MANAGERIAL ECONOMICS

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UNITE

13. THE ECONOMICS OF STRATEGIC RELATIONSHIPS

The Economics of Strategic Relationships

- → Which industries are more profitable, and which are less?
- → And why?
- → While there is no obvious measure of industry profitability, it is pretty clear that firms in some lines of business “do better” on average than firms do in other industries.

Porter's fives

- → Michael Porter, in the classic business strategy textbook Competitive Strategy, provides a framework for trying to answer this question, called the Five Forces.
- → Let's meet them one by one.

First force: barriers to entry

→ If firms within an industry are relatively profitable, the industry will attract new entrants, to the extent that there are no barriers in the way of those entrants.

→ And those new entrants will tend to compete away the relatively good profits that drew their attention. So, high barriers to entry tend to go along with supernormal profitability.

Second force: substitutes and complementary products

- → Firms inside an industry are more profitable the higher the prices they can charge their customers.
- → Insofar as there are substitutes for what the firms are selling, they are limited in how high they can raise their prices.
- → Hence, an industry whose products have a lot of good substitutes is likely to be less profitable on average than one whose products have few, bad, or no substitutes.
- → On the other side, demand for an industry's products or services is higher the more available and cheaper are goods that are complementary to what they sell. (Automobile manufacturers are more profitable, for instance, when the price of fuel is lower.)

Third force: supplier power

- → Suppose firms in an industry are making supernormal profits.
- → Suppliers to the industry, if they can, will suck those profits upstream, lowering those profits.
- → The key here is the if they can: It is a matter of the relative bargaining strength of the suppliers to the industry vis-a'-vis firms in the industry.
- → If there are lots of potential suppliers who compete among themselves, firms in the industry needn't worry much about having their profits sucked upstream. If a critical input to the industry is supplied by a single and powerful supplier, firms in the industry must worry, and perhaps even resign themselves to not being hugely profitable.

Fourth force: customer power

- → Even if there are no good substitutes, customers may be able to bargain for low prices.
- → Suppose, for instance, that a large share of the retail market in a particular good is held by Walmart.
- → Firms that manufacture this good probably don't get very high margins on what they sell to Walmart for resale.

Fifth force: rivalry

- → The fifth and final of Porter's forces is rivalry.
- → How hard do firms within the industry compete with one another?
- → If competition among firms in the industry is fierce, with price cutting and price wars the norm, profits will be relatively low. If firms in the industry compete in restrained fashion, profits are more likely to be relatively high.

The economics of relationships

- → In the world of Strategic Management, Porter's Five Forces is one of the pillars of analysis.
- → But while it is one thing to say, "Think about rivalry in the industry" or "Gauge the relative bargaining positions of firms in the industry and their suppliers/ customers", it is another thing to know how to do this.
- → And while Porter provides some tendencies in how these factors affect profitability, these are only tendencies.
- → When we have a better, more nuanced understanding of how suppliers are connected to the industry in question, we might learn more: way more than that!!

The 'way more'

→ A lot of that "way more" comes down to the relationships the firms within the industry have with one another and with their suppliers, customers, employees

→ This is most obvious when it comes to the relationships

* between firms and their customers;
* between firms and their suppliers;
* between suppliers of labor inputs or, in other words, the employees of the firm.

The road ahead

- → To carry out an intelligent analysis of the Five Forces, you need to understand the nature of economic relationships.
- → So, let's get started by learning a language for modeling and analyzing relationships.

Non Cooperative Game Theory

Summary

→ We discuss two ways to model multiparty interactions: strategic-form and extensive- form games.

→ We show how to analyze these models using dominance analysis and Nash equilibrium analysis.

Our work horse story

- → Two friends, Sam (she) and Jan (he), must decide independently where to spend a Tuesday evening after work.
- → The three possible choices are a bar named Old Pros, an art museum, and a coffee house named Cafeen.
- → Sam and Jan have preferences over these three spots, but they also have a general desire to be together, rather than apart. More specifically:
- → Sam's first choice is to be with Jan at Old Pros, second is to be with Jan at the art museum, third is to be alone at Old Pros, fourth is to be with Jan at Cafeen, fifth is to be at the art museum alone, and last is alone at Cafeen.
- → Jan's ranking is, from best to worst, be with Sam at Cafeen, be with Sam at the art museum, be with Sam at Old Pros, be alone at the art museum, be alone at Cafeen, and be alone at Old Pros.

