STRATEGIC THINKING

Outline of the lectures:

Theme	*Topic*
A	Strategic Decision Making (Weeks 6 and 7)
B	Credible Commitment (Week 8)
C	Repetition and Reputation (Week 9)
D	Bidding (Week 10)

Quotable Quotes

Game theory:

“the greatest auction in history”
The New York Times, March 16, 1995, p.A17.

“When government auctioneers need worldly advice, where can they turn? To mathematical economists, of course ... As for the firms that want to get their hands on a sliver of the airwaves, their best bet is to go out first and hire themselves a good game theorist.”
The Economist, July 23, 1994, p.70.

the “most dramatic example of game theory’s new power ... It was a triumph, not only for the FCC and the taxpayers, but also for game theory (and game theorists).”
Fortune, February 6, 1995, p.36.

“Game theory, long an intellectual pastime, came into its own as a business tool.”
Forbes, July 3, 1995, p.62.

“Game theory is hot.”
The Wall Street Journal, February 13, 1995, p.A14.

Game Theory

"Conventional economics takes the structure of markets as fixed. People are thought of as simple stimulus-response machines. Sellers and buyers assume that products and prices are fixed, and they optimize production and consumption accordingly. Conventional economics has its place in describing the operation of established, mature markets, but it doesn't capture people's creativity in finding new ways of interacting with one another.

Game theory is a different way of looking at the world. In game theory, nothing is fixed. The economy is dynamic and evolving. The players create new markets and take on multiple roles. They innovate. No one takes products or prices as given. If this sounds like the free-form and rapidly transforming marketplace, that's why game theory may be the kernel of a new economics for the new economy."

— Brandenburger & Nalebuff
Foreword to *Co-opetition*

1. Strategic Decision Making

1.1 A Decision

Piemax Inc. bakes and sells sweet (dessert) pies.

Its decision:

— price *high* or *low* for today's pies?

Considerations?

— prices of rivals' pies?

— prices of non-pie substitutes?

One possibility:

simply optimise its pricing policy for some, given its beliefs about rivals' prices

Think strategically.

Or:

try to predict those prices,

using Piemax' knowledge of the industry,

in particular: Piemax' knowledge that its rivals choose their prices on the basis of their own predictions of the market environment, including Piemax' own prices.

Game Theory →

Piemax should build a *model* of the behaviour of each individual competitor,

? look for behaviour → *an equilibrium* of the model?

Later: what is an equilibrium?

Later: ought Piemax to believe that the market outcome → equilibrium?

Now: what kind of model?

The simplest kind of model.

Simplest:

— all bakers operate *for one day only* (a so-called one-shot model)

— all firms know the production technology of the others

— study with the tools of:

➢ **payoff matrix** games and

➢ **Nash equilibrium**

Nash Equilibrium: no player has any incentive to change his or her action, assuming that the other player(s) have chosen their best actions for themselves.

Nash equilibria are *self-reinforcing*.

Repeated interactions.

If *more than one day* (a repeated game or interaction):

— then Piemax's objectives?

(more than maximising today's profits)

e.g. low price today may

→ customers switch from a rival brand

→ may increase Piemax' market share in the future

e.g. baking a large batch of pies may

→ allow learning by doing by the staff

& lower production costs in the future

But there are dangers.

But beware:

its rivals may be influenced by Piemax's price today

→ low Piemax price, which may

→ *a price war.*

dynamic games and extensive-form game trees

→ solution concept of *subgame perfection*

Subgame Perfect Equilibrium: a Nash equilibrium that does not rely on non-credible threats.

Uncertainty and information.

Uncertainty?

What if Piemax is *uncertain* of the cost functions or the long-term objectives of its rivals?

— Has Cupcake Pty Ltd just made a breakthrough in large-batch production?

— Does Sweetstuff plc care more about market share than about current profits?

— And how much do these rivals know about Piemax?

Incomplete information games.

Learning.

Learning:

- ➣ if the industry continues for several periods, then Piemax ought to *learn* about Cupcake's and Sweetstuff's private information *from their current pricing behaviour* and use this information to improve its future strategy.
- ➣ In anticipation, Cupcake and Sweetstuff may be loath to let their prices reveal information that enhances Piemax's competitive position:
- ➣ they may attempt to *manipulate Piemax's information*.

1.2 Strategic Interaction

Game theory → a game plan, a specification of actions covering all possible eventualities

Strategic situations:

influence, to outguess, or to adapt to the decisions or lines of behaviour that others have just adopted or are expected to adopt — Schelling.

Look forward and reason backwards.

In others’ shoes.

Game theory is the study of rational behaviour in situations involving interdependence.

- ➢ May involve common interests: *coordination*
- ➢ May involve competing interests: *rivalry*
- ➢ *Rational behaviour*: players do the best they can, in their eyes;
- ➢ Because of the players’ interdependence, a rational decision in a game must be based on a prediction of others’ responses.

  By putting yourself in the other’s shoes and predicting what action the other person will choose, you can decide your own best action.

