

**Extreme Events Part 2
Financial Catastrophes
The Overthrow of Modern Financial Theory**

Working Party Chair

David Sanders

1. Introduction
2. Are Financial Risks insurable?
3. Historic Financial Catastrophes
 - a. South Sea Bubble and laddering
 - b. Dutch Tulips
 - c. Darien Expedition
 - d. Railway Stocks
 - e. Wall Street Crash
 - f. Black Monday/87J
 - g. Mortgage Indemnity
 - h. Internet bubble
 - i. Enron
 - j. LTCM
 - k. Equitable
 - l. Asbestos
 - m. Argentina
4. Investing for the big one
5. The role of the regulator
6. Actuarial and Other Models
7. Entropy – the basis of all risk measurement?
8. Conclusions

1. Introduction

- 1.1 In this paper we consider Extreme Financial Events. These events are much more common than conventional theory anticipates, and like geophysical extreme events have a number of key characteristics that are found over and over again in actual examples. They are “unexpected”, and therefore not capable of being managed within the capital base, which the consequence that a single event compounds into a cascade of failures.
- 1.2 One distinction is that whereas insured catastrophes destroy real economic value, financial catastrophes in the main only destroy financial value. There is also a reputation loss.
- 1.3 Management philosophies such as 6 sigma (which really means plus or minus 3 sigma) do not help in understanding or managing such events. It assumes that everything is in a “normal” Gaussian world – where in practice real 6 sigma deviations really do occur on a regular basis. For example Black Monday would only occur once in every 10 times the current age of the universe. Newer tool kits, such as Levy stable distributions, are needed to analyses such events. The reliance on a standard deviation as a measure of risk is also in appropriate.
- 1.4 As actuaries we view events in the past as being a guide to the future. In analysing extreme financial events we often need to delve far into the past to derive similar financial conditions. At the end of 20th century the economic conditions changed from one of high interest/high inflation to one of low interest/low inflation. One cause of this could be the opening of markets world wide; in much the same way as reduction in trade barriers caused similar conditions after the Napoleonic Wars. Thus the analysis of such events can help us understand what is happening to day. We are dealing in long term cycles or waves.
- 1.4 In the analysis of extreme financial events, there are some differences when compared with geophysical extreme events. As mentioned above, the latter destroy economic value, whereas the former destroy primary financial value. In addition they also destroy reputation. A downturn in the stock market as a result of a geophysical catastrophe is a consequence of the destruction of economic value whereas the downturn in the stock market is a result of a financial catastrophe is consequence of a realignment of the connection between economic and financial value, with economic value often not being destroyed
- 1.5 This paper is subtitled the overthrow of modern financial theory, because it is precisely in the conditions of extreme events that the theories cease to work, and management techniques that are based on such theory tend to fail. One can think of it in the context that Extreme events are equivalent to the extreme of quantum and relativistic mechanics when compared with the Newtonian Modern Finance Theory. The Efficient Market Hypothesis rested on a number of assumptions, made to simplify the equations into solubility, that were in fact demonstrably untrue, particularly in extreme events. We review catastrophe theory and chaos theory as an alternative explanation. The theories of Socionomics and Elliott waves may give some insight into predictability of such events

- 1.6 Given our conclusion that sigma (i.e. the standard deviation) is not a good measure of risk we make the suggestion that entropy of the dynamical system may be a better measure and draw on how this measure fits into known actuarial and risk management techniques.

2. Can Financial Risks be insured?

- 2.1 In theory, insurers can offer coverage for any risk that they can identify and for which they have enough information to assess the probability and magnitude of the potential loss. The premium may be large and should exceed the expected loss. However, for some risks, the insurers will choose not to offer coverage as they fall outside what is known as the insurability framework.
- 2.2 Insurance can only operate within the limits of insurability. These limits are defined by a finite insurance capacity and also by other parameters. Typical constraints are regulatory and legal limitations, the inability to price insurance in an economically sustainable way and the incapacity to provide sufficient risk transfer solutions.
- 2.3 Other limitations include asymmetric information, in particular moral hazard and adverse selection. These limitations are the key to understanding financial extremes. There are also those risks where the level of uncertainty might become so high as to be become unmanageable. These risks are essentially those described as extreme geophysical events in previous paper.
- 2.4 Risk sharing is essential in a modern society. Without such risk sharing it would have been impossible to undertake large projects.
- 2.5 Baruch Berliner (1982) discusses criteria by which insurance firms can determine whether they will in principle offer to cover a particular risk. Those criteria are mainly supply side criteria. Others (see for instance Holsboer, 1995) define insurability as the situation for which a policyholder can buy the coverage he reasonably needs. This definition focuses on the demand side arguments.
- 2.6 From an actuarial point of view, the initial key criteria for insurability is that the Law of large numbers applies. In addition the maximum potential loss needs be managed and individual risks are not too positively correlated.
- 2.7 These conditions may be considered the same as identifying and quantifying the chances of the event occurring and then setting a premium for each customer or group of customers (i.e. a rate table). Against this the insurer may not offer cover because of insufficient demand or insufficient income to cover the cost and yield a profit. Therefore an insurance market can only exist in an environment where it is mutually advantageous to transfer risk
- 2.8 The main issue with trying to insure financial risks are, given that they may not obey the law of large numbers, there is often significant moral hazard

where the behaviour of the policyholder can affect the claims. There is an asymmetry of information. In non financial insurance the policyholder needs to be protected because the insurer usually has significantly greater knowledge of the risk, and if not regulated either directly or through the market, could take advantage of the policyholder. However when considering financial risks the asymmetry is often the other way. One particular example is the mortgage guarantee risks where the policyholder (the mortgage provider) had a great deal more information on each risk than the insurance company.

