collude or fight. Now, the outcome is in term of market share. So, how we can construct the pay off matrix? Suppose the entrant is deciding to enter and the incumbent firm is collude. Once the new entrant come the pay off will be 40 and 50. The market share will be 40 for entrant and 50 for the monopolist firm. If the entrant decides to stay out obviously his outcome is 0. He is not going to any market share and the incumbent firm they are going to get the they are going to get 100.

Then, so let us change this is the existing monopolist (No Audio From 04:08 to 04:14). Now, if the entrant decides to fight and the existing monopolist or the entrant decides to enter in the existing monopoly decide to fight. In that case if you look at then we will take into a case where maybe we can get minus 10 for the pay off and 0 for the monopolist. Why it is minus 10 and why it is zero? Because if the entrant is entering in the existing monopolist is fighting

may be no one is getting market share and it goes to, goes to somewhere around we can do it may be 90.

Then if entrant is entering stay out and obviously there is no choice this fight. So, this comes again to 0 and 100. Now, the basic purpose of doing a pay off matrix is to evaluate the options when the firm is trying to enter into the market. Basically, he is evaluating options that if he is entering what will be the market share what will be the outcome? And, if he is not entering what will be the market share and what will be the outcome?

Similarly, the monopolist has 2 options. If the entrant is getting into the market what should be the, what should he do whether he should collude whether he should fight. So, one pay off will come if the entrant comes into market and he is going to fight. What should be the market share? And, if the entrant is he is entering to the market if he is going to collude. What should be the market share?

So, collude fight 2 options for monopolist enter into the market stay out from the market 2 options for the new firm. So, in this case we get 4 pay off in term of 4 market share. And, among them now they will decide that whether it is a dominant what should be the dominant strategy for both of them whether they are getting a Nash equilibrium or whether they are getting 2 Nash equilibrium. If there is an absence of the dominant strategy both this cases. Now, in this case what should be the strategy of the rational monopolist because we assume that the monopolist has to rational?

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Managerial Economics

Application of Game theory in Economics

Market Entry Game

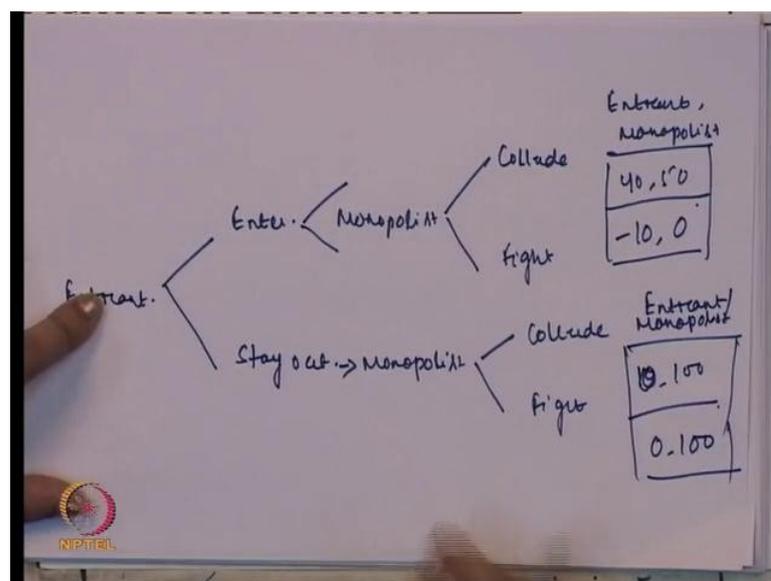
- What should be the strategy of a rational monopolist?
- Nash equilibrium occurs when the entrant enters and the incumbent firm colludes with it.

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And what should be the strategy of the rational monopolist. And, where the Nash equilibrium generally occurs. So, Nash equilibrium occurs when entrants enter and incumbent firm collude with it. So, in this case if you remember your pay off matrix that is the case where both of them they are getting a market share. In all this 3 options either of them is getting a 0 or them getting a minus but in this case when if the new firm is entering into the market and existing firm colluding with it. Then that is whatever the market share is getting that is more preferable for both from the monopolist point of view and the new firm point of view; if they are acting rational. So, when it comes to Nash equilibrium. Nash equilibrium typically occurs when the entrants and the incumbent firm collude with it because this is the point actually where both of them they are getting some amount of the market share. So, before going to this. This is what? This is which this is also a types of game. And, we will see what is the game tree over here, because this is also a sequential game and in this case sequential game. How will see how the game tree looks like?