Similarities.

Many diverse situations have the same essential structure.

— a *procurement manager* trying to induce a subcontractor to search for cost-reducing innovations

— an *entrepreneur* negotiating a royalty arrangement with a manufacturing firm to license the use of a new technology

— a *sales manager* devising a commission–payments scheme to motivate salespeople

— a *production manager* deciding between piece-rate and wage payments to workers

— designing *a managerial incentive system*

— *how low to bid* for a government contract

— *how high to bid* in an auction

— a *takeover raider's* decision on what price to offer for a firm

— a *negotiation* between a corporation and a foreign government over the setting up of a manufacturing plant

— the *haggling* between a buyer and seller of a used car

— *collective bargaining* between a trade union/employees and an employer

1.3 Several Simple Interactions

(from Dixit & Nalebuff, Chapter 1)

1.3.1 Basketball (or tennis?) and weak hands

— Does the “hot hand” exist?

— What if Larry was known to have a “hot hand”?

— Then other side’s behaviour?

— But Larry’s teammates?

— so that Larry’s hot hand leads to better *team* performance, although his own performance falls.

— Which of Larry’s hands do the other side focus on?

— So Larry’s hot hand may warm up his other

— Paradoxically, a better left-handed shot may result in a more effective right-handed shot.

— Moreover, you might focus too much on your opponents’ weaknesses and not enough on your own strengths.

1.3.2 To lead or not to lead

Sailing:

— a reversal of “follow the leader”: instead, follow the follower, even if it is clearly pursuing a poor strategy.

— Or play monkey see, monkey do.

— Keynes’ comments on the stock market as a “beauty contest”: the winner is not whoever chooses the most beautiful contestant, but whoever chooses the contestant chosen by most analysts.

Leading stock-market analysts and economic forecasters have a similar incentive to follow the pack, lest they lose their reputations.

— Newcomers may follow riskier strategies, and occasionally are proven correct.

Consider computers: most innovations have come from small, start-up companies. Also true with stainless-steel razor blades (Wilkinson Sword), and disposable nappies.

How to imitate? Immediately (as in sailing) or later to see how successful the approach is (as in computers)? In business the game is not zero-sum (winner take all) and so the wait is more worthwhile.

1.3.3 Here I stand: I can do no other

— To be known to obstinate or intransigent can be powerful: Martin Luther against the Catholic Church, Charles de Gaulle during the War and after, in influencing the evolution of the EEC.

— One player taking a truly irrevocable position leaves the other parties with just two options: take it or leave it.

— Others denied the opportunity to come back with a counteroffer acceptable.

— But usually the possibility of future negotiations — today's intransigence may be repaid in kind.

— Or others may walk away from the past intransigent.

— A compromise in the short term may prove a better strategy in the long run.

— To achieve the necessary degree of intransigence may be costly: an inflexible personality cannot be turned on and off at will.

— How to achieve selective flexibility? or how to achieve and sustain commitment?

1.3.4 Belling the cat — Who will risk his life to bell the cat?

Whistleblowing:

— How do relatively small armies of occupying powers or tyrants control very large populations for long periods?

— Why is a planeload of people powerless before a single hijacker with a gun?

— Apart from problems of communication and coordination, who will act first? (Khrushchev in 1956)

— The hostages' dilemma?

— The frequent superiority of punishment over reward. (The taxi dispatcher. The eviction of tenants. The sequential bargaining of Japanese electricity companies with Australian coal mines.) The "accordion" effect.

1.3.5 Thin end of the wedge

How is it that gains to the few always seem to get priority over much larger aggregate losses to the many?

— in use of tariffs, quotas, and other protective measures, which raise prices and reduce exports.

— Answer: one case at a time. Myopic decision-makers fail to look ahead and see the whole picture.

— How to develop a system for better long-range strategic vision?

1.3.6 Look before you leap

Many situations are expensive to get out of: a job in a distant city, a computer and its operating system, switching from your frequent-flier airline to another, a marriage.

Once you make a commitment, your bargaining power is weakened.

Strategists who foresee this will use their bargaining power while it exists, before they get into the commitment, typically to gain an up-front payment.

Indeed, such foresight may prevent some people becoming addicted: to heroin, to gambling, to tobacco.

1.3.7 Never give a sucker an even bet

Other people's actions tell us something about what they know, and we should use such information to guide our own action. Of course, if they realised that, they might try to mislead us. (Rothschild.)

1.3.8 Is game theory a danger?

Rationality on the part of the other player may be dominated by pride and irrationality.

Rationality doesn't require:

- ➢ our preferences are the same
- ➢ our information is the same
- ➢ our perceptions are the same

Gains from Trade

A voluntary exchange creates gains for both parties. The gains from trade arise from differences between buyer and seller:

- in their endowments (possess)
- in their preferences (like)
- in their productive capacities (do)
- in their expectations (believe)
- in their information (know)

Important in negotiation to explore the possibilities for mutual gain. (“win–win”)

In the Prisoner’s Dilemma and some other games:

the outcome of the game is not efficient—
if both players cooperated, they would both be better off; the Nash equilibrium is not Pareto-optimal or efficient.