- 2.10 If the moral hazard cannot be properly contained, a risk becomes uninsurable. In insurance, for a valid claim to be paid, the insured must suffer a financially quantifiable loss and does not profit by the event. Thus certain contracts which are considered to be insurance contracts in the financial sense (such as derivatives) are not insurance contracts in the normal insurance context.
- 2.11 The broad conclusion is that most financial risks can (or should) not be insured because of the inability to calculate an economic premium, the potential for moral hazard, and asymmetry of information.

3 **Examples of Financial Catastrophes**

- 3.1 There are a number of extreme financial events which we describe briefly below. In this analysis we show a repetition of behaviour patterns and a common reaction to the events. Many of events have an element of fraud, asymmetry of information, and laddering or false pricing. The regulatory influence is often non existent.
- 3.2 The most famous book on this subject is “The Extraordinary Popular Delusions and the Madness of Crowds” by Charles MacKay published in 1841. In addition to an analysis of well known events such as the South Sea bubble and Tulipmania., MacKay also identifies other popular delusions such as Alchemy, the Crusades, and Witch hunts. These confirm Schiller's dictum that anyone taken as an individual, is tolerably sensible and reasonable: as a member of a crowd, at once becomes a blockhead. It is this dictum that runs through many of our extreme events. Similar delusions can be found today in the belief of horoscopes, football supporters and of course in the stock market

3.3 The South Sea bubble

A summary of this event is given in Appendix 1.

A detailed account can be found in “A Very English Deceit” by Malcolm Balen

- 3.4 At the beginning of the eighteenth century a “bubble” was the profit on a share transaction. However, the terminology changed new investment schemes became commonly known as bubbles, The phrase “men cheated or bubbled each other for profit” was used in a play in 1692. Contemporary meanings include that like their liquid counterparts, financial bubbles are perfectly formed, float free of the gravitational market forces, but, by implication, there will be a day of reckoning, a time when they will grow to such a size that they can no longer hold up their shape, and implode with spectacular and messy consequences.
- 3.5 The actual South Sea bubble story is full of intrigue with the one important side player, John Law, being sentenced to death for murder, escaping from Prison and ending up by “saving” the French economy by the introduction of bank notes as a means of financial transactions. He was responsible for the Mississippi Scheme, outlined in Appendix 2.
- 3.5 The South Sea Scheme was set up to emulate the success of the Mississippi Scheme. The South Sea Company was originally established for trade in the South Atlantic and Southern America but in fact never undertook such trade. No ships sailed! It did, however, taken over the national debt of England. Basically the national debt was transferred into shares. The initial company set up made little or no actual profit yet saw its value increase substantially in anticipation of future profits, had transactions which benefited insiders, or the first investors, and included laddering and day trading. The initial investors were given shares at a knock-down price, but shares were sold to the public at par. Furthermore, with the issue of new shares, investors were only required to

pay 20p in the pound, which leveraged the value significantly. Among the investors were Isaac Newton, who commented himself that he could predict the motion of the heavens, but not the madness of people. The discoverer of gravity clearly understood their shares can go down as well as up!

Other investors who sold out early at a profit included Thomas Guy, whose legacy can be found today in the hospital that bears his name.

- 3.7 In May 1720, the price of shares rose significantly. The South Sea Company spent £1.25 million on bribes, £2.75 million on annuities, and £4.5 million on loans to individuals to buy its own shares. It had only £3.5 million in cash. The stock market valuations had little or no foundation. The company was valued at £300 million, which was incidentally 10 times the size of the debt it was holding. No ship had yet sailed anywhere near the South Seas!
- 3.8 To use maritime expressions, the company was afloat without a rudder and heading for the rocks. In August, in an attempt to try to support that price, the directors voted for a Christmas dividend of 30 per cent and an annual dividend of 50 per cent. To achieve this they would be required to make a profit of £15 million a year (on £3m cash). When it was realised that the sums didn't add up the stock price dropped like a bomb
- 3.9 As a consequence of the share dealings, some individuals were sued. In one laddering case the amount was for several million pounds. When one considers that at the time Scotland's has lost £400,000 supporting the Darien adventure, and this loss was so significant that it effectively bankrupted the country, then the scale of losses were enormous.
- 3.10 A popular refrain at the time was
My shares which on Monday I bought
Were worth millions on Tuesday, I thought.
So on Wednesday I chose my abode,
In my carriage on Thursday I rode
To the ballroom on Friday I went
To the workhouse next day I was sent
- 3.11 It should be noted that the South Sea Company inspired a number of similar "get rich quick" schemes. Included was the creation of many insurance companies promoted by "a desire to reduce the cost of shipwrecks, defray the cost of fire, or soften the blow of premature death." Many marine insurance companies were floated with significant capital of more than £1 million each (there are only two known cases where the capital was less than this). Among those companies incorporated in June 1720 were London Assurance and Royal Exchange Assurance. Coffee houses were the "Stock Exchanges" used to raise capital including ventures to raise £2 million for a general insurance company for houses and merchandise, and the Rainbow coffee house in Cornhill sought millions for a company granting "annuities of survivorship and providing for widows and orphans."