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So, this is for the entrant. It has 2 options. One is enter another is stay out. If it is enter then the existing monopolist has 2 options. One is collude and another is fight. So, in that case we get 2 columns for monopoly both for the entrant and for the monopolist. So, in this case we get 40, 50. So, if entrant enter monopolist collude with it we get a market share we get a pay off matrix 40 50, where the share of entrant is 40, where the share of the monopolist is 50. If entrant enter monopolist fight then we get a share of minus 10 for entrant because he cannot compete with the monopolist. And, 0 for the monopolist because the market share is not going to you. If it is fighting with the existing market or same thing can be analyzed in a

different version also because it is getting a market share of 90. Whereas the other entrant is getting the market share of 10.

Then, stay out what is the options for the monopolist. It is again collude; it is again fight. Again we will get a pay off matrix for both the entrant and the monopolist. And, here we get the pay off as 0 100 and 0 100 because if the entrant is staying out obviously the market share is 0. Whether and the 2 nd part is not at all relevant because if it is staying out. The question is not coming whether monopoly should collude or monopoly should fight. So, basically and the market share of entrant will be 0. And, whether and the all this cases the market share of the monopolist will be 100.

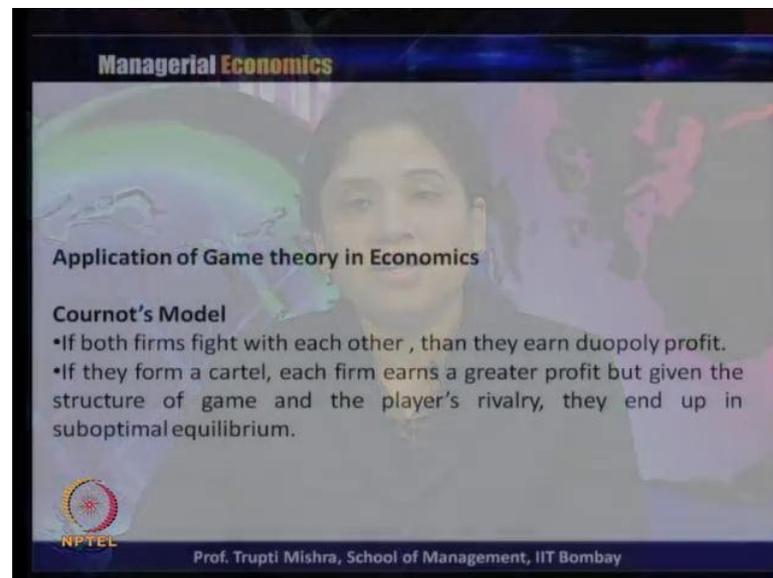
So, this is the case of a sequential game. Where the decision of one firm is always dependent on what is the decision of the other firms. And, in this case the decision is followed from whatever the market share. What is the end outcome? Here the end outcome is to maximize the market share dependent on what is the outcome with respect to its decision points. And, also looking at to that what is the rival sections like if the entrant is trying to get into the market. Now, what should be the, what should be the decision point of the monopolist. So, the entrant will evaluate option in term of 2 things that whether the monopolist is going to collude or whether the monopolist is going to fight.

Similarly, the monopolist is going to take the options that what would be the market share. If he is going to fight and if he is going to collude. On those basis he will see decide what is the dominant strategy for him. So, typically in case of a market entry situation in case of a situation when the market is trying to enter into the market. Where there is a monopolist firm generally this game theory is relevant typically a sequential game theory. Where it give us the sequence that what should happen if if one firm behaves in this direction and the other firms behaves in the following action.

Then we will talk about the application of game theory in case of a Cournot model. So, if you remember we discussed this Cournot model in case of a non collusive oligopoly. And, Cournot model talks about a situation that where there are 2 firms they are sharing the market. And, they always assume that the whatever the previous output plan for the other firm that has to be followed in the revised period also. But practically it it leads to a situation where they reach to a sub optimal solution or we can say top part of the market is still altered by both of the duopoly firm. Because they always assume that the output plan whatever

followed by the firm in the previous time period that has to that is going to be continued. So, the same thing we will see that how this game theory is applied to a Cournot model.