To realise the gains from trade, the players must overcome the game logic. How?

- *contracting* may support cooperation
- *repetition* and the possibility of retaliation may support cooperation, so long as
  - — the discount rate is not so high that future prospects of retaliation are harmless, and
  - — any player’s deviation can be observed

But meeting these conditions does not *guarantee* cooperation.

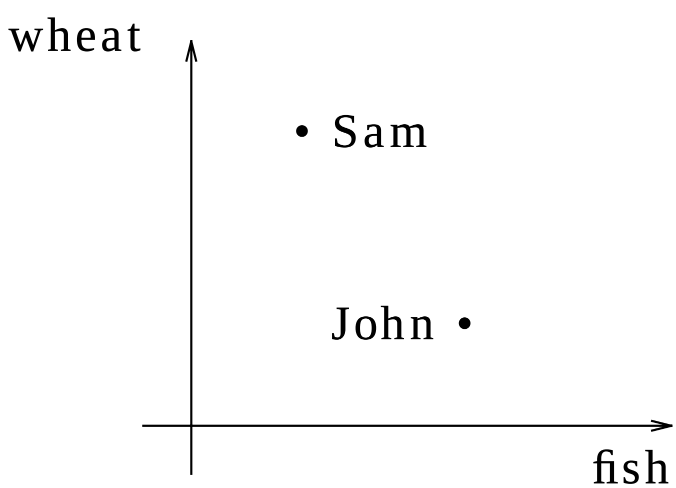
If there is more than one (efficient) equilibrium,

there is still a role for *bargaining* to determine which of these equilibria to achieve,

as in the Battle of the Sexes.

Gains to trade is synonymous with *positive-sum games*,

since at efficient strategy combinations (or Pareto-optimal outcomes) no other combination can make players better off without making at least one player worse off.



The Lens of Trade

1.4 Some Interactions

1.4.1 Auctioning a Five-Dollar Note

Rules:

- ➢ First bid: 20¢
- ➢ Lowest step in bidding: 20¢
- ➢ Auction lasts until the clock starts ringing.
- ➢ Highest bidder pays bid and gets $5 in return.
- ➢ Second-highest bidder also pays, but gets nothing.

Write down the situation as seen by

1. the high bidder, and
2. the second highest bidder.

What happened?

Escalation and entrapment

Examples?

1.4.2 Schelling's Game

Rules:

- ➢ single play, \$4 to play
- ➢ vote "C" (Coöperate) or "D" (Defect).
- ➢ sign your ballot. (and commit to pay the entry fee.)
- ➢ If x% vote "C" and (100 – x)% vote "D":
  - then "C"s' payoff = $\left(\frac{x}{100} \times \$6\right) - \$4$
  - then "D"s' payoff = "C" payoff + \$2
- ➢ Or: You needn't play at all.

WHAT HAPPENED?

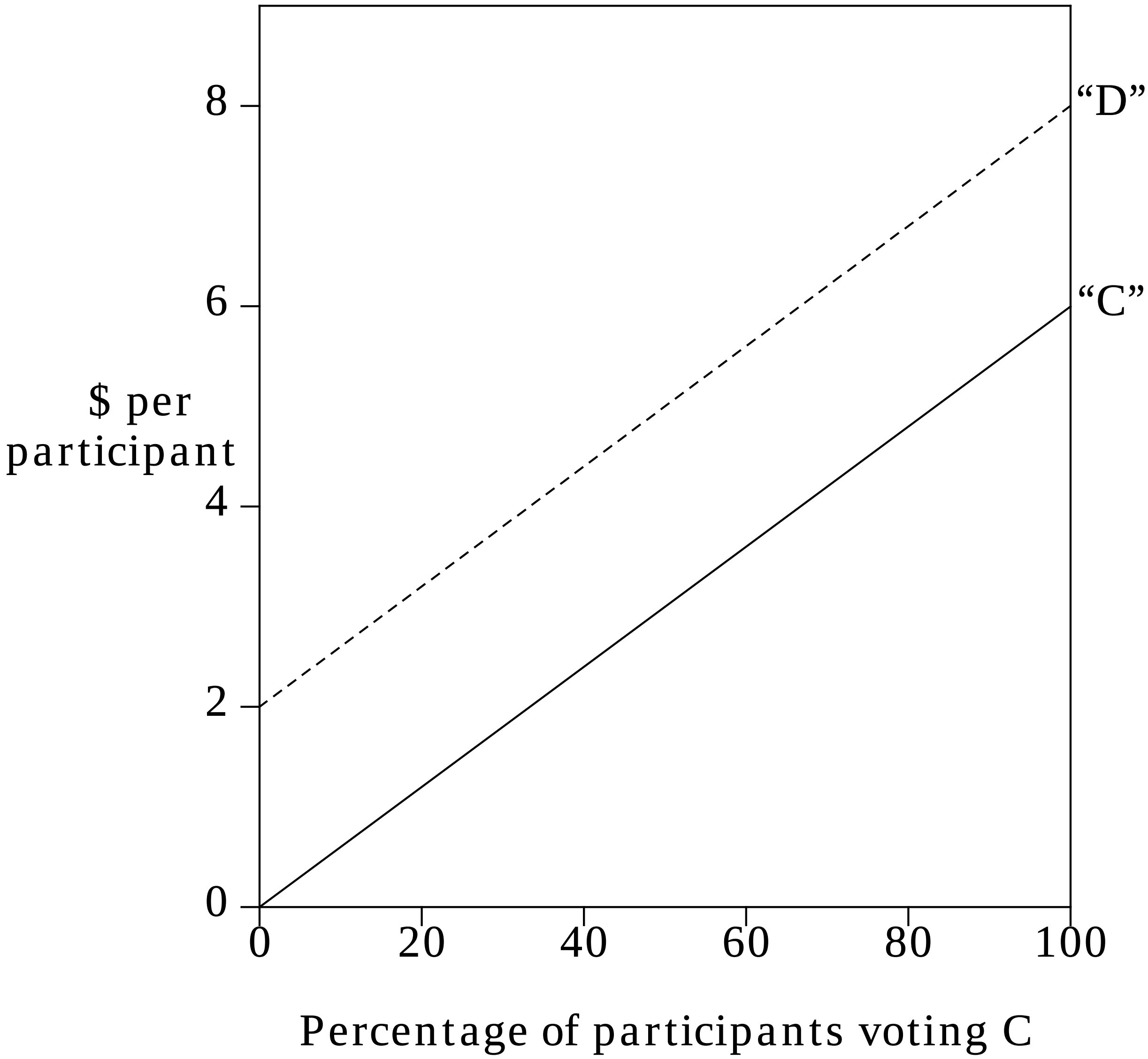
- ➢ numbers & payoffs.
- ➢ previous years?