3.12 Tulip mania

This occurred before the South Sea bubble and again is summarised within Appendix 1. It is also covered in Mackay's book. In the book he finds it most intriguing where most other scandals include shares, the consequence of a bulb resulting in the mass delusion of a nation is more extraordinary. However the delusion was not just a Dutch phenomena, as in 1636 bulb sales had public support in London. One consequence was that, in some cases, the values were raised to the amounts they traded in Amsterdam. Similar prices were found in Paris. Thus international arbitrage opportunities were cut by market forces even in 1636!

- 3.13 The enhanced prices of tulip bulbs still continued after the phenomenon died away. In 1800 the price for a bulb was about 15 guineas, with certain bulbs being sold at 75 guineas and some catalogued at 200 guineas

3.14 A reflection

Given these first two examples we pause to consider these reasons, commonalities, and analysis of the above events from an economic point of view.

The basis of modern economic theory is that economic value should relate to financial value. In other words, the stock market value of a share (the financial value) should relate to the expected risk adjusted discounted value of the future profits. However the standards for measuring these expected profits may differ between investors. If they differ substantially then a bubble is created where those inside the bubble have a view of economic reality than those outside the bubble. Those inside the bubble are often given the label of "new economy", whereas those outside the bubble are labelled "old economy".

- 3.15 The South Sea bubble did indeed help create a new economy. A consequence of the new economic environment was that company after company bid to take over or the national debt, each with clearly inadequate capital backing. The scarcity of such capital only increased the value and there was a perception of little or no risk. The "regulator" was Parliament, with many members being bribed or having a conflict of interest. The regulation was in fact left to the market, and one may ask "How can a deluded market regulate itself?"
- 3.16 The value of tulips represented initially its' scarcity value. The commodity in the end became more common. However, to some extent, the mania was a reflection of the times when investment in schemes such as alchemy (turning led to gold and the elixir of life) were also common. It also indicates a misperception of underlying value in anticipation of getting rich quick which is common in many schemes.

3.17 Other similar events

History is full of events where people and either over committed the capital or misunderstood the risk in anticipation of getting rich quick. Regulation was either left to the market or compromised by conflicts of interest.

3.18 The Darian expedition

The government of Scotland sunk over £ 400,000 on setting up a trading base in Panama. The venture was so disastrous that Scotland was no longer able to finance its national debt, resulting eventually in the Act of Union, where the English Treasury effectively reimbursed the money. The sitting in Scotland that voted for the Act of Union was to have been followed by a proposal for Scotland to issue bank notes instead of coins. This was Mr Law's scheme. However, as a consequence of the Act, Law became effectively an escaped convict (Scotland was a safe haven until the Act of Union) and he went to France and introduced bank notes there as part of the Mississippi scheme.

3.19 Railway shares

During the 1840's railway shares rose in value. The arguments at that time had many of the features of internet shares. Railways were seen as a way of improving communication, and as such enhancing trade. Thus the means of enhancing trade was the key investment, as opposed to underlying businesses whose profits were really enhanced (c.f. Amazon). It also meant the death of a number of businesses which were in areas which did not have rail communications, including the canals. Ironbridge in Shropshire is such a place. Shares were overpriced due to the anticipation of extraordinary profits and the belief that railways would fundamentally change the way that business was run.

3.20 Wall Street Crash

The fact about the Wall Street Crash of 1929 is that, with two possible exceptions, no academic economist forecast the crash and the following depression. Indeed papers written well after that the event conclude that, even using data unavailable in 1929, the Great Depression could not have been forecast!.

3.21 Economists have concluded that all stock market collapses occur when the private sector becomes heavily indebted. The lender trusts that the debtor will be able to repay the principal and interest on time and the debtor believes the same. The debtor does not have the money now that he will have little later. Accelerated indebtedness is a sign of over-confidence. Such over confidence can be seen in the South Sea bubble case.

3.22 One consequence is that shares become so highly rated that bank deposits provide a higher return at a low risk than ordinary stock. In this scenario, the only reason to buy stocks is the anticipation they can be sold at an even higher price to a third party. This is known as the "greater fool theory".

- 3.23 The story goes that Henry Ford was riding in a lift when the lift operator said “Mr Ford, a friend of mine who knows a lot about stocks recommended that I'd buy shares in A B and C. You are a person with a lot of money. Should you take this opportunity?” Ford thanked him, and as soon as it got out of the lift he called his broker and told him to sell everything. He explained that if the lift operator recommends buying then he should have sold long ago.
- 3.24 The identified key indicators to the crash of 1929 are the excessive optimism leading to an unwise investments and the increased indebtedness of corporations, households and the Government. The government debt was at the level of 190 per cent of GDP in 1929. Bankruptcies were being also being hidden by banks extending loans.
- 3.25 When the euphoria changed to pessimism, creditors panicked and tried to recover funds, creating foreclosures and bankruptcies and effectively deepening the crisis. Other factors included bogus companies being set up and misleading (untruthful) statements from real companies.
- 3.26 The lack of confidence caused people to stop spending and save (but not invest in stocks). Money was drawn out of banks and kept at home. The result was many bankruptcies and a rise in unemployment in US from 1.5 million to 13 million.

