Business

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The disciplines of business seek to provide tools to deal with risk and uncertainty. Business leaders frequently need to manage within relatively finite resources and relatively unpredictable levels of demand or supply. This chapter provides an overview of uncertainty in business, with techniques for dealing with uncertainty and also some recent failures to do so. It concludes with a specific example of understanding organised crime as a business. Many business rules are relevant to how policing manages itself, as well as how policing understands and responds to crime.

Most business decisions are made within a context of uncertainty. Coping with uncertainty is necessary to maintaining a continuing business operation. For example, many software project decisions are made within a range of uncertainties, such as those regarding project requirements. The uncertainties inherent in software development can result in project failure, budget overruns and delayed delivery (e.g. Na et al. 2004). A response is to attempt to better specify requirements early in the software development process and during the development life cycle. Nevertheless, if something as seemingly predictable as software projects cannot run to time and budget, then how can an investigation into an unknown criminal?

In the business context, uncertainty refers to situations in which it is not possible to assign probabilities. The critical distinction is that the ability to assign probabilities allows a range of formal estimates related to risk and the resulting consequences. Tools and analyses can then be applied to manage quantifiable risks and to manage uncertainties with assumed characteristics. While the management of risk is well covered in standard business texts, this chapter considers the more difficult issue of the management of less quantifiable uncertainties. Many business questions of interest involve decisions with risk and uncertainty. Two classic economic theories of decision-making are Von Neumann and Morgenstern's (1947) expected utility theory of choice under uncertainty, and Samuelson's (1937) discounted utility theory.

Smithson et al. (2008) suggest the following classification of issues regarding responses to uncertainty:

- reduced (usually by gaining more knowledge)
- accepted or tolerated
- controlled, harnessed or exploited
- denied
- banished
- surrendered to.

Interestingly the Committee of Sponsoring Organizations of the Treadway Commission (2004) includes in their framework avoiding, accepting, reducing, or sharing risk as management responses to align risks with the entity's risk tolerances and risk appetite. This chapter uses examples from business to consider some of these responses to uncertainty.

Reduced

One approach to uncertainty is to invest in collecting and analysing the necessary information to reduce uncertainty. An area of recent research that has seen explosive growth is the development and application of data mining techniques that can provide information to resolve some uncertainty from an environment where there is too much data for easy handling (e.g. Agrawal et al. 1993; Agrawal & Aggarwal 2001). The ubiquitous Google software is the most obvious technique for identifying relevant information from the world of electronic data. The use of the internet to facilitate the legions of users searching through data to identify important information is an area with potential. For example, filings by Securities and Exchange Commission regulated companies in the United States are available electronically to financial analysts, academic researchers, journalists, retiree investors and third-party software companies on the internet (see www.sec.gov). Having more eyeballs surveying an uncertain environment can potentially identify problems that might otherwise go undetected. There is however no equivalent for Australian company and superannuation fund filings.

Data matching across data bases has also improved the ability of companies to link all the information for a given customer or supplier. The improved ability to match data can now be used to search for the possibility of insider trading, by connecting, for example, company news announcements with previous share options trades by a director's spouse. More efficient and effective access to data, with appropriate safeguards and procedures, potentially improves the ability

to identify linkages and reduce uncertainties. For example, advertising can be directed at specific target groups, or tax audits facilitated by finding undisclosed or incorrectly disclosed sources of income (Bolton & Hand 2002).

It is always tempting when faced with a difficult management decision to attempt to reduce or eliminate the uncertainty. It is assumed, or perhaps hoped, that uncertainty can be converted into tractable problems of quantifiable risk management. More information can however uncover new uncertainties.

Similarly, when to stop gathering information is a difficult problem. There are academic tools that examine the optimal stopping point for gathering information in a range of decision contexts. The economic approach is that people continue to search for information until the marginal value of additional information exceeds the marginal cost of that information. Research has however found that such a rule is difficult to apply and therefore recent attention has been directed toward understanding the heuristics and rules that people use. For example, Browne et al. (2007) discuss the cognitive stopping rules used by people when terminating information search in online tasks. When a task is highly structured people will tend to use a single criterion or a mental list of items that must be satisfied prior to completing the search. When a task is poorly structured people tend to search until the new data is tending to confirm prior information, additional data is not altering their mental representation, or they judge that the quantity of information is sufficient.