Dilemma: { coöperate for the common good *or* defect for oneself

Public/private information

Examples?

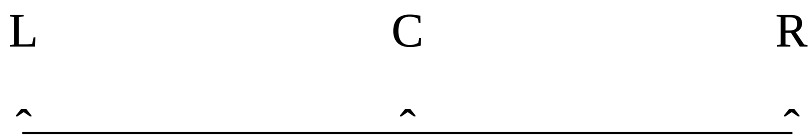
Schelling's Game



Note: the game costs $4 to join.

1.4.3 The Ice-Cream Sellers

(See Marks in the Package)



- ➢ Demonstration
- ➢ Payoff matrix
- ➢ Incentives for movement?
- ➢ Examples?

Modelling the ice-cream sellers.

We can model this interaction with a simplification: each firm can either:

- ➢ move to the centre of the beach (M), or
- ➢ not move (stay put) (NM).

The share of ice-creams each sells (to the total population of 80 sunbathers) depends on its move and that of its rival.

Since each has two choices for its location, there are $2 \times 2 = 4$ possibilities.

We use *arrows* and a **payoff matrix**, which clearly outlines the possible actions of each and the resulting outcomes.

What are the sales if neither moves (or both NM)? Each sells to half the beach.

What are the sales if You move to the centre (M) and your rival stays put at the three-quarter point?

What if you both move?

Given the analysis, what *should* you do?

The Ice-Cream Sellers

		The other seller M	*The other seller* NM
You	M	**40, 40**	50, 30
You	NM	30, 50	40, 40

TABLE 1. The payoff matrix (You, Other)

A non-cooperative, zero-sum game,
with a **dominant strategy**,
or dominant move.

Ice-cream sellers: market examples?

1.4.4 The Prisoner's Dilemma

(See Marks in the Package)

The Payoff Matrix:

- ➢ The Cheater's Reward = 5
- ➢ The Sucker's Payoff = 0
- ➢ Mutual defection = 2
- ➢ Mutual coöperation = 4

These are chosen so that:

$$5 + 0 < 4 + 4$$

so that C,C is **efficient** in a repeated game.

A need for:
communication
coördination
trust
or?

Efficient Outcome: there is no other combination of actions or strategies that would make at least one player better off without making any other player worse off.

The Prisoner's Dilemma

		The other player C	*The other player* D
You	C	4, 4	0, 5
You	D	5, 0	**2, 2**

TABLE 2. The payoff matrix (You, Other)

A non-cooperative, positive-sum game,
with a dominant strategy.

Efficient at _____

Nash Equilibrium at _____

(See page A-7 for a definition of Nash Equilibrium.)

1.4.5 The Capacity Game

Two firms each produce identical products and each must decide whether to Expand (E) its capacity in the next year or not (DNE).

A larger capacity will increase its share of the market, but at a lower price.

The simultaneous capacity game between Alpha and Beta can be written as a payoff matrix.