3.27 Black Monday/ 87J

In the months preceding Black Monday many commentators were expressing the view that the stock market was considerably overpriced. The expression “Coyote Country” was being used to indicate the comparison between the stock market and the Road Runner movies. In these movies the Coyote continues running when there is no visible ground, and it is only when he stops and looks around that he falls. The 22.9% loss in 1987 almost doubled the percentage lost in the Crash of 1929, which was 12.82%.

- 3.29 The crash started in the US on Friday – however the London stock exchange was closed following the devastation of Storm 87J. It is thought that the crash was set off by a number of events, that include the portfolio insurance and program trading. One of the consequences of the crash was the creation of circuit breakers, which are techniques that restrict trading at times in the market when market value is very unstable.



- 3.30 Others commentators believed that irrational (or rational!) behaviour was the cause. An interesting fact is that is that investors who sold made a loss, while those who held and continued a disciplined and systemic approach received rewards. By the end of 1997, total return for the year, including dividends, was approximately 5%.
- 3.31 Based on a normal distribution(a Six Sigma philosophy) the probability of the trading loss on Black Monday occurring has been estimated as once in every ten times the current age of the universe.

3.32 The Mortgage Indemnity Crisis

This crisis had a number of features. Up to 1986, the mortgage market was very stable, and mortgage guaranty was written as a safety net. The insurance companies underwrote the business using the same rates. The main providers of mortgages, the building societies, were prudent lenders with good underwriting of the risks. However, during the 1980's new lenders came into the market, fuelling an increase in house purchases and prices. Instead of 70% loan to value ratio offered, these new lenders offered mortgages at 100% level. Furthermore, the quality of the underwriting was not as good as the building societies. The insurance companies underwrote the risks on the same basis and premiums as the building societies. They did not factor in the radical change in the lending style, and took comfort in the boom in house prices.

- 3.33 The lenders took comfort in the fact they had insurance cover against default, and some lent on this basis. There was a reverse asymmetry in that the insured knew more about the risk than the insurer. Eventually the market was over lent and collapsed, leading to substantial claims against insurers

3.34 The Internet bubble.

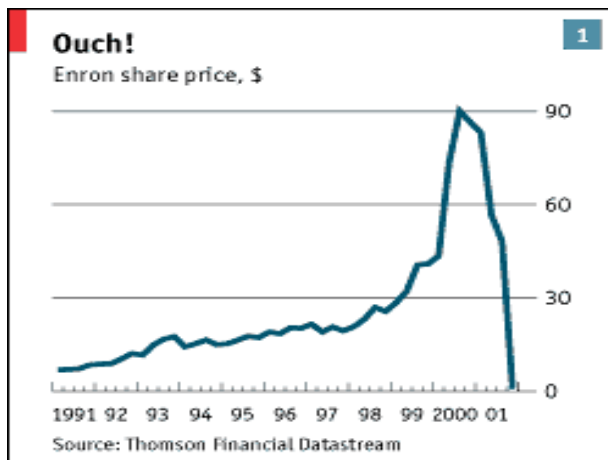
Studies of the Internet bubble show remarkable similarity to the previous examples, and can form the basis for analysis of similar future events. The period from 1998 to 2002 had an amalgam of at least four consecutive bubbles which caused enormous rises and falls in value of stock. The basic premise underlying these bubbles was the global revolution in technology accompanied with a notion that the internet would change forever the way we would do business.

- 3.35 As an example in the Guardian of 15 March 2000," after months of anticipation, the internet shopping business lastminute.com joined the stock market yesterday and immediately crystallise a £150 million paper fortune for its founders, Brent Hoberman and Martha Lane Fox.. Mr Hoberman and Ms Lane Fox, who have become pin-ups for the new breed of net entrepreneurs, were in their Mayfair offices early yesterday to watch the new leaves float its shares soar from a sale price of 380p to 555p in minutes, valuing the 19 month old company at £835 m at one stage."
- 3.36 Key players such as investment banks and venture capital firms changed the rules by which they did business so as to take account of the public's apparent willingness to invest in new stock. A consequence of the bubble is that instead of advancing innovation it has possibly permanently damaged some very good companies.
- 3.37 The key to the Internet bubble is understanding the financial value chain, where economic value has been converted into financial value. In most cases both values are closely linked in that shares have a price earnings ratio and so on. During the bubble the relationship was decoupled, creating high valuations for internet companies which hadn't yet produced a penny profit. This was achieved by arguing that a company was to have a strong future income stream. "Experts" within the financial markets produced the cash flows. Then, even if the hypothesized discounted cash flows did not meet the objective then the argument would be put that the interest rate were beginning to decrease, and as a result the net present value would increase substantially. (The word risk adjusted rate is rarely ever mentioned). As a justification for such an approach, examples included oil companies with oil in the ground but no production at the current time.
- 3.38 As a consequence we have the position where so much paper of little real value was sold to so many investors at so high a price. The regulators did nothing as the market was supposed to regulate itself. Strains were also put on relationships so that banks had to support offers prematurely because of the fear of losing the next offering. There was considerable competition of fees among banks, with the consequence that banks failed to maintain a goal, imposed by the SEC, to protect the retail and institutional investors.