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If both the firms they fight with each other. Then they earn the duopoly profit because they share the market and they earn a duopoly profit. But if they form a cartel, each firm has a greater profit but given the structure of the game and the player's rivalry, they end up in a sub optimal equilibrium. So, Cournot model if you look at always they feel. That the other one is going to take the half of the market. So, his decision point is on the basis of that the other firm is going to take half. So, let me take another half. And, in that process when the iteration takes place.

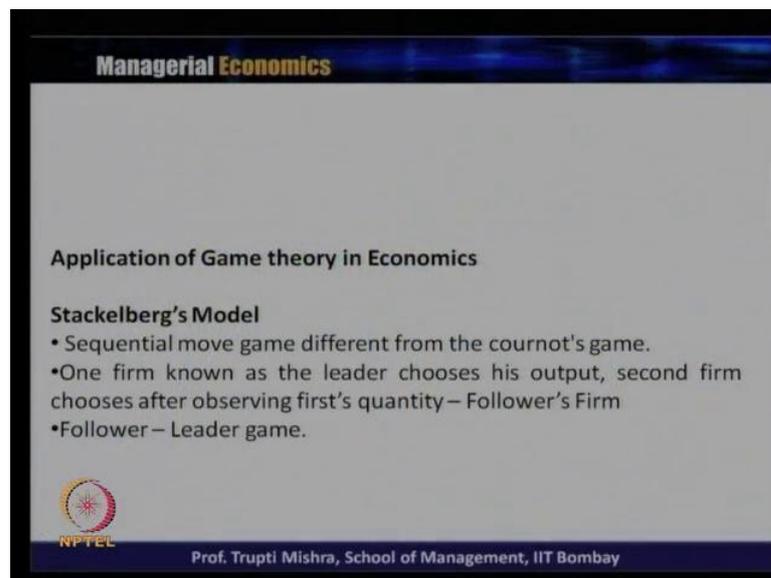
Finally, in the revised period revised period and in the n th period. If you look at the one third is only taken care of and rest if you look at rest of the rest rest of the market is not taken care of neither of this firm. But the other options is that it they form a cartel. If they cooperate with each other then they ideally they can decide on the basis of their productive capacity or on the basis of their cost function.

They can decide that who has to share how much of the market or who has to supply how much share of the market. And, on that basis they can trap the full market and they can reach to into a optimal equilibrium. But practically the structure of the game is such that Cournot model is such that there is a rivalry. And, they always believe that the output plan is not going to revise. Where the other player and that is why they go on consider the same output plan

and they accordingly they devise they price and output plan. And, that is why they lead to a sub optimal equilibrium rather than optimal equilibrium.

So, here how we can conclude? We can conclude that even if the cooperation is profitable still the firms they are not cooperating with each other rather they are competing with each other. And, going into a sub optimal equilibrium rather than a optimal equilibrium. Then we will see the stackelberg model. So, if you remember in case of stackelberg model it is a leader follower model. Generally one follow generally one takes a lead and the other one is followed.

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The slide is titled "Managerial Economics" and "Application of Game theory in Economics". It focuses on "Stackelberg's Model" and lists three key points: it is a sequential move game different from Cournot's game; one firm acts as the leader choosing output first, while the second firm acts as the follower choosing output after observing the leader's quantity; and it is a Follower-Leader game. The slide also features the NPTEL logo and identifies the speaker as Prof. Trupti Mishra from the School of Management at IIT Bombay.

So, we will see that generally the sequential kind sequential type of game is used in case of the stackelberg model. So, sequential move game is different from the Cournot game. And, typically in case of there is also a difference in case of a Cournot model and stackelberg model. Even if stackelberg model is the extension of the Cournot model in case of Stackelberg model the significant feature is that one firm act as the leader and the other firms act as the follower. So, sequential move game is that is how it is different from the Cournot game. Here one firm known as the leader chooses his output, second firm chooses after observing the first quantity of the output.

So, one is as the leader firm. Second is the follower firm. One firm generally chooses this is the output I am going to produce. And, the second firm after looking at or after observing that what is the output plan for the first firm generally the second firm decide his quantity. So, this is generally known as a follower leader game.