The Capacity Game

		Beta	
		DNE	Expand
Alpha	DNE	\$18, \$18	\$15, \$20
	Expand	\$20, \$15	**\$16, \$16**

TABLE 3. The payoff matrix (Alpha, Beta)

A non-cooperative, positive-sum game, with a dominant strategy.

Efficient at _____

Nash Equilibrium at _____

Equilibrium.

At a **Nash equilibrium**, each player is doing the best it can, given the strategies of the other players.

We can use *arrows* in the payoff matrix to see what each player should do, given the other player's action.

The Nash equilibrium is a self-reinforcing focal point, and expectations of the other's behaviour are fulfilled.

The Nash equilibrium is not necessarily efficient.

The game above is an example of the Prisoner's Dilemma: in its one-shot version there is a conflict between collective interest and self-interest.

An example: Advertising.

Given the social costs associated with litigation, why is it increasing?

David Ogilvy has said, “Half the money spent on advertising is wasted; the problem is identifying which half.”

Is the explanation for the amount of advertising a Prisoner’s Dilemma?

1.5 Modelling Players' Preferences

In *two-person games*, each of the two players has only n possible *actions*:

∴ represent the game with a $n \times n$ payoff matrix.

Two actions per player: $n = 2$.

∴ Each player faces four possible combinations.

For a one-shot game in *pure strategies*
(i.e., no dice rolling or mixing of pure strategies):

need only *rank* the four combinations:

best, good, bad, worst:

→ payoffs of 4, 3, 2, and 1, respectively

Larger numbers of possible actions:

harder to rank the larger number of outcomes
(with three actions there are $3 \times 3 = 9$),
but ranking sufficient.

(i.e. *ordinal preferences*, instead of asking "by how much is one outcome preferred to another?")

1.6 More Interactions

1.6.1 Battle of the Bismark Sea

It's 1943: *Actors*:

- ➢ Admiral Imamura: ordered to transport Japanese troops across the Bismark Sea to New Guinea, and
- ➢ Admiral Kenney: wishes to bomb Imamura's troop transports.

Decisions/Actions:

- ➢ Imamura:
  - — a shorter Northern route or
  - — a longer Southern route
- ➢ Kenney: where to send his planes to look for Imamura's ships; he can recall his planes if the first decision was wrong, but then the number of days of bombing is reduced.

Some ships are bombed in all four combinations. Kenney and Imamura each have the same action set — {*North*, *South*} — but their payoffs are never the same. Imamura's losses are Kenney's gains: a **zero-sum game**.

Market analogue ?

Two companies, K and I, trying to maximise their shares of a market of constant size by choosing between two product designs N and S.

K has a marketing advantage, and would like to compete head-to-head, while I would rather carve out its own niche.

The Battle of the Bismark Sea

		Imamura North	*Imamura* South
Kenney	North	**2, –2**	2, –2
Kenney	South	1, –1	3, –3

TABLE 4. The payoff matrix (Kenney, Imamura)

A non-cooperative, zero-sum game,
with an iterated dominant strategy equilibrium.

There is no other equilibrium combination: with all other combinations, at least one of the players stands to gain by changing his action, given the other's action.

For Imamura. going N weakly dominates going S.

Neither player has a *dominant startegy*.

Players' choices.

Neither player has a **dominant strategy**:

- ➣ Kenney would choose
  - — *North* if he thought Imamura would choose *North*, but
  - — *South* if he thought Imamura would choose *South*.
  - — So Kenney's best response is a function of what Imamura does.
- ➣ Imamura would choose
  - — *North* if he thought Kenney would choose *South*, but
  - — *either* if he thought Kenney would choose *North*.
  - — For Imamura, *North* is **weakly dominant.**

And Kenney knows it and chooses *North* too.

Equilibrium.

The strategy combination (*North*, *North*) is an **iterated dominant strategy equilibrium.** (It was the outcome in 1943.)

(*North*, *North*) is a (Nash) equilibrium, because:

- ➢ Kenney has no incentive to alter his action from *North* to *South* so long as Imamura chooses *North*, and
- ➢ Imamura gains nothing by changing his action from *North* to *South* so long as Kenney chooses *North*.

1.6.2 Boxed Pigs

Actors: Two pigs are put in a box:

- ➢ Big Pig, dominant
- ➢ Piglet, subordinate.

Game:

- ➢ a lever at one end of the box dispenses food at the other end.
- ➢ So the pig that presses the lever must run to the other end to eat;
- ➢ but by the time it gets there, the other pig has eaten most, but not all, of the food.
- ➢ Big Pig is able to prevent Piglet from getting any of the food when both are at the food.

Assuming the pigs can reason like game theorists, which pig will press the lever?

Payoffs.

Six units of food are delivered:

- ➢ If Piglet presses the lever, then BP eats all 6 units; but
- ➢ if BP pushes the lever, then Piglet eats 5 of the 6 units before BP brushes him aside.
- ➢ If both press together, then Piglet, who runs faster, gets 2 units before BP arrives;
- ➢ running costs half a unit.