3.39 Enron

The internet companies were “new” economy (as were the shares in the South Sea bubble example). Share valuations of new economy businesses are subject to the same rules as old economy, but with substantially different assumptions. What Enron did it was convert itself from old economy company to new economy, using dubious financial instruments to support its position. It is not the world’s largest bankruptcy. However it is the one with possibly the most serious consequence in that it led to the destruction of one of the world’s major accounting firms, the besmirching of the reputation of accountants in general, the embarrassment of many of the US’s most important political leaders, a substantial loss of confidence in the reliability of the US financial system as a whole and in particular the integrity of the information on which confidence was based, the inefficiency of regulators who missed the big picture, and the consequential loss of substantial investments in Enron and the pensions and jobs of thousands of Enron employees

- 3.40 From 1990, Enron changed itself from a rather ordinary company selling natural gas to an energy trader using modern information technology. As such, it became new economy and entered the bubble. However, because of its old economy reputation it didn't collapse with majority of the bubble companies in early 2000. It kept going well beyond the initial fall by taking steps that could be interpreted as misleading investors as to its true financial situation.



- 3.41 It was also unusual in that it gave substantial sums to politicians and obtained favourable legislation and rulings. Investment bankers also helped create and find investments for the complex partnerships at Enron which were used to mask true financial condition. There were enormous consequential conflicts of interest, including those with the regulators. Enron’s accountants could have stopped the lack of full reporting, but chose not to.
- 3.42 As an example, Enron was allowed to report borrowed money as operating cash flow. Swaps were created on Enron's balance sheet that would compensate the buyer of assets in the event of an unexpected loss. Sometimes the quality of the assets sold was doubtful (a block of Internet shares, say); sometimes the third-party entity would pay using a loan from Enron, which then booked the interest

on the loan as income. As result, Enron's 2001 pre-tax profit of \$1.5 billion should have been \$429 million, and many Enron insiders to the deal were millions of dollars richer. For the year 2000, and Enron's total reported revenue was \$100.8bn but should have been about \$ 9 billion. Mr Lay, the Chairman, was also a member of President Bush's inner cabinet, and a Enron was a significant contributor to the Presidential campaign.

The Enron Venture Capitalism Concept

You have two cows.

You sell three of them to your publicly listed company, using letters of credit opened by your brother-in-law at the bank,

then execute a debt/equity swap with an associated general officer so that you get all four cows back,

with a tax exemption for the five cows.

The milk rights of the six cows are transferred via an intermediary to a Cayman Island company secretly owned by the majority shareholder

who sells the rights to all seven cows back to your listed company.

The annual report says the company owns eight cows, with an option on one more.

3.43 LTCM

Long Term Capital Management was a business built up by individuals who were the worlds leading authority on risks and risk management of shares. They believed they could beat the market and create unlimited wealth. What they achieved was the creation of a trillion dollar hole in the international banking system.

3.44 The reason for the demise we have put down to two theories. The first theory is the perfect storm. Under this theory what happened was the events of summer 1998 were similar to a once in a 250 year hurricane. However, as we have seen above, market crisis are not random geophysical events, but are created out of human behaviour. LTCM may be considered as an attempt to control the weather which went badly wrong, as opposed to a luckless ship being tossed by a gigantic waves.

3.45 The second view it is human folly. LTCM was supported by the world's biggest investment banks who gave it special privileges, such as the need for no margins, and also unlimited vast it sums of money. It was seen as a remarkably successful, and the investment banks were keen to imitate it. As a result, investment banks ignored the risks, primarily out of greed for the potential profits they saw.

- 3.46 Modern economic theory assumed that there are willing buyers and willing sellers and that the price of the share is determined between the two. All other things and be equal, there is also a need for asymmetry of information, in that one party has to believe that he knows something more than the other party to recognise a differential in expectations and hence a transaction at the price. In practice there is asymmetry in information, with the result that a transaction takes place. If the market consisted of investors in the same information position and a same friction costs, then trade would not take place. LTCM was in theory holding information and other investors might not have, as was the common assumption of all hedge fund managers
- 3.47 Hedge funds were created under the hypothesis that the traders knew something more than the rest of the market, and investors could capitalise on it (at an above average cost). For this reason the fund took a larger cut of profits than a normal investment fund. At the end of the day, LTCM effectively controlled a substantial chunk in the some markets e, particularly those which traded in volatility. There was an expectation that matters would return to normal. In LTCM's case the buyer and seller for these stocks became effectively the same person, and stock liquidity did not exist. It became immobilised by the size of its position in certain markets.
- 3.48 Investment Bank's have found themselves in a unsettling position of having a considerable exposure to the hedge fund, but with little or no margin. LTCM's position was extremely leveraged with value to equity ratios well in excess of normal practice. The position became critical when it was realised that, in the hope of surviving, the fund would need to raise capital in excess of \$ 2 billion. This meant that to raise this level of capital, LTCM had to open its book to potential investors. It had to explain its trading position, and its secrets, and the asymmetry of information rule meant that it was now completely at its rivals mercy. Many of the trades were handled by only a few dealers who were employed by the very people reviewing LTCM's position. In particular, in the trades of equity volatility where there were only four or five dealers and each of them refused to transact with LTCM.
- 3.49 The people at LTCM also thought they knew all there was to know about options and option pricing. One of the fundamental assumptions they appear to make was that the variability in the auction price would remain constant or fairly constant over a period of time. This is true in a 6 sigma world, but in practice volatility varies significantly when you're dealing in stocks where the numbers of buyers and sellers are limited.
- 3.50 LTCM was severely undercapitalised for the risks it were running, Because it maintained a balanced position, and a negotiated special deals with different banks and was not required to put up a margin on transactions, it was in an extremely leveraged position.. At one stage it even increased the leverage by reducing the capital supporting the business. The reason for this reduction was to give the original players a better return on capital; i.e. the paramount motive was greed.