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Managerial Economics

Application of Game theory in Economics

Stackelberg's Model

- Leader firm sets a higher quantity of output and earns more profits than follower's firm
- First Mover Advantages

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And, here the leader firm always sets a higher quantity of output and earns more profit than the follower firms. And, by doing or this they get because they have the first mover advantage. Since, they are the leader they are the first one to decide what should be the output. Generally, they get a greater advantage in term of the share in market share in term of the profit, because they are the first one to decide, what is the share of them? And, this is generally known as the first mover advantage. And always in case of a Stackelberg model the leader firm get a first mover advantage because they are the first one to choose the output. And, in that way they can maximize the market share and they can maximize the profit also. So, in case of stackelberg model the equilibrium is decided on the basis of the backward induction in the game theory.

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Managerial Economics

Application of Game theory in Economics

Stackelberg's Model

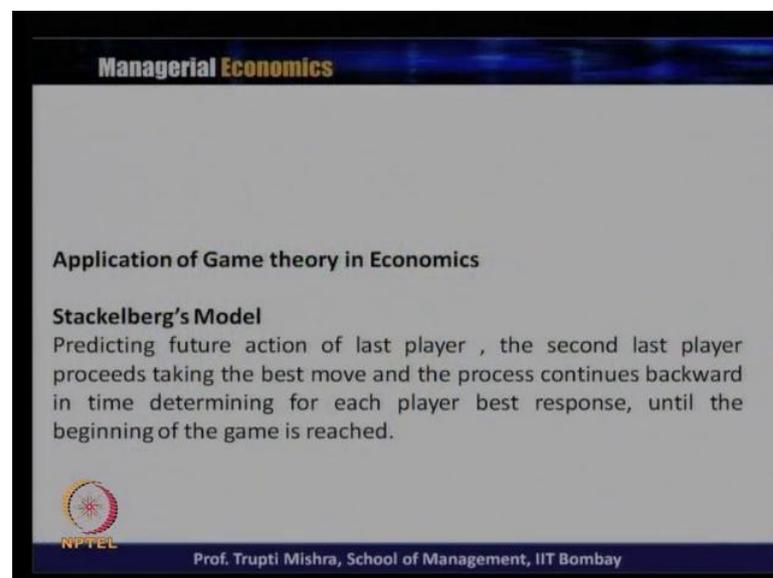
- Equilibrium – backward induction in the game theory.
- The technique first considers the optimal strategy of the player and its best response which takes moves that are last in the game.

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And, how we say this is the backward induction in the game theory. Because these techniques first consider the optimal strategy of the player. And, it is best response which takes the move that are last in the game. So, equilibrium whatever the method is followed generally known as the backward induction in the game theory. So, in the previous case also in the market entry. If you look at the decision of decision point is based on that what is the last decision point of the rivals or what is the last decision point of the opponent. So, this is the part of the backward induction in the game theory but the decision is dependent on what is the previous decision taken by the opponent. And, this technique first consider the optimal strategy of the player. And it is best response which it takes the move and that is the previous or previous time period that is the last in the game.

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Managerial Economics

Application of Game theory in Economics

Stackelberg's Model
Predicting future action of last player , the second last player proceeds taking the best move and the process continues backward in time determining for each player best response, until the beginning of the game is reached.

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Here predicting the future action of the last player, the second last player proceeds taking the best move. So, when it commence to take a bit above the last player or the predicting about the future action. Here the 2nd last player proceeds taking the best move. And, the process continues backward in time determining for each player the best response until the beginning of the game is reached. So, when we identify the best best what is the best option for each player. They go in a backward direction till the time they are reaching the the reaching the beginning of the game. Because that way they just go on evaluating what is the best response with respect to the previous time period or with respect to the action taken in the previous time period. And, in that way they decide the optimal strategy.

So, in the game theory typically to conclude the game theory we can say in the game theory; we discussed about the structure of the game. We discussed about what are the assumptions to be taken to use the game theory. And, then we talked about the types of game and how this game is being used in the case of the economic analysis. So, to sum up we can say that game theory is a tool which is used typically in the economic analysis to understand the group dynamics, to understand the group behaviour specifically in case of an oligopoly market structure.