		Jan's choice		
		Old Pros	Art Museum	Cafeen
Sam's choice	Old Pros	6,4	4,3	4,2
	Art Museum	2,1	5,5	2,2
	Cafeen	1,1	1,3	3,6

What can we say?

If we have the payoffs of Sam right, we can be fairly sure that Sam is not going to Cafeen. No matter what Jan does, Sam is better off going to Old Pros than to Cafeen.

		Jan's choice		
		Old Pros	Art Museum	Cafeen
Sam's choice	Old Pros	6,4	4,3	4,2
	Art Museum	2,1	5,5	2,2
	Cafeen	1,1	1,3	3,6

What can we say?

Suppose Jan is familiar enough with Sam to know Sam's payoffs for the nine outcomes.

Then Jan should conclude that Sam is not going to Cafeen.

Once there is no chance of this, Jan's payoffs are such that he prefers the art museum with or without Sam to being at cafeen without Sam.

		Jan's choice		
		Old Pros	Art Museum	Cafeen
	Old Pros	6,4	4,3	4,2
Sam's choice	Art Museum	2,1	5,5	2,2
	Cafeen	1,1	1,3	3,6

So, we conclude - on the basis of our assumptions - that Jan will not choose Cafeen.

Two objections

→ Being at Cafeen with Sam is Jan?s first choice. If Sam and Jan are friends, is there no chance that Sam will sacrifice her own interests to please Jan?

→ If the two friends get together frequently, might not Sam sacrifice her own interests on this one occasion, expecting that Jan would reciprocate in the future?

Two objections

In real life, the answer to both questions is: "Yes, this is possible".

But if these are possibilities, then:

→ We are unsure about Sam's payoffs. If she prefers to please Jan and sacrifice her own selfish interests, then the ranking we assumed for her is incorrect.

→ If the two friends face this sort of situation repeatedly, the "game" they play is a lot more complex than a one-shot choice of a place to go.

Let's try and go further

i.e. rule those objections out

- → We are left with the conclusions that Sam will not choose Cafeen;
- → If Jan realizes this, neither will he.
- → But this still leaves Sam and Jan each with a choice of either the art museum or the Old Pros
- → We thus reach an impasse.

		Jan's choice		
		Old Pros	Art Museum	Cafeen
	Old Pros	6,4	4,3	4,2
Sam's choice	Art Museum	2,1	5,5	2,2
	Cafeen	1,1	1,3	3,6

Try and go further

- → If Jan could anticipate that Sam would go to the art museum, the art museum is his best reply
- → If he anticipates that she would go to the Old Pros, then Old Pros is his best reply
- → The same is true of Sam; her best choice is to match whatever she anticipates he would do
- → Logic alone does not seem to answer the question, Where will they wind up?

		Jan's choice		
		Old Pros	Art Museum	Cafeen
Sam's choice	Old Pros	6,4	4,3	4,2
	Art Museum	2,1	5,5	2,2
	Cafeen	1,1	1,3	3,6

Try and go further

→ If we cannot say how Sam and Jan will coordinate their actions, can we at least predict that they will?

→ That depends.

→ If they could chat on the phone beforehand, it seems likely they will do so.

→ If they have to guess at what each other will do, they might not.

Suppose Jan moves first

→ Suppose for a moment that Jan chooses a location, goes there, and phones Sam, saying reliably and credibly, "I'm at location X, and I'm not moving". (which is in sharp contrast with our assumptions)

→ What do we predict?

→ Jan would go: "If I go to Old Pros, Sam will follow me there. If I go to the art museum, Sam will follow me there. If I go to Cafeen, Sam will go to Old Pros. So, predicting Sam's reply, I'm best off going to the art museum".

		Jan's choice		
		Old Pros	Art Museum	Cafeen
Sam's choice	Old Pros	6,4	4,3	4,2
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Watch this out!

This example is all the flesh our class is made of!

- → When Sam and Jan move simultaneously, they engage in a game in which their strategies are simple actions and, therefore, our figure represents their situation as a strategic-form game.
- → When we rule out Sam going to Cafeen, we are applying a dominance argument. Jan's decision in consequence not to go to Cafeen is an application of iterated dominance.
- → If Jan gets to move first, though, and Sam, having learned Jan?s choice, responds, then the game is converted to a simple extensive-form game of complete and perfect information, which is simple enough that we can apply backward induction, to conclude that Jan goes to the art museum and Sam follows.