- 3.51 Following the year of the rescue and bail-out of LTCM, Alan Greenspan commented that he thought that the Fed had encouraged risk-takers and perhaps increased the possibility of a future disaster. However, Greenspan has consistently shrugged off the need for regulation and better disclosure regarding to derivative products. The philosophy is that the lack of disclosure allows investors to be their own watchdog, which is good for the capital markets. The Fed's policy is thus head in the sand before the crisis and intervention after the fact.

3.52 Equitable Life

Equitable Life, the world's oldest mutual insurer was founded in 1762. In 1913 the society started selling pension products, followed by starting selling guaranteed annuity rates in their policies from the 1950s. Guaranteed annuity rates (GARs) guaranteed investors a minimum annuity rate when they retired.

- 3.52 The society was unusual, amongst mutual life insurance companies, in that it did not maintain a free reserve or 'Estate'. The Equitable philosophy on bonus, which complemented this stance, was that each generation of policyholders should get its own 'asset share', and neither inherit from the past nor give to the future. This philosophy had both supporters and detractors. This meant that the cost of any one off shock or event would fall to be borne by the current generation of policyholders.
- 3.53 The philosophy of not retaining profits to build up an Estate proportionate to the fund contributed to the declaration of bonus that was seen to be higher than that declared by other life insurance companies. The larger bonus materially contributed to the effectiveness of the sales force in acquiring new business and, through the consequent high volumes, to the low cost of administration. This generates a momentum that boosted the overall efficiency.
- 3.54 The company had also seen very good investment performance – due to its high equity backing ratio – when equities were riding high.
- 3.55 In the long term there is a trade off between policyholder's expected total return and the security of the policyholder's benefits. The absence of free reserves meant that the company lacked a potentially valuable instrument to cope with unforeseen financial problems as compared with other mutual (and proprietary) life insurance companies that had built up free reserves.
- 3.56 A feature of the Equitable's liabilities was the very high proportion represented by a single product range: the individual and group personal pension plans. These plans carried the GARs and some contained the open-ended option to invest further sums in the plan on the same terms as applied to the original investment. As GARs applied to top up premiums as well as initial or regular premiums the company had a potentially unlimited liability to the guaranteed rates.
- 3.57 The main reason for the company to feel able to accept the risks was that its management had determined, after it had introduced the terminal bonus, that

such a bonus provided the substantial flexibility required. This flexibility could, in its view and if events ever so required, permit adjustments day by day, policy by policy and even according to the decision each policyholder made about which annuity to purchase when the time came to convert the policy to an annuity. Therefore, unless circumstances arose which resulted in no terminal bonus payment, the Equitable believed it could rely on adjusting the level of terminal bonus so as to provide for the full cost of meeting the GARs.

- 3.58 A form of differential adjustment was apparently accepted in the seventies when GAR policyholders who had premium based guarantees were awarded an additional final bonus to make up for the fact that the contractual annuity rates were below those available in the market, whilst policyholders who opted to take part of their benefit in cash did not receive extra bonus on this element. It seems that no-one raised an objection to this differential adjustments to the final bonus.

i.e the company believed they could continue trading in this way as it believed 3 things:

- It expected people to use the cash option rather than using the annuity. Historically take up rates had been relatively low.
- It was reserving on a deterministic basis, i.e. no time value for option.
- It thought that it could just reduce the terminal bonuses on GARs to offset the cost of the guarantees themselves: almost completely negating the guarantee!

- 3.59 The Equitable did not regard these guarantees as requiring an addition to the provisions when they were first introduced, but it is also true that the valuation techniques used today were not then available. However, the failure to record at the time, within the valuation process, that they existed could be considered a contributor to the eventual problem. The fact that single premiums up to the revenue maximum could be paid at any time on these guaranteed terms and that the pension could be taken at any age in a wide range meant that the policyholder had an open-ended claim against Equitable. It is not known whether Equitable introduced a process for regularly taking note of such contingent liabilities. It would have been prudent for the Equitable to have had such a process from the outset, even when those liabilities could be treated as unquantifiable or negligible. Such a process could have ensured that the Actuary was reminded to consider whether the treatment was still appropriate.

- 3.60 During the early seventies, interest rates rose substantially. The 1971 Finance Act made it possible for a policyholder to take part of the policy benefit in cash instead of as an annuity. Given the investment conditions at the time, a policyholder would have been able to use that cash sum at whatever were the current market annuity rates to buy a larger annuity than that amount of cash would have provided under the contractual premium-based GAR. The Equitable therefore introduced a 'final bonus' for policyholders entering pensions. This 'final bonus' was applied only to the part of the fund not surrendered for cash, and was to compensate for the contractual annuity being lower than the one which could be purchased in the market.