When to stop information processing is also a difficult problem. Under time pressure, information-processing limitations and resource constraints, decision-makers frequently have to choose which information to pay attention to and which information to ignore. A simple example is the design of an information system to provide recommendations to shoppers browsing an online book store (Ho et al. 2008). Interestingly these authors find that while information systems can make more helpful recommendations after building a profile of a shopper's search criteria, shoppers take more notice of recommendations provided early in their information search.

It is however quickly apparent that searching for information to reduce uncertainty to quantifiable risk is avoiding the underlying problem of dealing with irreducible uncertainties. It is perhaps too easy too overinvest in the reduction of uncertainty. There are irreducible uncertainties that need to be managed or tolerated because they can not be eliminated. There are also reducible uncertainties that are not worth reducing. A greater emphasis on the management of uncertainty, in turn, helps us to understand the nature of the business and the ability to survive the unexpected outcome.

Accepted or tolerated

A basic assumption in business is that higher risk is expected to be associated with higher rewards. For example, an entrepreneur starting a new business will most likely fail. The rewards for success can however be very high, so risky investments will and must be made. Overly risk-averse management can lead to paralysis, the loss of business opportunities and even business failure. Risk and uncertainty must be accepted.

Representations of uncertainty potentially aid communication and improve perceptions of possibilities, threats and opportunities in a way that attempts at probabilistic estimation do not. Scenario analysis is a simple and valuable technique (Phelps et al. 2001). A recent example is the 'stress testing' of US banks (Federal Reserve Board 2009). There has been a return to the basics taught in MBA classes of examining the best and worst case scenarios as well as the expected case scenario. These analyses ask: 'What are the expected outcomes given a set of assumptions?' Such representations of uncertainty potentially aid communication and improve perceptions of possibilities, threats and opportunities.

Controlled, harnessed or exploited

Throughout history consumers and businesses have sought to limit the possible damage from uncertain outcomes. What does the management of uncertainty mean? What techniques are being revisited given the failure of some probabilistic measures of risk?

A problem familiar in both business and law enforcement is the coordination and deployment of resources. There is a need for robust planning, anticipating and confronting 'rude surprises' (Lempert et al. 2002, LaPorte 2007) and for reliable and resilient systems (Frederickson & LaPorte 2002). Frederickson and LaPorte argue that for commercial airline travel to be highly secure there must be high levels of technical competence; a sustained, high level of performance; regular training; structured redundancy; collegial, decentralised authority patterns; processes that reward error detection and correction; adequate and reliable funding; high mission valence (i.e. an attractive mission); timely, relevant and reliable information; and protection from external interference in operations.

A widely used coping mechanism is to pay a counterparty to assume some of the uncertainty. This can mitigate the potential losses from uncertain outcomes through insurance, derivatives, short selling and other techniques that limit one's loss given a possible outcome. Such techniques are however more likely to be provided where the counterparty can assess the risk being insured. Thus

the uncertainty is shifted to another party willing to bear the risk. It is worth briefly considering the nature of these businesses that assume other peoples' uncertainties. Consider a typical insurance company. They stay in business because people want to avoid uncertain outcomes. They provide an essential service but these businesses can only succeed when they can successfully put structure around risk management. To the extent that uncertainties can be quantified and assessed, they can be priced so that an insurer can profit over the long run. Just like a bookmaker, the insurer must set the odds against the customer winning. To the extent that there is unquantifiable uncertainty, the insurer will either avoid such business, or charge a high premium for the uncertainty.

