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For Global MBA
Manchester Business School

Strategy and Competition
The Economics of Strategy

Compiled by

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How to Use this Aide Memoire

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Follow the **Weekly Calendar** for scheduled events.

Visit the e-learning software Kaelo v2.0 available on www.patrickmcnutt.com for a general overview of the diagrams and mechanics of the underlying microeconomics.

Remember you are not alone, we are only an email away and your peers on this MBA and the MBA support term are available to chat to you regarding your problems and queries through the **Discussion Forums on Blackboard VLE**.

Weekly Calendar of Events

WEEK	ACTIVITY	SLIDE-SHOW
Week 1	Video Overview Discussion Threads & Blogs	***Aide Memoire*** + ppt SlideShow Available on Blackboard
Week 2	Online Lecture No 1	Strategy&CompetitionTheme1&2vFinal ppt Slides No 1-15
Week 3	***ProfPrompt No 1***	
Week 4	Discussion Threads & Blogs	
Week 5	Online Lecture No 2	
Week 6	Assignment Part I Due	
Week 7	Discussion Threads & Blogs	
Week 8	Online Lecture No 3 ***ProfPrompt No 2***	Strategy&CompetitionTheme1&2vFinal pptSlides No 16-34
Week 9 to Week 16	Face-to-Face Workshops Begin Face-to-Face Workshops End	**Strategy&CompetitionTheme3&4vFinal ppt Slides 1-55**
Week 17	Discussion Threads & Blogs	
Week 18	***ProfPrompt No 3***	
Week 19	Discussion Threads & Blogs	
Week 20	Online Lecture No 4	**Revision & De-brief and Pre-Exam preparation**
Week 21	Discussion Threads & Blogs	**Theme 5 will focus on the main take-ways from the Module with an application to real world companies. Objective: Reshaping strategy to become a winning strategy**
Week 22	Discussion Threads & Blogs	
Week 23	Exams Begin	
Weeks 24-26	Discussion Threads & Blogs	

Theme 1

TCE and the Sharing Economy

Readings

Read Besanko Chapters 1 & 3, and Chapter 4 and McNutt Chapters 1 to 3.

Readings from Hyperlinks

Strategy&CompetitionTheme1&2vFinal
ppt Slides No 1-15

Visit Kaelo v2.0

Learning Objectives from Theme 1

Understanding of the evolution of the firm

Coasian hypothesis & TCE

Grossman- Hart Property Rights Theory

Principal-Agent Contracting

Law of One Price

Latent Demand & Frozen Markets

Preamble

Welcome. In preparation please watch **Video Introduction** which will review the course and establish the key components of the narrative in the Module. These components include:

The economics of the sharing 'gig' economy as incomplete contracting

The nature of technology beyond the neo-classical production function

The Nash premise & Turing patterns

Signalling & Non Co-operative game theory

Introduction

The Module is entitled *Strategy & Competition: Economics of Strategy* and the central theme of the materials can be found in the application of economic concepts to an understanding of strategy and management behaviour. At one level internal decisions have to be taken in respect of costs and prices while at another level external factors such as consumer demand and competitor reaction manifestly impact on those internal decisions. The tools of analysis at the disposal of management are rooted in microeconomic theory, a branch of economics that looks at individual firm-specific decision making in the context of external factors.

Coasian Hypothesis

The theory of the firm was originally developed on the assumption of perfect knowledge. That assumption has now been substantially modified, and its modification has allowed the development of sophisticated theories of decision-taking under conditions of uncertainty. But this uncertainty relates simply to the future outcome of alternative courses of action; and it is uncertainty of a probabilistic kind. But uncertainty extends much wider than this. Data analytics provide management with information and data patterns which the traditional theory never assumed and in 21st century we have data-driven strategy and the firm has evolved to become a network organization.

The network organisation depends on other firms and individuals to carry out its activities through a *nexus of contracts*:

- The use of contract staff. Firms use a higher proportion of part-timers and contract staff not only to cope with periods of increased work pressure, but also to reduce the dependence on potentially non-required workforce. The lease of capital assets in high capital cost industries.
- The sharing or 'gig' economy that has witnessed the growth of new firms from Airbnb to Uber, competitors who can appear at anytime, anywhere, given the evolution of technology and innovation, to challenge the orthodox incumbents.
- Outsourcing as firms outsource from outside suppliers a proportion of their production or distribution. European and American firms outsource increasing proportions of their operations to lower cost countries such as China to reduce production cost.
- Current developments in telecommunications and information technologies which have resulted in e-trading or computer integrated manufacturing (CIM) have reduced the cost of transacting with other producers, thus encouraging the use of markets to co-ordinate exchange.

These practices signal a higher use of markets and online e-markets to co-ordinate transactions and support the economics of the Coasian hypothesis that exchange and trading are carried out within organisations when market transaction costs are high.

Roberts had argued for the need to redraw horizontal and vertical boundaries within a firm in order to refocus strategy, by creating smaller more autonomous sub-units with worker ownership of the decisions.

Read John Roberts *The Modern Firm* Chapter 2:
https://www.ukessays.com/essays/business/review-the-modern-firm-organizational-design-for-performance-and-growth-business-essay.php

The business world is increasingly using practices such as subcontracting labour or outsourcing production that gives rise to the network organisation. This type of organisation depends on others as agents to carry out its activities through a complex network of contracts and relations with external specialised organisations. The traditional boundaries of the organisation are thus diluted by a network of relationships with other organisations that uses markets as exchange co-ordinators as a substitute for internal exchange co-ordination.

THINK PAD: We have talked about redrawing vertical and horizontal boundaries within a firm to increase strategic focus. It is the theme of Robert's Chapter 2. Sub-units are created with more autonomy and worker ownership of the decisions. So let's re-consider Hammer & Champy's example of a horse-drawn-carriage maker's dilemma. Their research in the 1990s contributed to the trend in business process reengineering, BPR.

The horse-drawn-carriage maker that should have thought itself as a transport company and was caught out by the car presents a good example of the economics of differentiation - there is no particular reason to think that a company that excelled at constructing wooden carriages could adapt to a world of complex automobile manufactures. Rather the carriage company should have identified and capitalised on the strengths of its *operating processes* by diversifying into related industries, for example, by developing wood products and coordinating a supply network. Apple growers in the 21st century, losing market share in apple juice and cider, as consumer's drink preference change, should diversify into vodka and gin products. Theme 2 introduces economies of scope and multi-lateral rivalry. Theme 2 looks at the transition from 'should diversify' into the how to diversify and the likely reaction from competitors.

The Economics of the Sharing Economy

The advances in technology and innovation have created economic foundations for the sharing economy. Coase first raised the question of why transactions take place in firms. Are markets so efficient at allocating resources? His answer, yes, if simply, using the market is costly. The most important costs are (i) discovering what the market prices are and (ii) negotiating a contract for each exchange transaction in the market. According to Coase these costs can be avoided inside the firm through a degree of vertical integration.

Read: Harold Demsetz (1997): 'The Firm in Economic Theory'
America Economic Review Papers & Proceedings May pp426-429

There are opportunities and risks involved: increasing capacity without additional investment v closing a plant and any loss in specialised assets and capabilities.

An *s-firm* governance structure

Our focus is to define the firm or company for 21st century. Here we advance an s-firm governance structure. Traditionally, the firm in neo-classical economics is described by the production relationship in Theme 2 as it transforms inputs into outputs. Now the focus is on the production possibilities as measured by scale, size and scope. We need to understand the economics of the cross-sectoral impact of technological change (discussed in Theme 2 as multi-lateral rivalry) and the economics of the sharing economy. We introduce the stakeholder firm, the *s-firm*.

Read McNutt, P and C.Batho 'Code of Ethics and Employee Governance' *International Journal of Social Economics vol 32 No 8 pp656-666*

The governance structure of an s-firm has the following characteristics:

There is a degree of ownership within an agency relationship

Production technology trade-off, L v K

A rewards system to allocate a share in the value added or net revenues accruing

The production technology trade-off, L v K speaks to the internal organisation of the firm as a governance unit. But with a principal-agent relationship we look towards incentives, popularised by a measure of labour productivity. When the principal-agency relationship and a rewards system are added a framework for the economics of sharing economy can be created that straddles the economics addressed in both Theme 1 and 2.

Hart & Grossman's Property Rights Theory

Firm A, the principal, outsources to Firm B, the agent. Outsourcing occurs only when the costs of internal production are higher than the outsourcing costs, and Firm A decide to use the market mechanism. On the other hand, when the cost of internal co-ordination is lower than the cost of using markets, Firm A will decide to vertically integrate further or to use internal contracts in order to internalise the costs of co-ordination between the different stages of production. Internal contracts might include new worker-incentives to increase productivity linking bonus to performance.

Ownership in the form of share options, for example, could complement wages and salaries. In this situation, the firm is defined as a *nexus of contracts* between the exchanging parties, including all stakeholders.

Stake-holding is about an apportionment of property rights between principal and agents. It is a key driver of the Apps and sharing 'gig' economy as the providers (the agents) and end-users (the principals) engage in a principal-agent vertical arrangement. Furthermore the agents-as-principals sub-contract or licence to other agents in a vertical supply arrangement. Individual A registers with Airbnb and provides a room to let to Individual B. They engage in a supply arrangement in order to minimise the costs of the transaction – renting accommodation, booking a flight, taking a taxi ride, ordering food delivery, online purchases inter alia.

However, the incentive to cut costs (to make a profit) is at the heart of the vertical arrangement but getting the incentives just right can be difficult according to Hart and gives rise to incomplete contracts. In other words, Firm A takes over Firm B to produce X but in the drive to reduce the costs of producing X worker productivity falls due to a lack of incentives from management. Or individual B has a bad experience of renting from Individual B and mistrust in Airbnb sets in.

Transaction cost theory thus determines whether efficient firms should produce in-house or outsource production and distribution. The focus had traditionally been placed on the study of markets as the most efficient co-ordinator. It was not until Ronald Coase posed the question: why is so much economic activity carried out within organisational structures if markets are so efficient? In providing answers, organisations were studied as *exchange co-ordinators*. Collectively, scholars such as Coase, Williamson, Grossman, Hart and Holmstrom addressed the question by suggesting that the existence of transaction costs:

These transaction costs arise from:

- Researching potential suppliers.
- Collecting information on prices.
- Negotiating contracts.
- Monitoring the supplier's output
- Legal costs incurred should the supplier breach contractual negotiations.
- Incomplete contracting

Williamson, Hart and Grossman contends that these transaction costs in turn depend on

- bounded rationality
- opportunism
- mistrust
- intangible assets: specificity
- intangible assets: ownership

Bounded rationality refers to the fact that individuals are bounded by the limits of their own knowledge. Uncertainty exists when management do not have enough information to make rational decisions, but individuals may also be bounded in their rationality when they have too much information. In the game of chess, for example, the two players have perfect information but cannot fully process every potential move or countermove. In business, however, high levels of uncertainty and complexity thus result in higher transaction costs as the exchanging parties try to minimise bounded rationality.