- 3.61 Thus in the early seventies, there existed a form of differential bonus. Policyholders who converted their whole policy accumulated fund into the contractual guaranteed annuity were given a higher bonus than that given to those opting to take part as cash.
- 3.62 In 1975, terminal bonus was introduced for all with-profit business, but the 'final bonus', now renamed the 'final annuity adjustment factor', continued to be added to the amount converted into an annuity at the contractual rate. The interest rate underlying the guaranteed annuity rates in new contracts was increased to 7%.
- 3.63 Policyholders were encouraged to make old series contracts paid-up and to apply future premiums to a new series contract. There was no improvement in the terms for pre-1975 contracts. No mechanism was introduced to reduce GARs if the interest rates were to fall again.
- 3.64 The form of the contract was radically altered when the 1978 Finance Act introduced Open Market Options (OMOs). The Equitable maintained the principal attractions for its policyholders of maximum flexibility in making contributions and in choosing the date of retirement, and the policies continued to provide a guaranteed minimum rate for an annuity.
- 3.65 The present form of contracts reflects these changes made in 1978. The contract now gave a guarantee to a minimum level of accumulated fund at retirement, expressed as a cash sum, most of which had to be converted into an annuity. The contract provided a minimum guaranteed rate for conversion, the GAR. The 'final annuity adjustment factor' was abandoned because a policyholder could achieve the same practical effect by exercising the OMO.
- 3.66 This change to the contract arguably provided another opportunity for Equitable to appraise the overall risk that the company was running. At present an Appointed Actuary should be carrying out a risk appraisal for each new contract and periodically for the office overall.
- 3.67 In 1988 new legislation introduced Personal Pension Policies which replaced the earlier policies. The Equitable took the opportunity to redesign its terminal bonus system so that it could reflect more closely the investment return on the assets considered as supporting each policy.
- 3.68 The GAR was dropped from new Equitable policies and this may have been because policyholders' ability to use the OMO was regarded as sufficient protection against the insurer trying to give the policyholder a poor annuity rate. In October 1993, as a result of falling interest rates, the annuity rates in the GAR policy contracts began, for the first time, to exceed the Equitable's current annuity rates. This naturally was of concern to the Equitable, and no doubt to other life insurance companies who had policies guaranteeing annuity rates above those available in the market.
- 3.69 Equitable planned a communication explaining the policy of selectively reducing the terminal bonus to go out with the bonus notices in spring 1994. The market annuity rates then rose above the GAR again, and Equitable decided not to issue

the communication. If this issue had gone out then it is clear it would have produced objections from some policyholders.

- 3.70 Interest rates continued to fall, and by 1997 meant that current annuity rates fell below the GAR. For the 1997 bonus, payable in 1998, the Equitable announced that it would operate a different terminal bonus, so that any policyholder seeking to take advantage of the GAR would be awarded only a reduced terminal bonus. The Equitable considered this to be the correct way of maintaining equity between those with-profit policyholders whose contracts provided for a GAR and those whose policies did not. The Equitable has argued that the GAR still provided some benefit to those policyholders whose contracts contained it in the particular circumstances of the directors deciding upon a nil terminal bonus and of market annuity rates still being low. In such circumstances policyholders whose contracts provided by GARs would, if they chose to take advantage of GARs, receive a higher annuity than policyholders whose contracts provided only for market annuity rates.
- 3.71 In July 2000 the House of Lords ruled that Equitable was unable to pay lower rates of terminal bonus to those policyholders exercising the GAR option, or indeed to those policyholders whose policies included a GAR (whether or not it was exercised), and the mutual put itself up for sale in order to raise the capital it needed as a result. Unfortunately Equitable could not find a buyer, so on December 8 in the same year it was closed to new business.
- 3.72 The House of Lords judgement also invalidated the reinsurance contract held on the GARs.
- 3.73 In February 2001 HBOS agree to buy Equitable's assets (including the future profits on its linked business) for £500m, followed by two further payments of £250m which were dependent on the group reaching a compromise deal with its GAR policyholders, and on certain sales targets being met. Subsequent to this buyout Equitable announced that it planned to reduce the value of pension policies for with-profit policyholders by about 16% in July 2001. This then led to the government announcing an enquiry into the Equitable situation in August 2001.
- 3.74 The actual situation and the enquiry, which it spurned, have led to many effects on the insurance market. The effects and the enquiries are discussed below.

3.75 Fallout from The Equitable

All life company's writing this kind of business had to take legal opinion on GARs as to how the House of Lords judgement affected them with regard to offsetting costs via cutting bonuses.

- 3.76 There was a serious reputational damage to both the industry and to the actuarial profession. This led to many enquiries regarding the life insurance market and also an enquiry for the profession, see later.

3.77 GARs still exist in the market and will do for some time, but the problem has now been hedged via swaptions for many companies, although many have had a rough ride recently.

3.78 **Warren-Glick:**

The Warren and Glick Opinions (Counsel for the Equitable and the FSA respectively) advised on the possible consequences of the House of Lords judgement for those Equitable with-profits non-guaranteed annuity rate policyholders (the "non-GARs") whose policies had to support the cost of meeting the commitments to the guaranteed annuity rate policyholders ("the GARs"). Both Opinions suggested that there were grounds for thinking that significant numbers of Equitable non-GAR policyholders may have been provided with inadequate information at the time of the sale to satisfy the conduct of business disclosure requirements, ie they may have been "mis-sold". Note that mis-selling does not automatically equate to compensatable loss, and so even in situations where mis-selling can be demonstrated compensation may not be due.