Strategic form games

- → In a strategic-form game, we specify for each player a list of his/her/its strategies.
- → A strategy is a complete plan for playing the game, for any one of the players. Depending on how complex the game is, strategies can be ferociously complex.

But, in simple games, strategies are usually fairly simple. For instance:

- → In the Sam and Jan game, Sam and Jan must make a single choice where to go, and they must choose independently.
- → Hence, each has three strategies, namely (1) go to Old Pros, (2) go to the art museum, or (3) go to Cafeen.

Strategic form games

But suppose we change the way the game is played. Specifically, suppose Jan chooses where to go first, goes there, and then Sam, knowing Jan?s choice, responds.

Strategic games

- → Jan has a simple choice of Old Pros, the art museum, and Cafeen; Jan has three strategies.
- → But Sam?s strategies are more complex, because Sam has to plan what she will do contingent on what she learns about Jan?s choice.
- → One strategy for Sam is to go to Old Pros no matter what Jan does.
- → A second is to go to Old Pros if Jan goes to Old Pros and to go to the art museum if Jan goes to either the art museum or to Cafeen.
- → Since Sam has to choose one of three places to go and she must plan her choice in each of three ?information states,? Sam has 3 x 3 x 3 = 27 strategies under these rules.

Strategic games

- → Given a list of strategies for each player, the term strategy profile is used for a vector of strategy choices, one for each player.
- → In the Sam and Jan game where the two must choose simultaneously, and so each has three strategies, there are 3 x 3 = 9 strategy profiles.
- → In the formulation where Jan chooses first where to go, Sam learns Jan?s choice, and then Sam decides how to respond, Jan has three strategies and Sam has 27, so there are 3 x 27 = 81 strategy profiles!

...can be very cumbersome...

Sam's strategy: Where to go, given Jan's choice			Jan's strategy: Where to go		
If Jan chooses Old Pros, go to:	If Jan chooses Museum, go to:	If Jan chooses Cafeen, go to:	Old Pros	Art Museum	Cafeen
Old Pros	Old Pros	Old Pros	6,4	4,3	4,2
Old Pros	Old Pros	Art Museum	6,4	4,3	2,2
Old Pros	Old Pros	Cafeen	6,4	4,3	3,6
Old Pros	Art Museum	Old Pros	6,4	5,5	4,2
Old Pros	Art Museum	Art Museum	6,4	5,5	2,2
Old Pros	Art Museum	Cafeen	6,4	5,5	3,6
Old Pros	Cafeen	Old Pros	6,4	1,3	4,2
Old Pros	Cafeen	Art Museum	6,4	1,3	2,2
Old Pros	Cafeen	Cafeen	6,4	1,3	3,6
Art Museum	Old Pros	Old Pros	2,1	4,3	4,2
Art Museum	Old Pros	Art Museum	2,1	4,3	2,2
Art Museum	Old Pros	Cafeen	2,1	4,3	3,6
Art Museum	Art Museum	Old Pros	2,1	4,3	4,2
Art Museum	Art Museum	Art Museum	2,1	4,3	2,2
Art Museum	Art Museum	Cafeen	2,1	4,3	3,6
Art Museum	Cafeen	Old Pros	2,1	5,5	4,2
Art Museum	Cafeen	Art Museum	2,1	5,5	2,2
Art Museum	Cafeen	Cafeen	2,1	5,5	3,6
Cafeen	Old Pros	Old Pros	1,1	1,3	4,2
Cafeen	Old Pros	Art Museum	1,1	1,3	2,2
Cafeen	Old Pros	Cafeen	1,1	1,3	3,6
Cafeen	Art Museum	Old Pros	1,1	5,5	4,2
Cafeen	Art Museum	Art Museum	1,1	5,5	2,2
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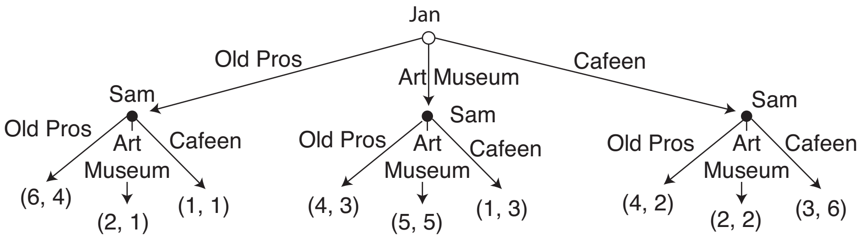
Cafeen	Cafeen	Old Pros	1,1	1,3	4,2
Cafeen	Cafeen	Art Museum	1,1	1,3	2,2
Cafeen	Cafeen	Cafeen	1,1	1,3	3,6