Opportunism is a consequence of asymmetric information arising when exchanging parties have different degrees of information can lead the more informed party to use her position in her best interest. Thus, for instance, it is in the interest of a second-hand car owner who wants to sell the car and knows it is a lemon (term used to denote bad second hand-cars) to lie about its real state to a potential buyer. The potential buyer, who knows the seller has more information about the car, could incur a higher cost to reduce opportunism if she brought the car to a mechanic to get it checked before buying it. Trust is crucial in minimising opportunism and both Airbnb and Uber, for example, rely on trust.

The Vertical Chain of Sharing

Transaction costs will determine whether markets or organisations or a combination of both are more efficient in co-ordinating exchange. Indeed, in the sharing economy hybrids of the two exist. The use of franchising, further illustrates the example of a structure which combines elements of market and a 'nexus of contracts' co-ordination. The ongoing sharing process adds an extra dimension to the analysis of vertical restraints offering a sharing economy competitive advantage that transcends global market boundaries. The sharing economy reflects the more *dynamic* nature of modern business based on processes and services rather than on products and markets *per se*.

Sharing firms are searching for cost efficiencies, for ways to improve customer services, to penetrate new markets with existing products, to enter into new products, thereby defending an existing market share. Vertical arrangements offer modern firms such possibilities. Over the centuries there has been a constant evolution in the techniques that have brought accelerating change to the production and distribution process. X-inefficiency refers to a situation in which modern firms waste resources resulting in costs being higher than they otherwise would have been at its existing scale of production. The existence of X-inefficiency in an established market facilitates the entry of sharing firms.

Across the sharing economy there are vertical agreements with principals and agents entering contractual agreements; they are vertical linkages with the explicit attempt to minimise transaction costs and reap economies of scale and scope. Integration brings benefits to the firm with the ownership and property rights invested in the stakeholder s-firm. However the transaction costs approach can be rationalised further to explain sharing behaviour.

Net Economies **Lemma on Intangible Assets**:

Sharing arrangements, agreements are introduced to minimise transaction costs, that is, either X-inefficiencies exist, there are informational asymmetries in the market or consumers incur transaction costs in search**.**

The sharing economy is a strategic response to acquire net economies: to provide service at a competitive price. An inefficient allocation of X-resources gives rise to x-inefficiency costs which vertical arrangements can abate through *net economies*. They can be measured by taking into account the following factors:

Ease of entry: the strategic conduct of the traditional incumbent firms;

Transaction costs: bounded rationality and opportunism; and

Ownership & Information: Rational consumers.

Example 1:

City taxis are regulated and their fares are regulated. Entry may be delayed. Uber taxis enter a regulated market, identify an opportunity and compete by offering lower fares and consumers respond. But the Uber App also provides the consumer with ownership of the taxi service provided, from the ID of the taxi-driver to tracking software as to precise location and car registration.

Intra-brand competition

Consumers shop around. But although retailers can reduce prices to attract consumers, market research evidence shows that consumers are guided by store location, reputation and repeat purchase and by product choice. In the product choice category we add the free rider behaviour; the retailer can accommodate the loss in revenues per customer by becoming more efficient in reducing overhead and advertising costs to a degree that net margin remains stable or increases.

Intra-brand competition raises the issue of lower retail prices and the likelihood of cost efficiencies. It also reveals a degree of monopoly that is best described as monopolistic competition where at the retail level, a corner store or a franchisee store in the larger shopping mall are both in a position to retail at prices above a perfectly competitive price. This is interesting in explaining the underlying economics and behavioural characteristics of a law of one price. It is also important in evaluating the economics of monopoly in technology markets.

Monopoly in technology markets is better understood as establishing dominance but dominance arises in special situations. These include the complexity of the technology, its interoperability and design specs, high degree of innovation as measured by high R&D expenditures and switching costs for the consumer and end-user. With high switching costs and lack of knowledge about the technology – think of mobile phones – rational consumers are more likely to visit a store that offers a reputable service and if they have had to sign an exclusive term contract with a supplier then they will, by default, visit the supplier's nominated retailer.

We focus on intra-brand competition because in the 21st century there is a renewed interest in retailer-retailer competition, *the Netiquette effect* of shopping mall price comparison with rational consumers visiting the official store and then buying online. This raises the issues of free riding. The *Netiquette effect* is intra-brand competition for 21st century: it is the phenomenon of shopping-mall price comparison with consumers 'free riding' on a visit to an official store but end up buying online.

Rational consumers are assumed to have perfect information and an income constraint. But modern consumers have imperfect knowledge of the prices and they continue to engage in searching online and across stores for the cheapest price. Such behaviour with the added assumption of homogenous products underpins a definition of irrational behaviour. In order to understand the underlying economics we explore the law of one price and the relevance of intra-brand competition.

Online Lecture Corollary: We will discuss demand and elasticity during an online lecture and return to it during Workshops. Main point is Table 9.2 pp314 Besanko and Figure 3.3 pp48 in McNutt.

Law of One Price

The discussion of irrational behaviour is characterised by the observation from shopping price comparison websites from eBay to Amazon that buy-it-now prices (BIN) on first visiting the online site are on average less than the final price paid:

$$\text{BIN prices} < \text{END prices}$$

How could this be rationalised? Firstly, shoppers search on Amazon and on Google and preferences are often influenced by the information retrieved by the online shopper. Online consumes are bounded rational and often rely on third party TripAdvisor-type recommendations before purchasing. For some products, clothes and shoes in particular, there is also the *Netiquette effect* arising from the time lapse between 'spotting' the purchase item online, travelling to the shopping mall to 'experience' the item at a focal shop and finally, the purchase online.

Finally, the 'sold-out' ticket sales phenomenon for booking music or sports events online, has created a secondary ticket market for 'suckers' who are prepared to pay that higher price for the event. They may or may not be successful is securing a ticket but at a point in time their demand is highly inelastic. Part of the reasoning here in terms of the sucker's payoff will re-appear in our discussion of the Prisoners' dilemma in Theme 4. In Theme 4 we argue that rational individuals have 'present–bias' preferences that lead to time inconsistent behaviour: rational people choose to commit themselves now to a (smaller) reward to choosing the (larger) delayed reward, a strategy they will later regret.

Read Richard Thaler (2016) 'Behavioural Economics: Past, Present and Future' American Economic Review vol 106(7) pp1577-1600

Given the apparent irrational behaviour of consumers and the significance of the law of one price, we advance the idea that many companies do have a 'natural' market monopoly to the extent that

(i) buyers incur transaction costs that are proportional to opportunity costs and the distance to the firm from the consumer and

(ii) on average all consumers shop closer to a particular firm they call the benchmark or focal shop.

Read: Henry Schneider (2016) The Bidder's Curse: Comment American Economic Review vol 106(4) pp1182-1194

The collection of information by consumers is a search cost and we can add this to the transaction costs required to buy a commodity: information is a by-product of canvassing the first shop. The consequences of these two points is that at a market equilibrium prices are dispersed provided the firms are not too far apart from each other The choice for a firm is to either capture part of the rival's through a low enough price rather than satisfy his own demand of 'natural' consumers at a higher price.

If there is market asymmetry we have two-sided markets as illustrated by dating sites or payment systems.

But is there a missing market? With a TCE foundation we can blend missing markets into an economics of sharing in terms of a differentiated economy – for example, taxi companies run by women drivers for women passengers only. This is a matching demand effect driving the economics of the sharing economy.

Latent Demand at LMC = 0

But we also have an interest in demand that is not necessarily a mismatch; strictly speaking, a mismatch can arise due to declining business volume as illustrated by excess capacity due to lagged differentiation or an uncompetitive cost structure and decreasing productivity. Frozen markets are an example of a latent demand, a demand that is triggered by technology and innovation. Technological change (defined as commitment to innovation) has been responsible for a disproportionate share of the exit and entry of firms via their introduction of new products and processes into the economy. The frozen market examples focus on the life cycle of early adopters who move away from mass production to mass customization.

Example 2: Bank branches v online & mobile banking

Decisions concerning investment in new technologies which give rise to new products and processes cannot be separated from the strategy of firms and the strategic analysis of markets. A process innovation such as mobile banking lowers the costs of service provision and increases net private returns to the firm. In this example the firm is following the preferences of the consumers. Changes in the consumer's preference set challenges the firm to innovate and to discover new ways of organising and directing productivity.

Example 3: Polaroid and Digital Film

Taking a picture and having it processed required a discharge of property rights and ownership and the picture had less intrinsic value but with digital film the owner could amend the photo and personalise it, restoring ownership. The radical realignment of ownership rights has ensured the return of Polaroid. It brings out the uncertainty about value of a photo, a thing, and the innovation and the strength of the innovation tending to cause price to return to value.

Example 4: Personics and Customised music.

In 1990s a company called Personics decided to start making customised music cassettes. The purpose was to increase the huge choice of music available on records, tapes and CDs in record shops. They developed a system that allowed customers to pick their favourite tunes from a selection of 5000 stored on special CD 'jukeboxes'. A sales clerk in the record shop then enters the selection into a computer; five to ten minutes later, the jukebox delivers the customer's tape complete with laser-printed label. Although it was argued in a business plan that it would increase net music sales, the main obstacle was in copyright approval for current hits due a fear of loss of royalties from music companies. It filed for bankruptcy in 1991.

Optional Read: Patrick McNutt (2010): *Political Economy of Law*. Chapter 12 'Frozen Markets'

As per the reading there is a legal dimension. There is the case of the apportionment of the rights of firms especially in front of national competition and regulatory agencies. What are the rights? Who owns the data? Who owns the IPR? Procedural and administrative rights are combined with the firms' natural rights. This speaks more to the institutional setting of a firm, for example, the game dimension or technology-sharing and raises the issues related to coordinating activities across competing firms. Either A and B merge to create a new firm C or the merger of both A and B requires a divestiture of production capacity, the result of which is a new firm D. Addressing the underlying theme of game theory we discuss the phenomenon of 'human and machine' in terms of the economics of technology (robots as in car assembly or credit card processing) and thinking machines. The frozen market is the service or product emanating from a self-regulating robot that operates without any human interaction or aid.