Decision:

- ➢ wait for the food, or
- ➢ press the lever & run for the food

The Boxed Pigs

Piglet

		Press	Wait
Big Pig	Press	3½, 1½	**½, 5**
	Wait	6, –½	0, 0

TABLE 5. The payoff matrix (Big Pig, Piglet)

A non-cooperative, positive-sum game,
with a Nash equilibrium.

Choices.

What is best for Piglet?

➢ He is better off to wait.

What is best for Big Pig?

➢ If Piglet presses, then BP gets:
$3\frac{1}{2}$ if she presses or
6 if she waits.

➢ If Piglet waits, then BP gets
$\frac{1}{2}$ if she presses or
0 if she waits.

➢ So BP's *best response* differs depending on what she conjectures her rival will do.

How to resolve this dilemma?

Equilibrium.

If BP puts herself in the shoes of her rival, then BP realises that Piglet's best action is unambiguous: Wait.

If BP presumes Piglet is rational, then she knows she should use her best response to her rival's waiting: thus she presses.

Rational behaviour, therefore, indicates a surprising conclusion:

Big Pig presses the lever and Piglet gets most of the food.

Weakness, in this case, is strength!

Not a Prisoner's Dilemma.

Unlike the Prisoner's Dilemma, Boxed Pigs generates no conflict between individual rationality and collective rationality.

∵ The Nash Equilibrium is efficient in this game.

The outcome cannot be changed without making one of the players (Piglet) worse off.

The outcome may not be fair—the pig that does all the work gets the smaller share—but there is no alternative that the players unanimously prefer.

Market Analogy

e.g. Consider OPEC as an effective cartel:

Saudi Arabia was the “swing” producer, it would unilaterally act to keep oil prices high by reducing its production when one of the smaller member cheated and increased its production of oil.

Not through altruism, but—as with Big Pig—through the logic of the situation: the smaller producers took advantage of the common knowledge that the cartel would collapse unless the Saudis limited their production.

Saudi captured for itself a sufficiently large share of the benefits of the high prices that it was rationally willing to bear a disproportionate share of the cost of maintaining the cartel.

1.6.3 The Battle of the Sexes

The Players & Actions:

- a man (Hal) who wants to go to the Theatre and
- a woman (Shirl) who wants to go to a Concert.

While selfish, they are deeply in love, and would, if necessary, sacrifice their preferences to be with each other.

No iterated dominant strategy equilibrium.
Two *Nash equilibria*:

- (*Theatre*, *Theatre*): given that Hal chooses *Theatre*, so does Shirl.
- (*Concert*, *Concert*), by the same reasoning.

How do the players know which to choose?

(A coordination game.)

Players’ choices.

If they do not talk beforehand, Hal might go to the Concert and Shirl to the Theatre, each mistaken about the other’s beliefs.

Focal points?

Repetition?

Each of the Nash equilibria is collectively rational (efficient): no other strategy combination increases the payoff of one player without reducing that of the other.

There is a **first-mover advantage** in this sequential-move game.

The Battle of the Sexes

		Shirl	
		Theatre	Concert
Hal	Theatre	**2, 1**	–1, –1
	Concert	–1, –1	**1, 2**

TABLE 6. The payoff matrix (Hal, Shirl)

A non-cooperative, positive-sum game, with two Nash equilibria.

Market analogue ?

- An industry-wide standard when two dominant firms have different preferences but both want a common standard.
- The choice of language used in a contract when two firms want to formalise a sales agreement but prefer different terms.

1.6.4 The Ultimatum Game

- ➢ Your daughter, Maggie, asks for your sage advice.
- ➢ She has agreed to participate in a lab experiment.
- ➢ The experiment is two-player bargaining, with Maggie as Player 1.
- ➢ She is to be given $10, and will be asked to divide it between herself and Player 2, whose identity is unknown to her.
- ➢ Maggie must make Player 2 an offer,
- ➢ Then Player 2 can either:
  - — accept the offer, in which case he will receive whatever Maggie offered him, or
  - — he can reject, in which case neither player receives anything.
- ➢ How much should Maggie offer?

Maggie's choices.

- Distinguish ① *the rationalist's answer* from ② *the likely agreement* in practice from ③ *the just agreement*.

The rationalist:

- Player 1 should offer Player 2 5¢ (the smallest coin).
- Player 2 will accept, since 5¢ is better than nothing.
- But offering only 5¢ seems risky, since, if Player 2 is insulted, it would cost him only 5¢ to reject it.
- Maybe Maggie should offer more. But how much more?

A real-world example:

- At a local motel in a small town, a few times a year (graduations, local festivals etc.) there is enormous demand for rooms.
- (On graduation weekends, for instance, some parents stay in hotels as much as 80 km away.)
- The usual price for a room in his motel is $95 a night. Normal practice in town is to retain the usual rates, but insist on a three-night minimum stay.
- The motel owner estimates he could easily fill the motel for graduation weekends at a rate of $280 a night, while retaining the three-night minimum stay.
- But there is a risk of being labelled a “gouger”, which could damage regular business.
- What should he do?