Extensive form games

→ In extensive-form games, an alternative way to depict (model) a competitive situation, the emphasis is on the dynamic back-and-forth tactics of the players.

→ The second version of the Sam and Jan game provides an ideal example.


Jan
Old Pros
Art Museum
Cafeen
Sam
Sam
Sam
Old Pros
Art Museum
Cafeen
(6, 4)
(2, 1)
(1, 1)
Old Pros
Art Museum
Cafeen
(4, 3)
(5, 5)
(1, 3)
Old Pros
Art Museum
Cafeen
(4, 2)
(2, 2)
(3, 6)

Extensive form games

→ There are nodes (one open circle and some filled-in circles);

→ labels on each node, where each node is labelled with the name of one of the players;

→ moves, which are depicted by arrows leading from one node to another node, with labels on the arrows that give the name of the particular move; and, at the end of each sequence of moves (or each path from the open circle, which is where the game begins, to the ?end? of the game);

→ payoffs for the players.

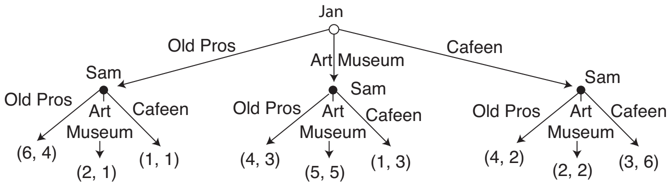
Information sets

→ A (seemingly) weird question: Can we model the original formulation of the Sam and Jan game – where the two must choose simultaneously – with an extensive form game?

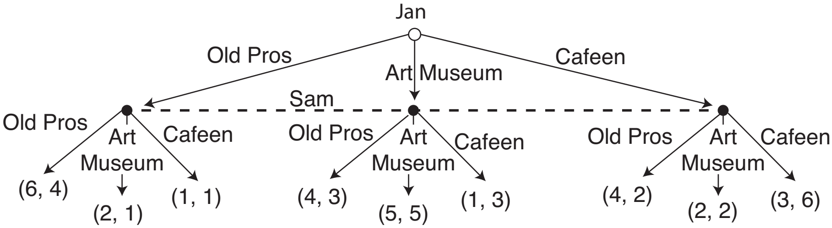
→ Suppose that Sam does choose before Jan.

→ If we put Jan's choice first and Sam's second, Jan does not know, when it is his turn to choose, what Sam has chosen.

→ Of course, this makes a difference. How do we record this difference?



Information sets



Information sets

- → The device used is called an information set.
- → We have joined the three nodes that belong to Sam (where she must choose) with a dashed line.
- → This indicates that, when Sam must choose, she isn?t provided with information about which of these three situations prevails.

Information sets

→ Suppose the situation is that Jan chooses first and then, if Jan chooses Cafeen, Sam is informed of this.

→ If Sam doesn?t receive this information, she knows that Jan didn?t choose Cafeen, but she doesn?t know whether Jan chose Old Pros or the art museum.

→ How would we depict this?

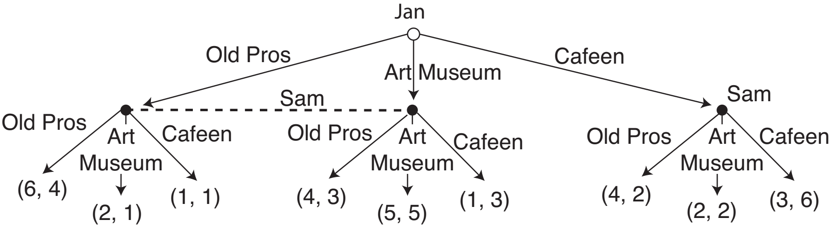
...answer in the following figure...