Theme 2

Costs, Capacity and Disruptive Technologies

Readings

Read Besanko Chapters 2, 5 and McNutt Chapter 5

Readings from Hyperlinks

Strategy&CompetitionTheme1&2vFinal pptSlides No 16-34

Visit Kaelo v2.0

Learning Objectives from Theme 2

Focus on the meaning of cost leadership

Total factor productivity

Economies of scale, size and scope

LAC and the learning curve

Sub-Additivity & Reserve Capacity

Contestability & Multi-lateral rivalry

Introduction

The narrative on technology and innovation will focus on a range of economic factors that will enable us to better understand the economics of the sharing economy. The economic concepts have been re-interpreted to enable a more robust discussion of their relevance in the 21st century:

Productivity as a phenomenon in its own right

Limited capacity

MLR

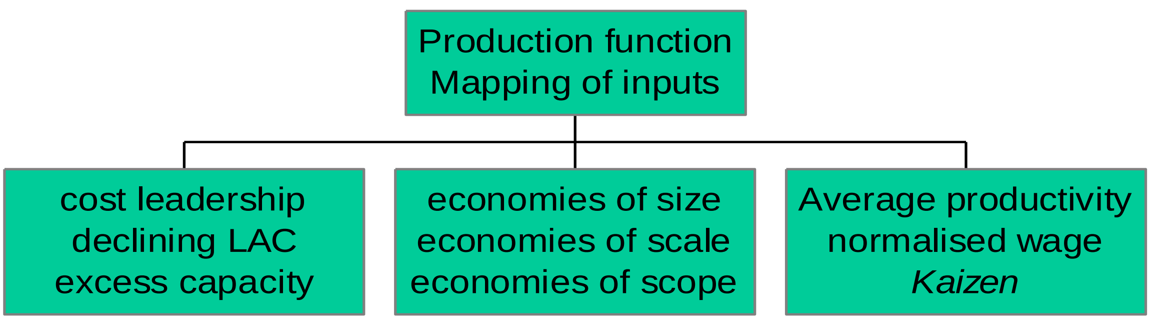
Before we advance the narrative we need to understand 3 key foundation stones to a neo-classical production relationship:

Law of diminishing returns

Long run average costs (LAC)

Excess Capacity v Reserve Capacity

Production relationship



The Learning Curve & Innovation Capacity

It is important for management to understand capacity to ensure cost efficiency throughout the production process. Here we focus on the link between the cost and product curves and we also distinguish between excess capacity and reserve capacity. In obtaining LAC cost efficiencies, management must be prepared to allow production to determine demand rather than allow demand determine production.

Normalisation & Total Factor Productivity

In terms of understanding the geometry of the cost curves it is useful to understand the inverse relationship between the product and cost curves:

$$AP_L = 1/AVC$$

Please note that the average variable cost (AVC) is inversely related to a measure of average productivity, (AP_L). It is a simple observation but one that can be so easily overlooked by management. The management at *TooBig plc* have decided that 7000 employees is too big a number to sustain as they search for cost efficiencies. So they decide to downsize to 4000 employees, with a plan to lay-off 3000 employees. This is achieved usually with generous redundancy payments.

In many cases, the most productive take the package on offer; after a period of time, management at *Smaller plc* with 4000 employees realise that they are not achieving their cost-minimising objectives. In fact, costs have increased in real terms at *Smaller plc*. One reason is because the 4000 employees remaining are not as productive on average as the 7000. The 7000 employees included the 3000 most productive workers who took the redundancy package and now end up re-employed by *Smaller plc* on a fixed-fee contract. In other words, costs are increasing at *Smaller plc* because productivity has fallen; it is not the only explanatory of increasing costs but it is often a contributor. It would have been more judicious for *TooBig plc* to focus on the productivity issue, encourage the most productive staff by way of incentives and to encourage the least productive to leave the plant. This is referred to as normalised wage structures: wage structures that offer incentives to the most productive workers to stay and the least productive to exit.

Size & Cost Leadership: Normal Cost Hypothesis

Management intent on cost leadership will not produce at the minimum point on a SAC curve because if it did it would loose in the sense that it could produce at a still lower average cost, with a slightly larger but under-utilised plant if it were to the left of the minimum point of the LAC, and with a slightly smaller but over-utilised plant if it were to the right of low point of the LAC curve.

A key assumption in our horse-drawn-carriage maker's dilemma is that management can change the plant size. This can arise due to economies of scale from the larger size plant when to the left of the minimum point on the LAC curve. The minimum point on the LAC is the *optimum scale of plant*, the MES. SAC represents the cost structure of the smaller scale plant and the corresponding minimum point on the SAC is *the optimum rate of output*. The challenge for management is to move from optimum rate of output to the optimum scale of plant. Division and specialisation of labour can bring about the economies of scale; likewise the adoption of advanced technology, for example, robotics and computer technology can trigger economies of scale.

Modern firms today seek to obtain economies of scale in the supply chain by out-sourcing to a lower-wage economy in equipment manufacture, textiles, or back-office financial administration. However, with outsourcing management must ensure that productivity does not decrease at the outsourced plants: simply offering lower wages does reduce the variable costs but average costs will only decline if productivity is increased. As output increases management are faced with a second challenge in understanding the capacity constraints that may emerge during the production process.

THINK PAD: It is important to note that average productivity can increase if existing workers are more productive so that $q^* > q$ for a <u>given</u> number of workers, L, hence $q^*/L > q/L$, and productivity has increased because output has increased to q*. This is contrary to an approach in 21st century that reduces the number of workers from L to L* believing that $q/L^* > q/L$: the intended productivity result may not necessarily obtain, for example, due to

Measurements of productivity differ and productivity lags with prices and costs.

Technology (advances in technology, applications of technology, and adaptation of technology) increases by more than a year every year – in other words, technology is a phenomenon in its own right.

Productivity may fall at a level of output, q, if the most productive workers exit.

Cheap labour may give rise to ethical issues and concerns on product quality in the supply line.

COST-LEADERSHIP

Five Step Analysis

CHECKLIST

STEP 1: Distinguish between Economies of *Scale,* Economies of *Size* and Economies of *Scope* within the production process.

***Scale*: $\Delta K = \Delta L = 2\%$ and $\Delta q > 2\%$**

***Size:* achievable in competitive market with $\Delta q = 4\%$ in phase 1, decide ex-post in phase 2 of the production process the most optimal, ΔK or ΔL, and implement in phase 3.**

***Scope*: across production so that $c(q1,q2) < c(q1) + c(q2)$**

STEP 2: Focus on increasing average productivity of labour AP_L. How?

Note that $AP_L = w/AVC$, where w = wage proxy and AVC = average variable costs.

STEP 3: Normalise the wage structure: let w = 1. In other words, offer the workers incentives or bonus payments as productivity increases, revisit the organisational structure and consider the production process as a nexus of contracts.

STEP 4: Control more of the production costs to allow more costs to come under control during the production process. Hedge positions on material inputs, minimise exchange rate risks, workers on fix-wage fix-term contracts with incentives per flexible manufacturing.

STEP 5: Demarcate between excess capacity (idle capacity) and reserve capacity (installed capacity), aware that excess capacity can occur if the product is not sufficiently differentiated fast enough in the market to capture market sales. At the point of production in phase 1 ensure sufficient installed capacity to meet demand in later phases of production.

Brian Arthur's Technology

We trust nature, we hope in technology. Rational players in 21st century hope in something we do not trust. Arthur's search for a theory of technology begins with the premise that technology is evolving. It either replaces humans (symbiotic) or it assists humans (complimentary). There is a distinction to be made between industrial robots for manual repetitive work and social robots that behave like humans. These interactions will increase and expand in new directions. Maybe not building a brick wall but in the IoT. With the IoT we as rational individuals outsource memory. It reminds one of the Indian fable of the blind men and the elephant. When asked to describe what the elephant looks like, the men feel different parts of the elephant's body. The blind man who feels the tail says the elephant is like a rope. The blind man who feels the trunk says the elephant fells like a tree branch and so on.

Optional Read: Brian Arthur (2009) Chapter 1 *The Nature of Technology*

All these men are right, However, like the IoT, they only know the part of the elephants' physical features that each 'sees' through their own immediate experiences and perceptions. They represent our experiences with intelligent machines where we each tend to understand IoT through our own belief system and experiences. The key issue is whether a thinking human's decision can be improved upon by a thinking machine. If a thinking machine can improve upon a decision by a 'thinking human' then the thinking human is trumped by a thinking machine. This is the Turing machine. It recognises the existence of higher dimensions of thinking. Machines may evolve to adopt human aspirations. They are thinking because we have stopped thinking – we outsource memory. Our preferences have become more fickle and ever-changing. An earlier constraint for management was technology's impact on productivity. There is now the added constraint of limited capacity to meet an ever changing demand.

Limited Capacity: Excess *v* Reserve Capacity

During the production phase it is important for management to properly understand the capacity constraints facing a modern production facility. We distinguish between excess capacity and reserve capacity. For each plant size there is a minimum efficient scale of operation, know as the MES. At this point average costs are at a minimum and production beyond this point will give rise to diseconomies of scale and rising costs. However, production is often at a production level to the left of the MES plant size. Traditionally this is the point of excess capacity, and the older arguments were developed in economics accusing the monopolist of producing with excess capacity. Why bother to produce more (towards the MES output) – there was no other rival supplier in the monopolist's market. This is *McNutt's dilemma*: do management build a larger plant that may be under-utilised or retain existing plant that may be over-utilised? The dilemma cannot be solved unless management introduce a normalised wage structure and demarcate at what point present production levels are at in terms of capacity.

The economic argument is simply that the LAC curve derives its shape because of returns to scale. Management are keenly aware that volume depends on market size, market growth and ultimately on market share. In an oligopoly market with an acute zero-sum constraint, the ability to maintain a level of market share is dependent on the actions of competitors in addition to the constraints imposed by ever changing consumer demand on sustaining a level of market share. Adoption of contemporary production techniques from outsourcing to vertical chain arrangements is guided by the desire of management to obtain competitive unit cost advantage and high profitability.

However, modern firms today can be producing with excess capacity simply because they are faced with an ever increasing demand for their product or service at a time when they are unable to product differentiate fast enough to meet the demand. They technically have *spare capacity* in the plant, which translates into excess capacity with a slack demand for the firm's product. Unless the firm is able to differentiate its product in the market, it will be producing at a point to the left of its MES, with excess capacity. It is equivalent to *capacite excedentaire*. This is not a preferred position for management to be located to the left of the MES because it is simply not cost-efficient.