1.6.5 Negotiating with a Deadline

Players and game:

Mortimer and Hotspur are to divide $100 between themselves. Each knows that the game has the following structure:

Stage 1:

- Mortimer proposes how much of the $100 he gets. Then
- *either* Hotspur accepts it, and the game ends and Hotspur receives the remainder of the $100;
- *or* Hotspur rejects it, and the game continues to . . .

Stage 2:

- The sum to be divided has now shrunk to $90.
- Hotspur makes a proposal for his share of the $90. Then
- *either* Mortimer accepts it and gets the remainder;
- *or* he rejects it, and each receives nothing and the game ends.

What will Mortimer demand at the first stage?

What is the least Mortimer can induce Hotspur to accept?

The other's shoes.

Mortimer puts himself in Hotspur's shoes, and imagines that the game has reached the second period. Hotspur is now in a strong position. Why? What will Hotspur propose for division of the $90?

Thus, from the perspective of the first stage, Mortimer can predict what Hotspur will do.

Mortimer knows that Hotspur knows that Hotspur can assure himself of (close to) $90 if he, Hotspur, rejects Mortimer's first-stage offer.

Hence Mortimer knows that the least Hotspur will accept in the first round is $90; the best Mortimer can do is demand $10 for himself.

Good bargainers.

When both players have gone through this line of reasoning, the actual play of the game is straightforward.

Shows the power of a *deadline*.

In reality the rules of the game rarely specify the order of offers (think of the dollar auction). If you get your offer in just before the deadline, then your bargaining partner may have no choice but to accept.

Good bargainers:

- ➢ look several moves ahead, by putting themselves in the other's shoes.
- ➢ Each bargainer thinks through the other's rational responses to all possible contingencies.