Information sets

→ Sam has two information sets.

→ One, depicted by the dashed line, consists of the two nodes following choices of Old Pros or the art museum by Jan.

→ The second, which doesn't need a dashed line because it consists of a single node, is where Jan has chosen Cafeen.



14. THE ECONOMICS OF STRATEGIC RELATIONSHIPS. PART TWO

Moves by Nature

- → Let us move to more managerial situations...
- → In all sorts of competitive situations, pure chance can play a part.
- → When a firm engages in R&D, it is unclear whether the particular research will pan out.
- → From the perspective of the firm considering whether to do the R&D, this is a random event and, unlike the actions of rivals and other players, it is a random event whose outcome is under no one?s particular control.
- → How do we model such things?

Moves by Nature

→ Imagine two firms, call them A and B, that are separately contemplating entering into the market for a brand new product. Each is concerned with two things:

  → How expensive will the product be to produce?
  → Will the other firm enter as well?

Moves by Nature

In terms of timing, suppose that:

→ Firm A must decide whether to enter in the next month;

→ Firm B has the luxury of waiting to see what Firm A does.

Firm A, however, is able to decide right now whether to pursue some quick R&D that will tell it whether the production costs will be high or low. (Firm B cannot engage in this R&D.)

That is, in the model we build, costs will be high or low, and doing the R&D will tell Firm A which it is.

Note well: firm A does not need to do this R&D; that is a choice it can make.

Strategies and the strategic form

Available strategies for firm A:

→ Don't do the R&D. Enter the market.

→ Don't do the R&D. Don't enter the market.

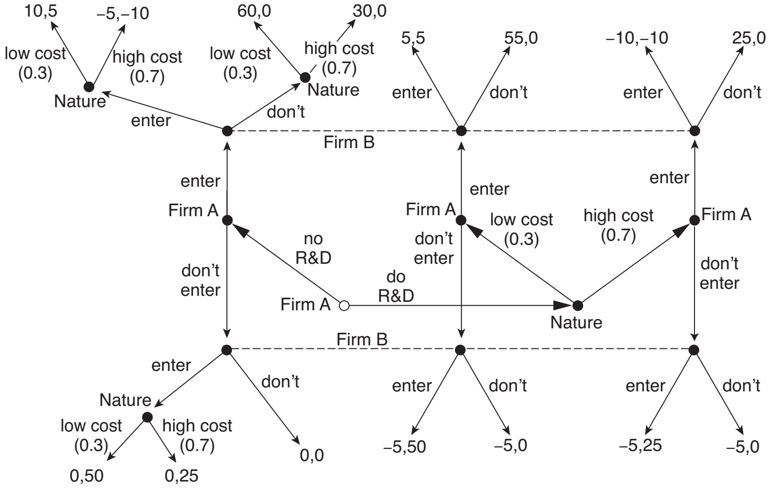
→ Do the R&D. Enter the market regardless of what is learned about the costs.

→ Do the R&D. Enter the market if costs are low, but don?t enter if they are high.

→ Do the R&D. Enter the market if costs are high, but don't enter if they low.

→ Do the R&D. Don?t enter the market regardless of what is learned about the costs.

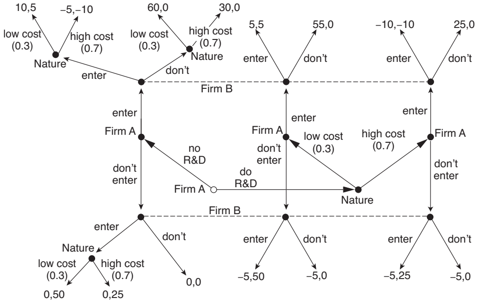
Moves by Nature



explanation

Firm A has the first move: it decides whether to undertake the R&D or not.