Conversely, reserve capacity arises when production is at a point of LMC = 0. It is best to think of reserve capacity as *installed capacity* used by management when it is required. In other words, different levels of production can be reached at zero marginal cost. This arises because the company has built in additional capacity into the production process early on in the production cycle. This could arise in a product market where *production determines demand*: this is very relevant for the management of innovative products such as mobile phones, printers and video game consoles.

The reserve capacity is illustrated by an L-shaped cost structure for the LAC – all points to the right of MES. In economics we refer to this as level of production as production where constant returns to scale prevail. However, more interestingly is the case where the L-shape neither increases upward (looking like an elongated U-shape) nor downward (representing a declining LAC). In this case the cost structure implies that output is not large enough to observe whether or not average costs will rise. Management may prefer to be cautious and not push production too far in case costs increase.

The curse of differentiation

Excess capacity is present when economies of scale are not exhausted due to product differentiation In other words the firm does not produce a quantity large enough to reach the minimum average costs of production because demand is not infinitely elastic. With many products today consumers demand new functionalities more 'bells and whistles' in the product. Companies attempt to differentiate their product in the market in order to capture increased market share. However, failure to differentiate fast enough could give rise to a situation where the company has overproduced a warehouse full of product that the average consumer does not want to purchase because it is technically obsolete. The company will exhibit excess capacity in its plants. This is understandable.

The demand (for the product) is so demanding - what we call *reserve capacity on demand* or CoD - that it is better for the manufacturer to allow production to control demand. This is contrary to the conventional wisdom that it is demand that drives production. But to avoid the curse of differentiation it may be better for production to determine demand - signal to the market production delay or design problems or delay in the integration of different functionalities. What you observe is a flat-bottomed cost curve and with seasonality in demand or a new innovative product on demand, the company with reserve capacity in production will be better placed to meet that demand at cost efficient levels of production. The firm is more likely to emerge as a cost leader in its market.

Joint production, scope economies and MLR

Multi-lateral rivalry (MLR) is simply about competitors emerging from anywhere at any time. Such competitors are described later as spherical competitors in the market-as-a-game but in the interim the phenomenon can be illustrated by the example of Amazon competing with Deliveroo and UberEats in the delivery of take-away food and services. In the following section we introduce the economics of the firm environment based on Baumol's theory of contestability. Our objective here is to prepare you for the discussion on

(i) the threat of entry, and (ii) sustainable prices

What is of interest to the wider debate on strategy and competition is that with new technology, and with disruptive technology, in particular, inter-industry rivalry can result from economies of scope that transcend industry boundaries. Rather than focus on *disruptive technology* we attempt to embed Arthur's technology in terms of the latent demand at the margins of a good or service. The purpose of doing this is to widen the debate on the economic foundations of the sharing economy.

Optional Read: William Baumol (2002) Chapter 1 & 2
The Free-Market Innovation Machine

Baumol's sub-additivity

Baumol's argument is that competition enables companies to innovate and often they collaborate as competitors to adapt more efficiently to new technology challenges. Competitors face a common challenge in technology. In understanding the economics of Baumol we go back further to Baumol's theory of contestability. Here we have to reflect on the meaning of sustainable prices and on the economics of sub-additivity. For example: Firm A, a natural gas firm, places fibre optic cables in its natural gas pipelines or Firm B runs communications cables along its rail-tracks. In 21st century we have quad-play with the bundling of telephony, cable, broadband and TV. And the sharing economy has facilitated an innovation machine:

Table 1: Baumol-Jamison Tableau

	Market 1	Market 2	Market 3	Market 4
Firm A	x	x	x	x
Firm B	x	x	x	
Firm C	x		x	x
Firm D			x	

Firm A represents a monopoly. Firms B, C and D represent smaller firms that could produce the monopoly's output. The x illustrates potential rivalry in which the smaller firms could, but not necessarily do, compete with A. The shaded X illustrates which firms actually compete in which market. Firm D across only one market represents a classic monopolist in Market 3. However, Firm A across all 4 markets indicates Baumol's natural monopoly if its costs are lower than the costs of smaller firms, B, C and D that would or could, in the aggregate produce A's output.

This allows for two scenarios to be discussed as follows:

would smaller firms, B, C and D in the aggregate produce A's output.

or

could smaller firms, B, C and D in the aggregate produce A's output.

It is this dichotomy that is of interest in the economics of the sharing economy. We call it the *monopolid* phenomenon and we have chosen to represent it by constant AVC with limited capacity. The discussion relates directly back not only to the Coasian TCE but also to what we will refer to later as frozen markets. The latter is not dissimilar to Christensen's disruptive technology wherein innovation creates a new market. We argue that an incumbent chooses neither to produce nor compete in a marginal segment of the market (so, literally there is no demand, the market is *frozen*) thus allowing a new entrant to exploit that demand and awaken a latent consumer demand.

Optional Read: Clay Christensen (2000) Chapter 1
The Innovator's Dilemma

Optional Read: Patrick McNutt (2010): *Political Economy of Law*.
Chapter 12 'Frozen Markets'

The X in Table 1 above without shading indicates potential points of competition. We introduce sub-additivity as a general term that incorporates the economies of scale and economies of scope from Theme 2. Please note that in Baumol's original model, sub-additivity also incorporated economies of joint production which we interpret as economies of scope.

Definition A: A firm's costs are strictly sub-additive for a particular level of output if it is less costly for a single firm to produce this level of output than for all possible combinations of two or more firms. If a firm's costs are strictly sub-additive at a particular level of output q then the firm is a natural monopoly at q.
Definition B: Sustainable prices are a set of prices that does not attract rivals to the industry. A potential entrant could produce any portion of a natural monopoly's output but opts not to do so given the set of prices, contingent on costs and revenues.

So where the entrant serves the entire market demand at the entrant's price we have an unsustainable monopoly. However, given the costs and revenues and the likelihood of an entrant's capacity constraint, early entrants may choose to serve less than the entire market.

Limited Capacity

Should early entrants choose to serve less than the entire market we need to define limited capacity. Our strict definition and explanation of *limited capacity* will be illustrated by diagrams during the Online Lectures but and it is centred around:

the normalisation of costs, and the economics of time

This allows us to address the production-cost relationship for the 21st century from the perspective of Kahn's short-period and crucially, the condition of minimum costs. The latter can be explained as follows: a key Neo-classical assumption is that the primary goal of a firm is profit maximisation, since, given this assumption, the firm will wish to keep cost at a minimum for each level of output. However, minimum cost is a necessary but not *sufficient* condition for profit maximisation.

Recent trends in both technology and innovation challenge the Baumol assumption: for any two groups of products there are never economies of joint production if the two groups are produced together. At the time Baumol assumed that there are no economies of joint production between non-switched dedicated telephone lines and electricity lines but today with advances in technology there are examples. We now observe that inter-industry rivalry in communications can result from economies of scope that cross industry boundaries. Optics cables can be embedded in natural gas lines or along rail-tracks that allow a gas or rail company to create a telecommunications subsidiary. And both Uber and Amazon could and do compete with Deliveroo in home delivery.

Online Lecture Corollary: To prove the necessary condition let us suppose that the firm's goal is not profit maximisation but rather maximum plant size. In this case, as illustrated in the Online Lecture only TC and AC will be relevant long-run cost curves. But if market demand is less than q5 and only plant size with TC and AC are employed then profits cannot be maximised, since plant sizes exist with superior cost configurations.

Case A: constant AVC with limited capacity as excess capacity

This is the classic monopoly, the only supplier extracting quasi-rents and monopoly profits by restricting demand with a given supply. Taxi companies before Uber.

Case B: constant AVC with limited capacity as reserve capacity

This is frozen markets and the point in which the MC curve is discontinuous. The discontinuity manifests itself with entrant players like Uber becoming Ubus and Airbnb becoming Airhome through an adaptation of an economy of scope and exploiting a latent frozen market demand.

Think Pad:

The traditional Chandler's thesis is that structure follows strategy. In other words, it is the behaviour of management, observed as strategy by competitors, that determines the market structure. If a firm's strategy is to be carried out, or implemented, individuals working within the firm must know about the strategy and its operational requirement for tasks and actions, and their coordination. This is the key driver of Roberts' modern firm, challenging the vertical and horizontal boundaries in order to refocus strategy.

Read Mazzucato (2011): *The Entrepreneurial State* Chapter 1

How the firm responds to problems of information and innovation were addressed in Themes 1 and 2. How it addresses coordination and commitment in a game will deliver its sustainable competitive advantage. The extent to which the State has a role in supporting a competitive advantage will be discussed online. Mazzucato's hypothesis viz-a-viz role of the government funding in biotechnology or in green technology should be considered in terms of support for collaboration between competitors. Themes 3 and 4 will focus on an important game assumption in that a group of companies realise that they are in a game whenever the fate of one company depends not only on its own actions, but also on the actions of the rest of the companies in the market.

Theme 3

Competition and Reaction

Readings

Read Besanko Chapters 6, 7,8, 9 and 10 and McNutt Chapter 6-8

Readings in Hyperlinks

Strategy&CompetitionTheme3&4vFinal

ppt Slides 1-55

Visit Kaelo v2.0

Learning Objectives from Theme 3

Strategy in a game dimension

Management as players

Markets as a game

Dynamic non cooperative games

Commitment and Retaliation

Entry and Exit Strategies

Limit Pricing Model & Entry Deterrence

Games as Strategy

The central contribution of game theory to the economics of strategic management is a new language for the understanding of how to formulate and study strategic or inter-company optimization involving two or more players. There is a wealth of application but we are suggesting here that there are two fundamentally different classes of application of game theory to economic problems in business. The first is the application of two-person zero-sum games to primarily tactical business problems. The second is the application of n-person non cooperative games to strategic issues involving threat analysis and price wars. It is this combined application of games that provides the genesis of the economics of strategy.

http://www.economist.com/node/21527025

Games are about strategy. The concept of a game of strategy as any situation where the fates of two or more parties are linked has facilitated the application of game theory to many areas. A *zero-sum game* can be defined as any situation where the choices of two or more rational decision makers together lead to gains and losses for them. In addition, a game may simultaneously involve element of both conflict and cooperation among the decision makers.