Negotiation with a Deadline

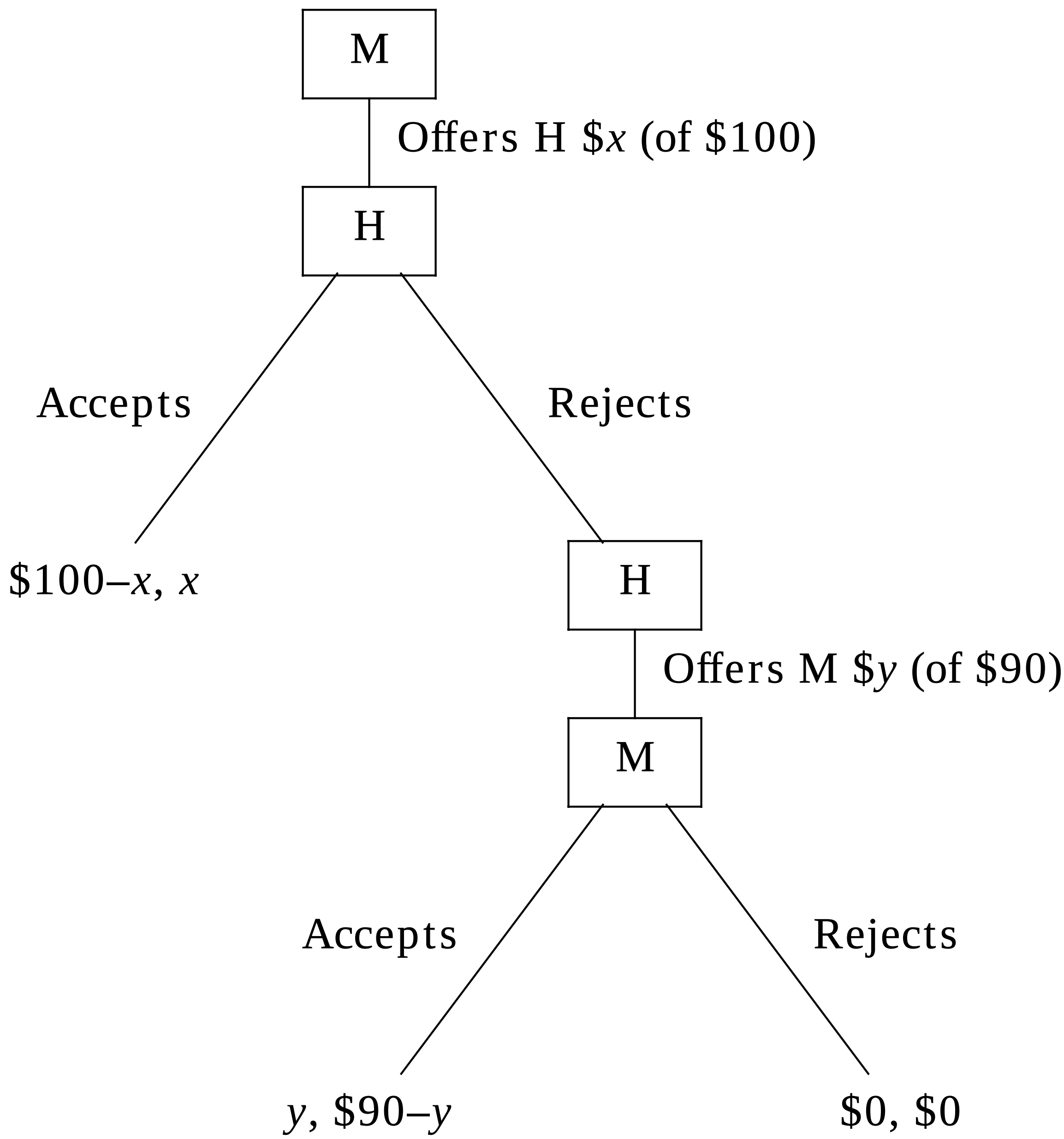


Figure 1. An extensive-form, sequential game (M, H).

What does M. believe?

Introduce: putting oneself in the other's shoes, second-mover advantage, reputation.

1.6.6 The Inheritance Game

The players:

- ➢ Elizabeth, an aged mother, wishes to give an heirloom to one of
- ➢ her several daughters.

The game:

- ➢ E. wants to benefit the daughter who values it most.
- ➢ But the daughters may be dishonest: each has an incentive to exaggerate its worth to her.

A second-price auction.

- so E. devises the following scheme:
  - — asks the daughters to tell her confidentially (i.e. a sealed bid) their values, and
  - — promises to give it to the one who reports the highest value
  - — the highest bidder gets the heirloom, but only pays the second-highest reported valuation.

Will Elizabeth's scheme (a Vickrey[1] auction, or *second-price* auction) make honesty the best policy?

Yes.

1. The late Bill Vickrey shared the Nobel prize in economics in 1996.
(See Package readings.)

Why? Thinking through the options.

Consider your reasoning as one of the daughters:

- three options:

  truthfulness, exaggeration, or understatement.

- The amount you pay is independent of what you say it's worth,

- so the only effect of your report is to determine whether or not you win the heirloom, and hence what you must pay.

- *Exaggeration*: the possibility that you make the highest report when you would not otherwise have, had you been honest.

  i.e., that the second-highest report, the one you now exceed, is higher than your true valuation.

  But → that what you must pay (the second-highest report) is more than what you think the heirloom is worth.

  Exaggeration not in your interest.

- *Understating* changes the outcome only when you would have won with an honest report;

  but now you report a value lower than that of one of your sisters, so you do not win the heirloom.

  Not in your interest either.

It works.

So the mother's scheme works, and the truth is obtained—but at a price, to Elizabeth, the Mum.

E. receives a payment less than the successful daughter's valuation,

so this daughter earns a profit:

= her valuation – the 2nd-highest valuation.

= the premium the mother forgoes to induce honesty

Market Analogue ?

Think: how can the neighbours who propose building a park overcome each household's temptation to *free-ride* on the others' efforts by claiming not to care about the park, when contributions should reflect the household's valuation of the park?

How can the users of a satellite be induced to reveal their profits so that the operating cost of the satellite can be divided according to the profit each user earns?

1.7 Concepts Used:

Best response means the player's best action when faced with a particular action of his or her rival

Nash[2] equilibrium is the outcome that results when all players are simultaneously using their best responses to the others' actions;

thus at an equilibrium all players are doing the best they can, given the others' decisions; that is, all are playing their best responses.

If, conversely, the game is *not* at an equilibrium, then at least one of the players could have done better by acting differently.

∴ A Nash equilibrium is self-reinforcing: given that the others don't deviate, no player has any incentive to change his or her strategy.

An **efficient** outcome is an outcome when there exists no other outcome that all players prefer

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2. John Nash received the Nobel prize in Economics in 1994 for his work done in the early '50s.

1.8 What Have We Learnt?

Rule 1: Look ahead and reason back.

Rule 2: If you have a dominant strategy, then use it.

Rule 3: Eliminate any dominated strategies from consideration, and go on doing so successively.

Rule 4: Look for an equilibrium, a pair of strategies in which each player's action is the best response to the other's.

1.8.1 Another Simple Simultaneous Game:

The notorious game of Chicken!, as played by young men in fast cars.

Here "Bomber" and "Alien" are matched.

Chicken!

		Bomber	
		Veer	Straight
Alien	Veer	Blah, Blah	Chicken!, Winner
	Straight	Winner, Chicken!	Death? Death?

TABLE 7. The payoff matrix (Alien, Bomber)

1.9 Summary of Strategic Decision Making

The following **concepts & tools** are introduced:

The Ice-Cream Sellers:

payoff matrix
incentives to change — use arrows!
dominant strategy

The Prisoner's Dilemma:

possibility of repetition
efficient outcome
non-zero-sum game
inefficient equilibria

The Battle of the Bismark Sea:

zero-sum game
iterated dominant strategy
Nash equilibrium

Boxed Pigs:

rationality
weakness may be strength
efficient equilibria

The Battle of the Sexes:

coordination, not rivalry
first-mover advantage
focal points

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