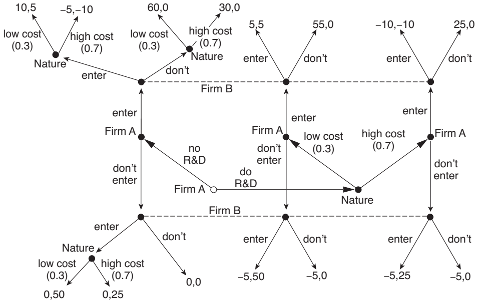
If it does not, then it has a second decision, whether to enter the market or not.



explanation

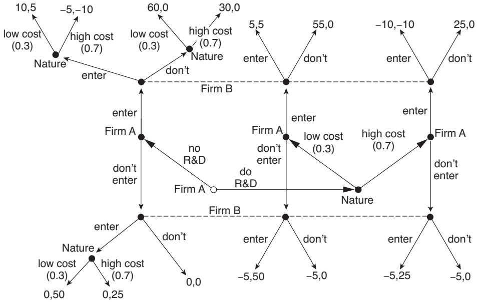
On the other hand, if it does undertake the R&D, it learns whether the costs are high or low.

If Firm A decides to do the R&D, we next put in a node belonging to Nature, who decides whether costs are high or low.



explanation

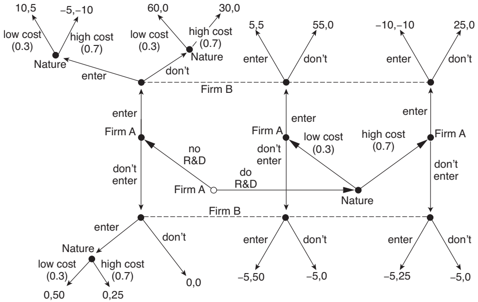
We record those odds as probabilities on the branches; in this case, the diagram shows that the odds of high costs are 0.7, while the odds of low costs are 0.3.



explanation

Firm A has then to decide whether to enter the market or not.

Since we are in the part of the game tree in which Firm A choses to do the R&D, it knows what Nature decided, and we have two different decision nodes for Firm A: one for each of Nature's two choices.



explanation

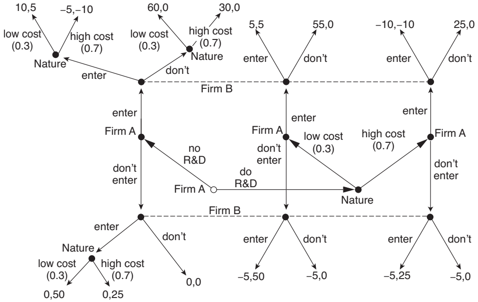
Now it is the turn of Firm B: Does it enter the market or not?

Note the use of information sets here: Clearly, we are supposing that Firm B knows whether Firm A entered or not. But what have we assumed about Firm B's knowledge of whether Firm A did the R&D?

We could assume that Firm B did see whether Firm A did the R&D, even if Firm B doesn't learn the results.

And we could assume that Firm B only knows if Firm A entered or not.

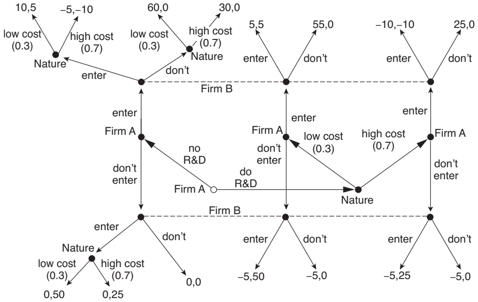
The diagram models the situation where Firm B doesn't know whether Firm A undertook the R&D.



explanation

We need to put into our model the payoffs to the two firms. Presumably, these depend on (a) which firms entered the market, (b) what are the production costs (high or low), (c) and for firm A, whether it undertook the R&D (since the R&D probably wasn?t free).

If we have all the numbers handy, we can supply those payoffs in the part of the tree where we know the production costs.

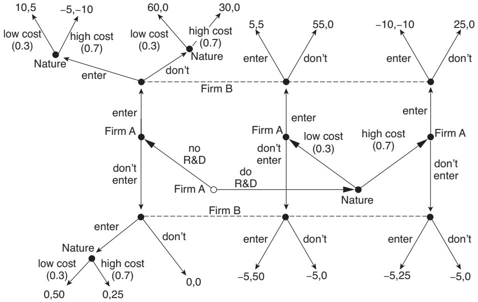


explanation

But if Firm A did not undertake the R&D but did enter, or if A did not undertake the R&D and chose not to enter but Firm B did enter, we need to know what are those costs.

So, in the part of the tree where A has chosen not to do the R&D ? the left-hand side of the diagram? and after A and B have made their entry choices, we need nodes for Nature?s moves, determining the costs and, then, at the end of each complete path or branch, the payoffs.