Think of a game as a typical game of poker where a sequence of moves is played, the game ends and then payoffs are realised. The sequence of poker-hands can be regarded as moves and they represent a game. Schooled players will look for connections between hands and each player will be observing what every other player is doing or not doing as the game unfolds. The payoffs are determined by the components of the game. If the game is played just once then there is a unique payoff of [say] (2,2). It can be any number but both players receive exactly the same amount

Nearly 100 years ago, in the late 1920s, the French mathematician Emil Borel wrote a series of articles to show how games, war and economic behaviour were similar activities in that they all involve the necessity of making strategic decisions. Today, we define competition as a game. Competition may manifest itself in different ways, for example, in terms of price competition or advertising expenditures but in a game we are focusing on *patterns* of observed behaviour. In this enriched view of a market management as a player continue to look at prices but will also look at patterns of prices over a period of time; they may need to also look at entropy in the market shares.

Typology of Games

Game theory is broadly divided into two branches, ***co-operative*** and ***non-cooperative***. The distinction sometimes can be unclear but, essentially in a co-operative game, players can make binding agreements before and during the game play. Communication between the players is allowed. In a non-cooperative game, the players cannot make binding agreements, although communication may and may not be allowed.

Rules of the Game

Rule 1: Games and strategy are about actions, not only of a single player, but of all players involved in a strategic situation. The actions of one player will be observed and trigger a likely reaction by the other players.

Rule 2: Players are assumed to be rational. Although game theory allows for irrationality in its more complex forms, one of the cornerstones of the basic theory is rationality. Players can act irrationally in a strategically important situation, however, it is generally accepted that those who do, are more likely to fail and therefore others (being rational) are likely to respond by not playing the game, or, changing the game dimension completely.

Rule 3: A commitment by one player will not generate the desired response from a competitor unless it has three characteristics *viz* it must be visible, it must be understandable and it must be credible.

Rule 4: Players have a type and some players keep to type. Some are price leaders while others are price followers. Some players respond via price movements while again other players move only on the quantity side.

Rule 5: The notion of a game suggests competition and reaction. In business companies find themselves in competitive markets, in which strategies are required to win in these situations by beating the competition. However, the game theory model also allows for analysis of alternative courses of action where, in certain circumstances, it may be beneficial to (cooperate) with the competition in order to minimize the exposure to loss in value to all players.

Game theory refers to techniques for predicting the actions that interdependent rivals may take in their relations with each other. In ***strategic games***, players choose strategies that will maximise their payoffs, given the strategies that are selected by their competitors. Such games are also described as ***normal form*** and represented by a set of players, strategic reactions and payoffs in matrix form. When we use decision trees the games are described in ***extensive form***. Price games are referred to as ***Bertrand*** and non-price games as ***Cournot***.

Finding a Nash Equilibrium

Best simple description of Nash equilibrium and the Nash premise can be found at the citation

http://www.columbia.edu/~rs328/NashEquilibrium.pdf

In a normal game, we have a payoff matrix

Table 1

	Strategy I	**Strategy II**
Strategy I	3,3	0,5
Strategy II	5,0	1,1

Note the positioning of: 5 > 3 > 1 and the symmetry on diagonal (0,5) and (5,0)

Note: if the blue player moves from the NE box (changes from playing Strategy II to Strategy I) independently of the opponent, the blue payoff falls from 1 to 0. Same applies to the opponent, so (1,1) is NE – simply, a higher payoff is only feasible if an opponent accommodates your change in strategy. So both players must coordinate to play Strategy I to obtain (3,3).

Check: No player can obtain a higher payoff number by deviating unilaterally from the box (1,1) so (1,1) is a Nash equilibrium. But there is a trust issue: both players require an assurance that neither will deviate from an agreed strategy play. A player may punish and build a reputation on punishment.

Table 2: Thief of Nature

	Player B	
Player A	2,2	0,3
	3,0	1,1

Playbook Sequence A [Trust, Rank, Signalling, Cooperating…]

Move 1 = (2) Rival Move 1 = (2)

Move 2 = (2) Rival Move 1 = (2)..After 2 moves (4)

Move 3 = (2) Rival Move 1 = (2)……After 3 moves (6)

Move 4 = (2) Rival Move 1 = (2)

Move 5 = (2) Rival Move 1 = (2)

Move 6 = (2) Rival Move 1 = (2)

Move 7 = (2) Rival Move 1 = (2)

Move 8 = (2) Rival Move 1 = (2)

8 Moves **Σ** = (16)

Playbook Sequence B [Trust, Betrayal, Punishment…..]

Move 1 = (2) Rival Move 1 = (2)

Move 2 = (3) Rival Move 2 = (0)…After 2 moves (5)

Move 3 = (1) Rival Move 3 = (1)…After 3 moves… (6)

Move 4 = (1) Rival Move 4 = (1)

Move 5 = (1) Rival Move 4 = (1)

Move 6 = (1) Rival Move 4 = (1)

Move 7 = (1) Rival Move 4 = (1)

Move 8 = (1) Rival Move 4 = (1)

8 Moves **Σ** = (11)

Thief of Nature Playbook

A dominant strategy is one 'under no circumstances yields a lower payoff and sometimes does better' in the PD game. In a one-shot game, a dominant strategy is to cheat, and in a repeated game there is the probability of punishment. Both players believe that punishment is a play and nether player knows who will cheat first, so only a Selten 'handshake' signalling with trust and commitment delivers a Nash bargaining outcome. So the question is: how many moves? Each move is information in the game. In other words, how do we re-shape strategy? We need T/3 corporate intelligence gathering, find the near-rival.

The *Thief of Nature* explains the playbook embedded in the payoff matrix where there is a pure strategy play of co-operation by both players based on trust. If we convert the strategies into high prices v low prices, the Playbook includes mistrust and an incentive to cheat. The elusive 3 payoff is a dominant strategy. It is rational for both players to play a dominant strategy in Table 1 so a Nash equilibrium (NE) occurs (observed as a price war) with a payoff of (1,1).

Read Rao, Bergen & Davis 'How to Fight a Price War'
HBR Mar-Apr 2000

Alternatively there is a 'Fun Read' at

https://fleximize.com/articles/001044/why-not-to-get-into-a-price-war-with-a-competitor

Zero-sum and Non zero-sum Games

Zero sum games are a special case of constant sum games, in which choices by players can either increase or decrease the available payoffs. In a zero sum game the total payoff to all players in the game, for every combination of strategies, always add to zero.

Matrix I: Zero-sum

	Strategy A	Strategy B
Strategy A	-1, 1	3, -3
Strategy B	0, 0	-2, 2

Matrix II: Non-Zero Sum

	Strategy A	Strategy B
Strategy A	2,2	0,3
Strategy B	3,0	1,1

Informally, in non zero-sum game, a gain by one player does not necessarily correspond with a loss by another. On the non co-operative front, Nash has broken down the restrictions on zero-sum games and came up with the concept of ***Nash equilibrium*** which is one of the more important tools that game theorists have at their disposal. Under the Nash equilibrium, each player's predicted strategy must be that player's best response to the predicted strategies of the other players in the game. Therefore in Nash equilibrium, no one has any incentive to deviate from the equilibrium outcome as each is doing his best given what the other party is doing. It is thus deemed to be strategically stable or self-enforcing equilibrium**.**

Games can be ***sequential (dynamic)*** or ***simultaneous (static)***. When a game is sequential, each player moves in turn and each player is aware of the moves that have been taken previously. The question each player is trying to answer is 'what should I do, given what my competitor has done and given what my competitor will do when they know how I have moved? When a game is simultaneous, each player may be thought of as moving at the same time. Each player moves without knowing what the other has done. In such a situation, the question asked is 'what should I do, given that I do not know what my competitor will do and my competitor does not know what I will do?

Repeated games are game repeated with infinite numbers of times, a finite but known number of times, or an unknown number of times. Players need to consider the impact of their actions in each round on the future. One-off games are simple, as players need only concern about the gains or losses arising from that single round. In the video game industry, repeated games are applicable as competitors are always observing and reacting to each other moves.

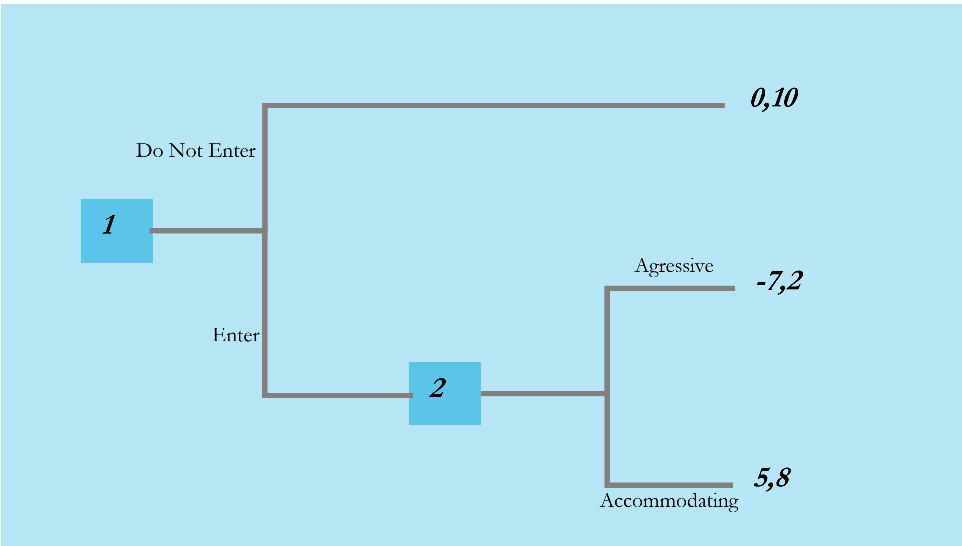
Bain-Modigliani Limit Pricing Model

The limit pricing model is a classic representation of entry-exit strategies. Many scholars now believe that game theory is valuable to management because it requires explicit consideration of competitor's actions, possible options and outcomes and often drives management to the conclusion that, once analysed, the dimensions of the game needs to change for strategic objectives to be met.

Read McNutt's Online Lectures Notes

The classic example of a firm considering entry into a new market is presented as a demonstration of non cooperative game theory. The biggest uncertainty faced by the new entrant is predicting the reaction of the incumbent player in the market, whose perceived options are, firstly, be accommodating and allow entry, or, react aggressively with price cuts or discounts. An aggressive response could reduce the value of the market due to an ensuing price war. In this analogy, the incumbent is more likely to cede market share to avoid a price war.

Figure 1 Market Entry Decision: Extensive Form



If the decision is taken not to enter the market, the payoff for the new entrant will be zero and the incumbent retains the full value of the game (10). Should the company decide to enter, the incumbent has two strategies to pursue: retaliate with aggressive price cuts, thereby risking a price war that will leave it with a reduced payoff of 2. In the above example, we are assuming that the new entrant could not afford such a price war and would fail to return a profit from the venture (losing 7). If the incumbent accommodates the new entrant, its payoff is reduced to 8 through ceding market share to the new comer, who makes a successful entry with profits of 5.