In recent decades derivative securities have become increasingly important. A derivative security depends on the value of more basic, underlying security. For example, a forward contract is an agreement to buy or sell a security or commodity for a certain price at a certain time in the future. A company that knows it has to pay an invoice in pounds sterling in ninety days time can enter into a contract today to buy pounds in ninety days. That is, the company removes the uncertainty arising from future changes in foreign exchange rates by taking a fixed price today for the debt it will pay in pounds in the future. For further examples refer to Hull (1989).

A stock option is a derivative security where the value is contingent on the price of an underlying share. Options on shares were first traded on organised exchanges in 1973 and their use has grown dramatically. A call option gives the holder the right to buy the underlying shares by a certain date at a certain price. Under specific assumptions, the Black-Scholes differential equation (Black & Scholes 1973) can be used to estimate the value of an option as a function of the current share price, time to expiry, share price volatility, and the risk-free rate of interest. Uncertainty can be valuable. While humans like to tame uncertainty, the value of options is increasing in share price volatility—the uncertainty in share price changes. All else being equal, the higher the volatility of the possible outcomes, the higher the value of an option over those possible outcomes. The simple intuition is that if you are in a losing position then it is the volatility of possible outcomes that can produce a profitable outcome.

Trading derivatives is a high risk activity. If a trader is in a losing position he or she can truncate the possible outcomes and take a loss with certainty now, or hold a position because a gain is still possible. Of course, a bigger loss is also possible and hence the use of derivatives can vary from offsetting companies' exposures to foreign exchange risk, prices of commodities, or other operating risks; through to speculation and the inevitable rogue traders who are found to double-up on their losing positions like any other gambler at the table (Jorion 1995; Leeson & Whitley 1996).

Multiple derivatives can be used for valuable purposes such as to create a 'collar' around the exposure to volatility. That is, contracts are entered into to set a maximum and minimum future price of the underlying security to which the buyer is exposed. An aspect of derivatives that has been revealed by recent financial collapses is the problems that arise from the complexity of strategies using these instruments. Multiple derivatives, and derivatives on derivatives, however quickly increase the complexity involved in understanding the risks being taken. Recent failures have highlighted how this complexity can hide the underlying uncertainty in the positions taken (e.g. Dash & Creswell 2008).

Denied

There are also examples of business managers denying uncertainty. Courtney et al. (1999) argue that executives take a binary view: either they underestimate the uncertainty in order to come up with required budgets and projections; or they overestimate the level of uncertainty, ignore all analysis, and go with their instincts. Unfortunately, in going with their instincts there is also evidence that managers are overconfident in their judgments. A fundamental of business analysis is that higher expected returns are associated with higher risk. Denying risk can lead to managers focusing on the high returns without considering the risks implicit in their businesses.

Banished

Business would be a much easier activity if uncertainty could be banished, set aside and not dealt with. A relevant concept in economics is that of externalities. An externality arises when the effect of production or consumption of goods or services imposes costs or benefits on others which are not reflected in the prices charged for the goods or services. An example is where uncertainties about environmental impacts of a manufacturing process are disregarded in costing the final product on the basis that the manufacturer is not liable for such impacts. The responses to this type of uncertainty include legislative responses to impose the cost of the externality on the manufacturer. Examples include the consideration of an emissions trading scheme that is intended to impose a cost for carbon emissions (Garnaut 2008).

Managerial responses can also avoid ignoring the costs of externalities. It is naïve and incorrect to assume that businesses will consider externalities for purely social benefit reasons. The directors' duty is to the shareholders, not to society at large. There are, however, many uncertainties regarding costs that are externalities today that may give rise to future liabilities for the business.

Such externalities should be considered in managing the company on behalf of shareholders over a longer term. Recent examples include the asbestos liabilities incurred by CSR Limited and James Hardy (Elks 2009). With respect to law enforcement there may be increasing need for sophisticated investigations linking problems of today to past corporate failures.