That gives us the game tree in the diagram. How did we determine those payoffs?



explanation

Diagram says that costs will be low with probability 0.3 and high with probability 0.7

so the payoffs for A and B, respectively, in the cell A4?B1 are:

(0.3)(5) + (0.7)(5)=2 for A

(0.3)(5) + (0.7)(25)=19 for A

If one carries this out for each of the 6 x 4 = 24 cells, you get the strategic-form representation of the situation that is shown in the diagram.

	Firm B's strategy			
Firm A's strategy	Enter regardless of what A does	Enter if A enters. Don't enter if A doesn't	Don't enter if A enters. Enter if A does not	Don't enter regardless of what A does
Don't do R&D, enter	–0.5, –5.5	–0.5, –5.5	39, 0	39, 0
Don't do R&D, don't enter	0, 32.5	0, 0	0, 32.5	0, 0
Do R&D, enter regardless of results	–5.5, –5.5	–5.5, –5.5	34, 0	34, 0
Do R&D, enter if costs low (only)	**–2, 19**	–2, 1.5	13, 17.5	13, 0
Do R&D, enter if costs high (only)	–8.5, 8	–8.5, –7	16, 15	16, 0
Do R&D, don't enter regardless	–5, 32.5	–5, 0	–5, 32.5	–5, 0

Strategies and the strategic form

- → We now try and see if we can actually make predictions.
- → For games in strategic form, one form of analysis is directed at the question: Can we confidently predict that certain strategies will not be employed by the players involved?
- → Affirmative answers to this questions involve dominance arguments. Have a look at the following game...

Dominance: Alice and Bob

Bob chooses the column

		column 1	column 2	column 3
Alice chooses the row	row 1	7, 3	3, 1	0, 5
	row 2	5, 1	5, 3	2, 2

Dominance

→ Can we rule out any of Bob?s three strategies?

→ Column1 is dominated by column 3

→ We predict that Bob is not going to choose column 1

		Bob chooses the column		
		column 1	column 2	column 3
Alice chooses the row	row 1	7, 3	3, 1	0, 5
	row 2	5, 1	5, 3	2, 2

Moves by Nature

→ Suppose that Alice is smart enough to replicate our argument that Bob will not choose column 1.

→ Whether Bob chooses column 2 or column 3, Alice is better off with row 2 than with row 1.

→ Therefore, row 2 iteratively dominates row 1, following the first dominance argument that eliminated column 1.

→ Based on an argument of iterated dominance, the prediction is that Alice will not choose row 1

		Bob chooses the column		
		column 1	column 2	column 3
Alice chooses the row	row 1	7, 3	3, 1	0, 5
	row 2	5, 1	5, 3	2, 2

Dominance

→ Having eliminated row 1 from consideration, column 2 iteratively dominates column 3.

→ After removing column 1 and then row 1 from consideration, column 2 is Bob?s clear best choice.

→ Column 2 and row 2 are all that remain.

→ By iterated dominance, the prediction is that Alice chooses row 2 and Bob chooses column 2.

		Bob chooses the column		
		column 1	column 2	column 3
Alice chooses the row	row 1	7, 3	3, 1	0, 5
	row 2	5, 1	5, 3	2, 2

Dominance

- → Dominance solvability is not always available;
- → If you go back to the Sam and Jan game you?ll see that! (try it as an exercise)

Moves by Nature

→ Note worthy: do we sometimes play dominated strategies?

→ Surprisingly enough, the answer is ?yes, sometimes we do?.

→ There is a huge empirical literature on this issue. Just ask and I?ll give you some references.

Weak dominance

→ Have a look at this game:

	column 1	column 2
row 1	3, 0	2, 1
row 2	3, 4	0, 0

→ Row 1 weakly dominates row 2: Against column 2, row 1 does strictly better than row 2, while against column 1 row 1 does just as well as row 2

→ Can we therefore conclude that row 2, which is weakly dominated, will not be chosen?

→ Can we iterate on this and say that, once the column-selecting player concludes that row 2 will not be chosen (and hence row 1

Weak dominance

→ The answer to this question must be settled empirically;

→ However weak dominance does not do nearly as well as strict dominance, and iterated weak dominance can do quite poorly.

→ Be wary of analyses you see that invoke weak dominance.