The concept of total value or payoff from a game will be examined from a different perspective in terms of the probabilities attached to each action in decision analysis. Self interest (profit maximization) governs the likely response of the market incumbent, thereby negating the value of any probability calculation if the incumbent's first response is to prevent entry. It is important to analyze, not the probability of the reaction options, but instead be guided but what actions the rational, self-interested respondent is likely to reply with in the game.

Dominant Strategy

The same game can be represented in a payoff matrix or strategic form. The game matrix directs the players to only logical strategic choice. Player 1 assumes that player 2 will act in rational self-interest, and it is in player 2's interest to assume the reciprocal arrangement applies. The concept of 'dominance' is introduced.

Check Figure 6.3 pp89 McNutt Decoding Strategy

Suppose that there is a first strategy that "under no circumstances yields a lower payoff and sometimes does better" than a second option. It is said that the first strategy *dominates* the second. In Figure 6.3, Player 1 (the entrant) has no dominant strategy. If they do not enter they will not have any payoffs, Player 2 (the incumbent) does not need to react and will retain the payoff, noted at 10. An entrant player believes that the 'do not enter' strategy dominates the 'enter' strategy should the incumbent react even with an incumbent discounting a loss from 10 to 2. So the entrant parks entry at this particular time because a zero payoff is better than a loss of 7

However, for Player 1, the accommodating strategy of the incumbent would result in a higher payoff for the new entrant, than not entering at all. It is clear that Player 1 has no dominant strategy. Player 2, however, has a dominant strategy. In both cases of 'do not enter' and 'enter', the incumbent is better off by accommodating the new entrant. This is indicated by the payoff of 10 if the newcomer does not enter and a higher payoff of 8 versus 2 if Player 2 accommodates. Hence an accommodation strategy dominates the aggressive retaliation strategy. The (0,10) on top LHS cell of the matrix in Figure 6.3 is not relevant at this time to Player 2. The optimum strategy in this game is that Player 1, knowing the payoffs (as opposed to the probabilities), realises that at this point of entry it is in Player 2's best interest to accommodate and Player 1 will therefore enter the market.

Retaliation

The reply will depend on the player's belief about the type of player the competitor is in a game. Like the Galton's ox weight contest each player will observe how individual errors and biases in predicting likely reactions will tend to cancel each other out as the sought-after information about type is distilled in some aggregate measure of belief. Players will either adopt a binary approach or not:

Player A asks:

Binary: Will Player B react? Yes or No
Non-Binary: Player B will react: Probability = X%.

Notice that in Figure 6.3 each of the options available to the rival result in a change in the total payoff of the game. Retaliation would lead to a price war in which lower profits would devalue the total returns available to all players. In this example, the resulting market losses are 5. Alternatively, allowing the new company to enter would grow the market value overall, to 13, the sum of the payoffs 5 and 8.

The strategies open to the players are clear. Notice that the first decision lies with the new entrant, the subsequent response by the incumbent makes this a sequential game: Outlining the strategies forms the key to systematic thinking about which one of those strategies is the optimal path to follow.

Strategy Set

S_A: Do not enter, do not retaliate (status quo)
S_B: Enter and Retaliate
S_B: Enter and Accommodate

Strategy of Limit Pricing Model

Strategy behind limit pricing: the incumbent may remain passive and accept entry, or alternatively irreversibly commit resources in order to fight entry. In each case the entrant has a choice to enter or sat out of the game. The idea behind limit pricing is that potential entrants are attracted to the game by high profits, which are themselves the consequences of high prices. If an incumbent(s) reduces prices to a limit price at which level the new entrants would choose to stay out, the incumbent will ultimately end up better off than if entry had taken place.

Later we look at commitment and reputation. In the interim, whether or not limit pricing is part of an incumbent's strategy playbook depends on a range of economic factors:

- If the level of pre-entry sunk costs investment incurred by an incumbent is high then unlikely to accommodate an entrant.
- An incumbent may opt to engage in brand proliferation, product quality and product differentiation.
- An entrant may call an incumbent's bluff and enter notwithstanding the limit pricing threat signal.
- Both players may adopt a fighting ship strategy
- An entrant may ally with a smaller incumbent
- Entrant as a CL type and enter with low prices and the probability of an episodic price war. (This is discussed below).

The Reasoning Behind *the implausible payoff* of a credible entry strategy because once the entrant enters, the incumbent's best strategy is to accommodate. The playbook pair of (enter, accommodate) is a Selten sub-game equilibrium.

1. Pre-entry function

The limit pricing model is a good representation of the entry threat in a Bertrand game. Simply, a rational incumbent will deter entry by limiting pricing. The reasoning brings together the pre-entry function, post-entry function and BE entry pricing and the reputational advantage of an incumbent. An entrant has an entry function E. A limit price PL is a price signal that converts a pre-entry positive function E(PL) > 0 into post-entry negative function such that E(PL) < 0. On BE analysis a rational entrant will avoid entry. Our discussion charts the game dynamic reasoning inherent in this implausible payoff by addressing the economics of entry beyond the probability that an incumbent will attempt to deter or retard entry of a potential entrant player.

2. Selten's sub-game

Step 1: Represent the winning strategy in a limit pricing game as a sub-game equilibrium as observed by (i) an episodic price war of finite duration or (ii) fighting ship strategy. Both build reputation and support Besanko's 'top-dog' strategy.

Step 2: Convert the limit pricing game into an extensive decision tree and find the NE. Link back to the Prisoners' dilemma where compete/cheat was a dominant strategy for both players.

Read McNutt's Online Lectures Notes

Note: Lesson from Step 2 is that backward induction prescribes that the incumbent acquiesce whenever a potential entrant enters the game. So there is an accommodation strategy. However, T/3 argues that a theory of rational behaviour needs to be coupled with a theory of irrational behaviour as well expressed as some form of non-maximising behaviour or as some lack of knowledge of the game or player type. An early example is Selten's 1975 sub-game perfect equilibrium.

Step 3: Continue with the implausible payoff in search for a Selten sub-game equilibrium for the entrant-incumbent limit pricing game where there is a threat of entry. Remember that entry is contestable (unlikely) so, what would happen in a sub-game matters because of what would happen if it were reached!

Contestability assumes that an incumbent faced with the threat of entry will behave in a way to deter entry – reduce prices as a predatory pre-entry tactic or signal capacity. The binary choice for the entrant is to attack or avoid and the binary choice for the incumbent is to fight or retreat.

Table 3: Sub-Game Equilibrium

	Fight	Retreat
Attack	-1,-1	1,0
Avoid	0,1	0,1

If the incumbent commits to fighting and the entrant attacks both are worse-off at the (-1,-1) payoff. But if the entrant believes that the incumbent is committed to fighting the entrant may delay entry and avoid the game. If the incumbent believes that the entrant will avoid entry because the entrant believes that the incumbent is committed to fighting, the incumbent will retreat. But if the entrant believes that the incumbent will retreat because the entrant believes that the incumbent believes that the entrant will attack then the entrant commits to attack.

Read McNutt's Online Lectures Notes

The Table 3 playbook (attack, retreat) is a Selten sub-game equilibrium as the incumbent would rationally retreat rather than fight under attack, yielding a **0** rather than a **-1**. If there is no reputation or commitment to fight from an incumbent then entrant would attack and the incumbent should retreat.

If, however, the incumbent were to commit to fighting, then the incumbent would be better off – giving the incumbents commitment and reputation, the entrant would avoid entry, yielding the incumbent a payoff **1** rather than payoff **0**. The entry deterrent strategy involves the incumbent building capacity, building a reputation with a 'big bang' effect in t-1 as a credible threat and securing an implausible payoff **1** rather than payoff **0**.

Corollary: Likewise the playbook in ppt slides that replicate Figure 6.2 pp88 in McNutt's *Decoding Strategy* book (enter, accommodate) is a credible entry strategy because once the entrant enters, the incumbent's best strategy is to accommodate. The playbook strategy pair of (enter, accommodate) is a Selten sub-game equilibrium.

If-then **and Military Strategies**

What is interesting from a business perspective is the length of the Bertrand game. In other words, the duration of a price war as measured in days, weeks or months adds a military dimension to the business game. During the price war, strategy is revealed, type is revealed and belief systems can be betrayed. Although corporate intelligence is gathered, the duration cost must be discounted against any likely gains in a key performance metric such as market share.

Moving forward the theme of moves and commitment will focus on 'pricing pressure' facing companies: to follow a price decrease with the likely triggering of a price war or the price leadership of putative cartel pricing and the concentration-collusion debate is triggered. The overlap with the economics of antitrust becomes self-evident as the company evolves from pre-merger to oligopoly and from post-merger to monopoly.

The critical difference between a business game and a game of chess is that the players lack information: either incomplete information on player type or imperfect information on the game itself, in particular, any t-1 history and the likely duration of the game. Both players must choose simultaneously so neither knows the other's strategy when choosing her opening move.

Counter-factual: engage in an episodic price war of limited duration. So if both players are reducing price this should lead to lower average prices then higher volumes should compensate for lower margins. And lower average prices are a design signal, a price designed in such a way that everyone can observe everyone observing everyone, thereby generating common knowledge among the players. T/3 hints that, among multiple players, a degree of common knowledge sufficient to make collective action possible, may be generated by third-party signals on lower average prices in the market-as-a-game.

Table 4 Episodic Price Wars

	Episodic price war	Fighting ship
Episodic price war	6 months	6 months
Fighting ship	2 months	10 months

At first glance **the client** has a problem – it would be best to opt for the same duration as their **near-rival**, and both enter a 6 months episodic price war. But when they make their decision they don't really know how long the game will last. However the game is more easily solved if you take the view of the near-rival. For the near-rival, an episodic price war minimises the exposure *whatever* the client does, so her action is clear. After working this out, the client's decision also becomes clear; enter an episodic price war. The episodic price war, in this instance, would be considered a stable 'safe' equilibrium because a player choosing a 'double-cross' fighting ship strategy unilaterally would be worse off.

Theme 4

Commitment and Strategic Reaction

Readings
Read Besanko Chapter 7 & 8 **McNutt Chapters 7-9** **Readings in Hyperlinks**
Strategy&CompetitionTheme3&4vFinal
ppt Slides 1-55 **Visit Kaelo v2.0**

<u>Learning Objectives from Theme 4</u>

Normal Form and extensive Form Games

Prisoners' Dilemma Simulation

Beyond Nash equilibrium solutions

Further analysis on type and signalling

Bertrand Strategic Reaction and Price Wars

Preamble

So as we draw close to the end of the Module you can see that the arguments are not dissimilar to war games wherein costs are measured in terms of committed resources as games of attrition (mass deployment mass casualties) v strategic games (know your opponent's type before engaging).