Further discussion

No discussion of uncertainty and business would be reasonable at this time without consideration of some of the mistakes that lead to the current global financial crisis and the resulting economic uncertainty. It is somewhat fashionable to refer to large, inexplicable 'black swan events' having occurred in 2007 and 2008. (The 'black swan' alludes to the once widespread belief that all swans were white—proved false when European explorers found black swans in Australia. A 'black swan event' is something extreme and unexpected (see Taleb 2007).) That is, large, unexpected events resulted in a global financial crisis (e.g. Grenville 2009). This provides an initial issue to consider whether such a large shift as the global financial crisis of 2007 was the result of unexpected events in a very uncertain business environment, wrecking the hubris of the investment bank 'masters of the universe' who denied the possibility of such events, or should these events have been foreseen and averted with prudent risk management?

As the evidence of events preceding the credit crisis of 2007 emerge, many of the explanations seem to suggest well known, but too soon forgotten, risks. Commercial and investment banks heavily exposed to a maturity mismatch by borrowing for the short term to buy assets maturing over a longer term, banks lending to borrowers with poor credit, rating agencies assuming that house prices only increase, banks hiding debt off balance sheet to avoid having to take prudent reserves for risk, analysts not considering the high correlation of asset price declines during recessions, and regulators maintaining a low interest rate environment for too long (e.g. Brunnermeier 2009). In hindsight, very few of the factors contributing to the initial period of recession were new. The primary lesson appears to have been the failure to adequately consider the magnitude of these imbalances. Perhaps the new aspect is the growing linkage of economies in an increasingly global community and therefore the high correlation between failures across the globe.

Once a recession starts, it is a well known phenomenon that business frauds, businesses with too much debt, and businesses with bad business models are all revealed more easily. During periods of high growth new business investment

can hide past mistakes. During periods of recession bad business models, and outright frauds that rely on generating cash from new investors to pay off old investors, are revealed as the supply of new investment evaporates.

Economic uncertainty will continue to exacerbate the pressure on business and their owners and managers to do what is needed to survive. Recessions reveal past financial malfeasance, and also provide an incentive for management to perpetrate fraud in order to survive during a period of harsh business circumstances. Recent research on fraud (e.g. Dechow et al. 2009) highlights the frequency of top management involvement in major corporate fraud. The evidence suggests that there is an escalation of fraudulent behaviour to continue the perception of a successful business.

Conclusion

Economists rarely hang out with drug dealers. On the occasion that the books of a drug gang fell into the hands of an economist it was found that the gang worked a lot like most businesses. The particulars of the drug gang are covered in three papers by Venkatesh and Levitt (2000a, 2000b, 2001). Venkatesh and Levitt (2000b) track the evolution from independents to corporate super-gang. As with any business, the books were used as a tool for managing day-to-day operations and as a means for tracking operations for reporting to higher levels in the gang hierarchy. The gang systematically sought, acquired and distributed revenues, and managed an effective product distribution system. The organisational chart of the gang was very similar to that of a legitimate corporation. The results were however bleak. Over a four year period a junior gang member had a 1 in 4 chance of being killed.

If crack dealing is dangerous, why would anybody take the job for what worked out to a starting wage of \$3.30 per hour? The results of this research suggested that crack dealing is similar to other extremely competitive professions. Just like professional sports or accounting partnerships, the junior employees participate in a tournament with uncertain outcome where those who reach the top are paid extremely well, but at low levels the financial compensation does not compensate for the risk and uncertainty. If I were to speculate how to help such a business to fail, my list would include an increased ability to access and cross-match financial data in order to identify and then penalise unexplained wealth acquisition of the higher level management.

Most business decisions are made within a context of uncertainty. Reward however is associated with risk taking. Overly risk-averse management can lead to the loss of business opportunities and even business failure. While some risks can be managed or insured against, other uncertainties must be accepted or even

exploited for businesses to thrive. In an increasingly complex world, products such as insurance and derivatives can be used to manage and shift risk to those willing to bear it. These techniques do not however reduce the importance of understanding the uncertainties involved and the continued need to manage uncertainty.

Acknowledgements

With thanks to Damon Muller and Michael Smithson. All errors remain the responsibility of the author.

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