Commitment and Chat

It is by knowing when and how to make a decision for each player that a description may be forthcoming. But rival competitors will do everything to keep one another guessing. Interpreting management as participants in a market is nothing new. However, we will approach management as participants from a different angle: as players in the market-as-a-game. In particular, we will focus on players, games and patterns in an effort to introduce the significance of player type in understanding management behaviour and company strategy in product and service markets, local, national and global markets. The focus on type is a key driver to understanding actual, observable conflict of subjective outcomes in a non-cooperative market wherein management as individuals compete against each other for market share, and as rivals they keep each other guessing.

Consider the following payoff matrix:

Table 1

	A	**B**
a	1,1	0,0
b	0,0	1,1

The row player can play **a** if she can reasonably believe that the column player could play **A**, since **a** is a best response to **A**. She can reasonably believe that the column player can play **A** if it is reasonable for column to believe that the row player could play **a.** He can believe that she will play **a** if it is reasonable for him to believe that she could play **a**, and so on. This provides an infinite chain of consistent beliefs that result in the players playing to an outcome (a, A).

As in the Bain-Modigliani new entrant game discussed in Theme 3, players should always seek out their dominant strategy in order to maximize their own payoff. A strictly naive strategy is a strategy that gives you a lower payoff than at least one of your other strategies, regardless of what your opponent does. Therefore games can benefit from coordinated actions amongst players.

In Figure 1, it is clear that by player 1 playing strategy A, player 2 would be unwise to play Strategy Y, as this will lead to (0,0) and lost value for both players. With both players having conducted their analysis, they would be better-off agreeing the outcome in advance by playing either (A, X) or (B, Y). A key concept here is the benefit of information and communication.

Figure 1 Coordinated Simultaneous Game

		Player 2	
		Strategy X	Strategy Y
Player 1	Strategy A	**10,10**	**0,0**
	Strategy B	**0,0**	**10,10**

THINK PAD: When coordination is required in a game, should a player be always open, honest and trusting? In Figure 1 there is no clear 'winner takes all' outcome. If the situation were that there is a finite total value to be derived from the game, then coordination (cooperation) is futile. Each player would attempt to maximize their own payoff, and that would be to the detriment of the other player. These scenarios were alluded to earlier and are known as fixed sum games. Communication and chat are means to save on experimental or learning costs in a game when they display diminishing returns.

The role of information is important in the fixed sum game. Where players are operating from a position of imperfect information, trying to out-guess the opponent is more important than negotiating a bilateral arrangement. In these situations, advantage is often gained through more comprehensive information. Management are said to be suffering from bounded rationality when existing circumstances that would affect the outcome of a decision are unknown to them at the time of making that decision. When developing strategies, it is vital for a company to undertake extensive market and competitor analysis to give it the best possible informational advantage.

Read McNutt's Online Lectures Notes

Information plays another important role in out-guessing games. Through signalling, albeit via misinformation, that a company's intention is to play one strategy, it attempts to divert its rival attentions away from its real intentions. Games of chicken often involve signalling in this fashion. It is preferable to communicate a tougher position in a game of chicken, even if this stance is untenable – in game theory this is known as a 'play mean' strategy. However, if a rival is aware that such a stance is untenable and the position taker is aware that the rival comprehends this, the game may evolve to a trust and coordination situation. These options require consideration in order to avoid competing in a fixed-sum game, where increasing payoff is to the detriment of your competitors.

Strategic Reaction & Price Wars

The controlling of a mass coordination game can lead to a monopoly situation for the market leader. With a mass coordination game in a market experiencing network externalities, the situation can arise where all the players are satisfied and the outcome of the game is stable. In this case, no player regrets the outcome, given the strategies taken by the other player(s). A Nash Equilibrium obtains when each player's expectations are fulfilled and their chosen strategies are optimal – there is no need to change strategy.

On the non-cooperative front, Nash had broken down the restrictions on zero-sum games and came up with the concept of Nash equilibrium, which left an incredible mark on game theory by proposing a solution to games where none seemed to exist. It is often touted as one of the most important tools that game theorists have at their disposal. Under the Nash equilibrium, it can be said, each player's predicted strategy must be that player's best response to the predicted strategies of the other players. Therefore, in Nash equilibrium, no player has any incentive to deviate from his strategy to disrupt the equilibrium outcome given that the other players do not deviate. It is thus deemed to be strategically stable or self-enforcing equilibrium.

Figure 2 Nash Equilibrium

		Player 2	
		Strategy X	Strategy Y
Player 1	Strategy A	**0,0**	**8,-5**
	Strategy B	**-5,8**	**10,10**

In Figure 2, two Nash Equilibriums exist; (A, X) and (B, Y). In a cooperative move, it is in player 1's interest to convince Player 2 to move strategy Y. Obviously both players are better off in a stable game that yields the greater payoff (B, Y). If the players cannot move to (B, Y), then player 1 should retain strategy A, to either force player 2 into a loss situation or, to move to the inferior Nash Equilibrium, where at least losses are not incurred. In this strategic scenario, the largest payoff is also the most superior Nash Equilibrium; therefore, it is the obvious strategic position for both players to take.

Read: Kevin Coyne & John Horn (2009): *Predicting Your Competitor's Reaction*

It is possible for multiple Nash Equilibriums to exist within the confines of a single game. However, not necessarily all positions offer the best payoffs. Dominant strategies are always played no matter what the other player does, if both players then follow their dominant strategies, Nash Equilibrium will evolve. The equilibrium may, however, not be the best result in terms of payoff. Players in the less superior equilibrium positions should try to move towards the best possible strategies.

Nash equilibrium is more difficult to achieve when the most superior equilibrium is not the best payoff. In Figure 3, it would be difficult for Player 1 to convince Player 2 to move from following strategy X, since this would involve Player 2 ceding, at the minimum, 2 in payoff terms (from 12 to 10). Strategy (B, Y) is no longer stable since both players are better-off choosing to play the strategy giving each a higher payoff. This is strategy A for player 1 (if player 2 plays Y) and strategy X for player 2 (if player 1 plays B).

The logic of Nash Equilibrium explains why, in a price war, the players are ultimately destined to make zero profits. In a price war, no firm is happy charging more than its rival for goods or services since this would result in reduced sales. The firm therefore charges less than its rival. This process of under-cutting will continue until both firms are charging prices equal to cost. This equates to the lesser Nash Equilibrium strategy of (A, X) in Figure 3

Figure 3 Nash Equilibrium and Price Wars

		Player 2	
		Strategy X	Strategy Y
Player 1	Strategy A	**0,0**	**12,-5**
	Strategy B	**-5,12**	**10,10**

Nash-Bertrand Reaction Functions

The essence of the competitive process is trying to understand the complex web of competitors' behaviour. Reaction function allows management to track the price reactions of competitors. Management in a game under the zero-sum constraint will soon learn that to weigh competitors' price reaction more than the limitations imposed on price by the own demand elasticity. This is the essence of strategic pricing. The focus here is on strategic complements in a highly differentiated oligopoly market. It focuses on likely price reactions in such a market. This model examines the pricing behaviour of interdependent companies in a product market with few competitors. This is more applicable to the oligopoly markets.

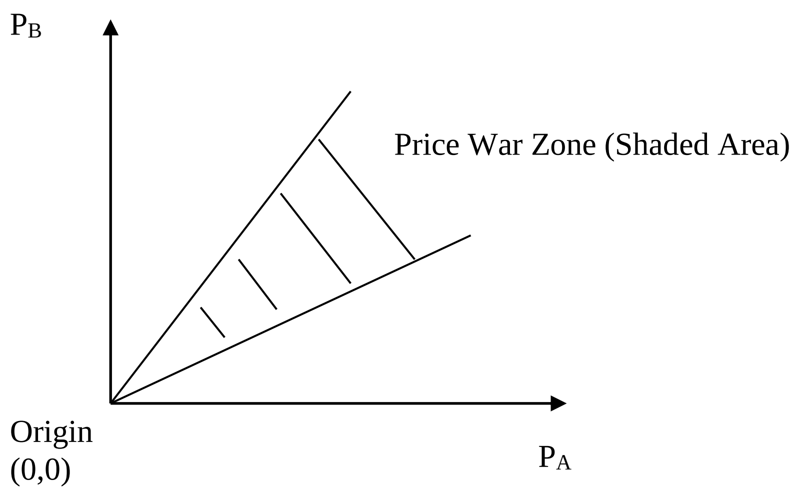


Figure 4: Bertrand Zero-Price Solution

Figure 4 shows non-intersection of the reaction functions of companies A and B. The price equilibrium is zero, at the origin. There is every likelihood that both players could drive the price to the (0,0) price equilibrium as the game will continue until the equilibrium price is reached. Price war is a term used in business to indicate a state of intense competitive rivalry accompanied by a multilateral series of price reductions. One competitor will lower its price, and (in sequence) others will lower their prices to match. If one of the reactors reduces their price below the original cut price, then a new round of reduction is initiated. A prolonged price war is usually costly in terms of the opportunity cost of real resources used to defend market shares. Management should avoid price wars that are costly and profits are eroded.

The challenge for the Bertrand model is to explain (i) in some markets in the absence of overt collusion competing players are able to maintain high prices: US cigarette industry 1990s; (ii) in some markets where interdependence is acute, there is significant price competition: regional cement suppliers and global video games market post 1998 and 2001-2005.

Bertrand Challenge Explained by.

1. Realisation of the Nash equilibrium

2. Folk Theorem Benefit-Cost Condition

Realisation of the Nash equilibrium

The first we now explore in Figure 5 with intersecting reaction functions where the point of intersection is a Nash equilibrium price for both players.

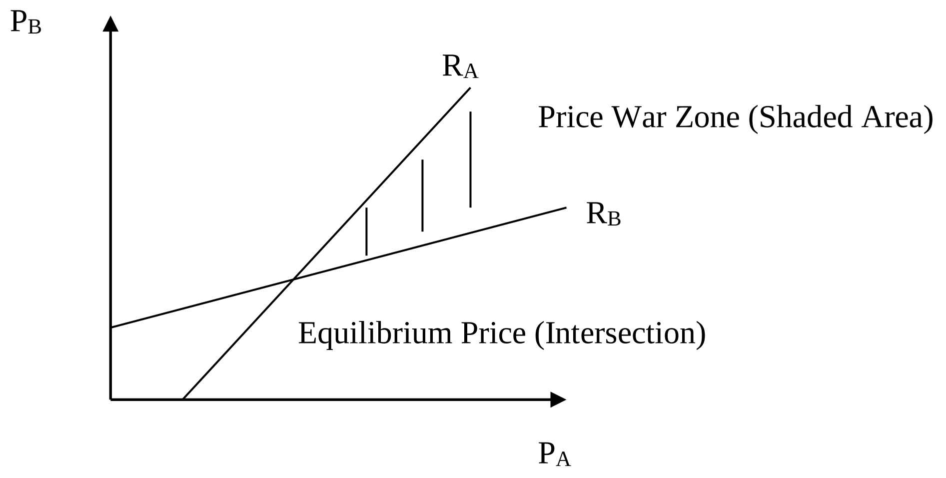


Figure 5: Bertrand Modified Model

It is neither an equal price nor a profit maximising price nor does it represent equilibrium where both players have equal market shares. It is the best outcome for each player given the reaction of the other player. Figure 5 shows the intersection of the reactions functions of the companies. Price war occurs till the intersection point of the two reaction functions. That is the Nash equilibrium price.

Prisoners' Dilemma

Repeat play & Simulation = Thief of Nature

Cost of Playing

The Prisoners' Dilemma game is a basic descriptive example of game theory fundamentals. It is in fact, a derivative of the Nash Equilibrium. Reducing prices can lead, in the short term, to attracting new customers the expense of rivals. However, longer term, when rivals reciprocate, all players suffer. In the example below, both players have the option of charging high or low prices. Regardless of what the other player does, both players are better off offering low prices. If Player 1 charges low prices, Player 2 is better off doing the same for the fearing of customer defection and zero profits. For both companies, charging low prices is the dominant strategy, so the likely outcome amongst rational players is lower payoffs for both players

The Prisoners' dilemma is one of the pitfalls that management needs to anticipate in formulating future strategies for the company. There would need to be a large amount of trust between players to overcome the potentially damaging situation arising from deception. The Prisoners' dilemma can be played-out over repetitive periods. The outcome of such situations depends on whether there is a lifespan attributed to the game. If there is no end to the number of iteration of a game, then it is in both parties interest to cooperate (within the limitations of antitrust law). However, if the game has a finite period or iteration, and the players are aware of it, it is likely that one player will breach the others confidence and 'play mean' in order to gain the last advantage.

Cost of Playing a Game

Consider the case of small firm A *v* large firm B in a market setting where management as players have individual utilities or private benefits from competing in the market and in the game. We ascribe a simple cost to each player. The PD payoff matrix for this example is as follows: again players would prefer to be in the top left cell of the matrix, but because each player has a dominant strategy of competing, they will find themselves in the lower right cell of the matrix in Table 2.

Read: Justin Fox (2015): *From Economic Man to Behavioural Economics*

The zero-sum assumption dictates that player A's market share gain will be at the expense of the player B and *vice vearsa.* No two players move *simultaneously.* Both players prefer to avoid (0,0) outcome.

Table 2

	Player A	
	Cooperate	**Compete**
Cooperate	½ , ½	¼, ¾
Player B		
Compete	¾, 1/4	0,0

For the purposes of the game, assume that the private costs to player A of cooperating or 'keeping his promises' can be represented by

$$c(A) = x^2/2$$

and the private costs to player B can be represented by

$$c(B) = 2x^2.$$

Neither player knows the cost function of their opponent. The cost to player A of a cooperative outcome = 1/8 and the cost to player B = ½; thus suggesting that player B, given the specific cost function, is no better off. Management at B should attempt to reduce the private costs of playing the game. However if B is tempted to go for the ¾ payoff its costs would rise significantly to 1.11 with the inevitability of a (0, 0) outcome as player A retaliates. So B with no legal sanction cooperates with A. Maximising private benefits can be difficult.

Data-Driven Strategy

A sequence of moves in a game creates a critical time line, CTL. We call the sequence a Turing pattern if the number of moves is less than 5-7 moves and player type can be determined. The observed pattern will be either a Bertrand price sequence or a Cournot non-price sequence or a combination of both. A break in the pattern can often characterise the presence of a Nash equilibrium in the observed signals, that is, an end point, where one game (say, Bertrand sequence) ends and a new game (say, Cournot sequence) begins.

Corollary: The Sony-Microsoft case is a game of observed duration 1999-2008 and continues today. The game 1999-2004 is a Bertrand game PS2 v Xbox and NE at 2004 on $149 price, new Cournot game begins PS3 v Xbox360 with quantity signals on logistics, production, video game content and IPRs.

Read pp141-143 McNutt *Decoding Strategy*

The central point in McNutt's *Decoding Strategy* is to find a pattern in the data, construct a critical time line of actions and reactions and by doing so discover a sequence of moves in a cause and effect relationship. The fighter pilots are trained to observe, orient, decide and act before full engagement with an enemy: known as the OODA loop, it requires a beginning and an end, and NE provides an end to a business game.

Hypothesis: we can generalise that for any two players of game dimension extant v de novo type that they will follow, with Fibonacci probability p = 0.68, the Turing sequence of action and reaction as illustrated.

The risk therefore, for business games is that they can become competitive fixed-sum games. Significantly, if one player perceives the reward to be at the expense of a competitor, there is no point in cooperating or trusting. This is cutthroat competition. Signalling plays an important role in the Prisoners' dilemma as it is often the way to achieve tacit cooperation.

In a repetitive period game, a price increase by one company could lead to temporary losses, however, it can also signal to the competitor to increase its prices and move the total value of the payoff to a beneficial position for both parties. Fear of retaliation is a factor the rival will consider in deciding whether or not to follow suit and raise prices. To ensure that the retaliation factor is a credible deterrent, the company should build a reputation for itself for swift retaliation. The building of reputation in one game, G1, can explain the observation of episodic price wars, where a player is signalling to a competitor that the pricing strategies in G1 could be repeated in G2.

Signalling

- Firms displaying certain traits such as swift and robust response to price competition will develop a reputation in the industry for strong defence of its market position.

- If a player moves quickly it confirms type and commitment to the game.

- An increase in advertising can act as a deterrent to rivals and an incentive to customers. Furthermore, the larger the advertising budget the greater the perceived financial strength of an organization and the greater the commitment to a market.

- If a firm ceases advertising, it can be interpreted as a signal of strength and confidence in a firm's client base, or, a possible withdrawal from a market.

- Media reports convey messages to targeted audiences.

- Silence or a 'do-nothing' strategy is a powerful signal. If signalling means deception about a players' position, then staying silent for the sake of not deceiving will communicate as strong a message.

Signalling correctly can lead to networked externalities whereby markets are created or enlarged from the momentum created by communication from the main players. An additional approach to success when information is scarce is to consider the value of strategic options available. Conditions of limited information introduce risk into strategic situations. Players can use option value as a guide to decision making in a game situation. Pricing strategies can be dependent on high quality information. In the game between a company and its customers, the more a firm knows about its customers the better it will understand customer price sensitivity. This can lead to effective customer segmentation and augment profits by charging lower prices to price sensitive customers only, whilst maintaining higher prices to the price insensitive segment.

Read McNutt's Online Lectures Notes

Online Lecture Commentary: The narrative behind the final set of power point slides builds on the understanding of the Nash premise introduced in Workshop as an action-reaction sequence of moves that describes a pattern. The pattern provides corporate intelligence and by decoding the pattern, the sequence also provides metadata equivalents on player's type, move timings and frequencies and the game dimension. There is a reference to the patterns as Turing patterns but a greater focus will be on the construction of a CTL. Many examples of CTL are to be found in the Appendix of McNutt's *Decoding Strategy*.

Read McNutt's Online Lectures Notes

Threat in the Data

So we continue to focus on the corporate intelligence and on identifying the 'threat in the data' from the sequence of moves. For example, knowing neither the existence nor the identity of the near rival provides a threat – the competitor who is more likely to react first to your opening move in the sequence of moves. Technology and innovation *per se* can present a threat and, with economies of scope and de novo entry, incumbents in game G2 can present a credible threat of entry into G1. The strategic focus in a T/3 framework centres on the 'what-if' scenarios and by assigning probabilities to players' type – the probabilities will have elements of imperfect information on how the game is played and incomplete information of player type. The T/3 framework then proceeds to define the likely reaction as binary or non-binary.

Winning: Self-Enforcing Mechanisms

There could be two NE. Such games are referred to as assurance games with a risk-dominant play and a payoff dominant play. To ensure the stability of a payoff dominant play and to bind trust there has to be commitment, so in class, we presented the hypothesis of EK-Qantas alliance as an assurance game.

Table 3

	Alliance	No Alliance/No JV
Alliance/JV	2,2 Payoff-dominant	0,1
No Alliance/No JV	1,0	1,1 Risk-dominant

Note the positioning of 1 = 1 and the symmetry on diagonal (0,1) and (1,0)

The EK-Qantas assurance game reached a payoff-dominant NE when Qantas moved is passenger hub from Changi Singapore to Dubai and crews seamlessly fly both and both logos appear as a joint branding. If a player wants to secure a short-term benefit by price competing or remaining independent of an alliance there is the risk in t+1 of a reaction from the near-rival.

There is an *opportunity cost* of not agreeing to an alliance or a regret cost in t+1 when a player has misread or over-estimated their chances of winning (in terms of payoffs). There is always more information in the game and more information has an embedded payoff gain. It is difficult to compute before a move. But all moves convey information on a player's type in a game and often a move can be explained as rational in terms of confirming the type of a near-rival. The strategy here is to use your first move for the purposes of extracting information from the game – information on anticipated events and likely reactions in order to confirm your opponent's type in the game. This allows you to predict with a degree of probability the likely outcome of your action and assign resources accordingly. In a T/3 game the 'what-if' scenario planning creates a decision tree. The 'if-then' scenario provides a backward-induction or feedback loop. So the dilemma is: do I move first or not?

Prognosis

What is winning? It is not necessarily obtaining the 'highest short-term payoff' but it could be a 50:50 profit split or respective intelligence about each other's strategy set. It might be an episodic price war of finite duration to build a reputation in order to minimise the threat of price wars in future. It might be a self-enforcing mechanism of mutual respect to consolidate joint market shares or game playbook of a minimum number of moves. The player with CV ≠ 0 has perfect information on how the game is played and complete information of player type. No bounded rationality, no surprises. In other words, the player has a best reply strategy to the question: if my opponent moves, do I move? This is the quintessence of winning and securing a sustainable competitive advantage in the market-as-a-game.