3.79 **Corley Report:**

On 21 December 2000, the Faculty and Institute of Actuaries announced that an inquiry would be held into events surrounding the closure to new business of Equitable Life, with a view to determining whether there were any implications for the profession. The terms of reference for the enquiry were:

- I. Review the adequacy of the professional guidance in relation to the events leading to the closure of the Equitable to new business
- II. Consider whether there are any implications from those events of relevance for the roles of Appointed Actuaries and other actuaries who are directors or senior employees of long term insurance companies
- III. Make recommendations to the Presidents of the Faculty and Institute of Actuaries.

The committee concentrates on the period from the introduction of the first relevant contracts in 1956 up to the judgement by the House of Lords in July 2000.

3.80 The committee recommended the following:

- The Faculty and Institute, in their current review into ways of monitoring compliance with the professional standards, make an external peer review of work of the Appointed Actuary a requirement.
- The provision of an annual Financial Condition Report be made mandatory.
- The guidance notes refer specifically to open-ended guarantees and their potential impact on the financial condition of a life insurance company.
- The Guidance Notes make plain that the Appointed Actuary should require that there is a process for reviewing communications to

policyholders and potential placeholders. The process should embrace stated principles that the illustrations and other literature must reflect, and a consideration of how the policyholder who is not familiar with the constraints on a life insurance firm might read them.

- The Guidance Notes should have more explicit references to the formulation of bonus recommendations to directors, maybe through a separate section. This section should include some wording that when a new with-profit product is introduced, the Appointed Actuary should consider whether it should join an existing common bonus pool.
- The Guidance Notes should require that, when advising the Board on policyholders' reasonable expectations or any successor concept under insurance regulations, the Appointed Actuary should ensure that other relevant strategies for meeting them are presented to the Board for discussion.
- The Guidance Notes should require that an actuary resists holding the dual role of CEO and Appointed Actuary or any role that compromises his or her ability to fulfil their duties as an Appointed Actuary.
- The Guidance Notes should require that in the fields where the Appointed Actuary is responsible for making recommendations to the Board, the reasonable alternative courses of action with their advantages and disadvantages should at least be set out.
- The wording of GN1 and GN8 be reviewed to ensure that they are expressed in a clearer and more user-friendly manner.

3.81 **Baird Report:**

This looked into the regulation of Equitable Life (September 2001). Chapter 7 of the report recommended various improvements in terms of regulation of life insurance (and non-life insurance, to a certain extent), including:

- Current solvency framework needs to be restructured so that the required minimum capital reflects all the risks in the business.
- Financial guarantees and onerous options in life insurance policies should be valued stochastically and consistently with traded option prices in the market.
- That the exercise of discretion over the use of implicit items should be reviewed.
- That a review be undertaken of the extent to which the financial strength of the industry is eroded by the amount of financial reinsurance in place.
- Full disclosure of financial reinsurance arrangements, including the material contingencies to which they are subject, should be made in regulatory returns.
- Regular review the possibility of introducing multiple control levels as a basis for triggering proportionate regulatory action.
- That Appointed Actuaries should be subject to independent external review. This may be carried out by the FSA or by independent firms, but must be conducted to a level which would provide comfort equivalent to that of an external audit.
- The purpose, content and frequency of the regulatory returns be reviewed. The information provided by all firms must be both timely and sufficient to assess the risk of customer detriment which might arise from

issues relating to either solvency or policyholders' reasonable expectations issues.

- The assessed financial risk must be an integral part of an overall risk assessment which is consistent and consistently applied across the FSA.
- The regulator must also have the ability to obtain further relevant information where appropriate, and perhaps routinely for higher risk firms, and may want to conduct its own review in appropriate circumstances.
- FSA consider the feasibility of producing on a regular basis a review of issues and trends that may pose a regulatory risk on the industry.
- That FSA, in its regulation of the long term insurance industry:
 - Where, appropriate to do so, be prepared to act more proactively in pursuance of its statutory objectives to ensure that the interests of customers are properly protected;
 - Forms and articulates a clear view of what are the permissible boundaries of proactive regulation;
 - Reviews its approach to the use of its powers of investigation influence and intervention so that it acts in a way proportionate to the perceived risks; and
 - Adopts a more proactive, risk-based approach so that the frequency, depth and breadth of contact with firms is related to the risk category of that firm
- FSA devotes more resources to developing internal awareness between teams both as to what functions each team performs and the information each team requires to assist it to do its job. We welcome the FSA's creation of one division, comprising prudential and conduct of business regulators and GAD, to deliver integrated supervision of the insurance industry.
- Wholly integrated supervision of the insurance industry being introduced. The FSA should remain alert to the difficulties of implementing change and in particular be alive to the risk that such structural change may facilitate better communication and co-ordination within the FSA, but it will not necessarily achieve it.
- When any matters emerge which is of a certain size and scale and/or has potentially significant reputational issues, the FSA management take steps to ensure that:
 - The existing team structure includes all those with a relevant interest in and the necessary expertise concerning the matter; or
 - A special team is formed to handle the matter; and
 - In both cases, the team is properly constituted with persons with the necessary experience and knowledge and thereafter works cohesively exchanging all relevant information and managing issues in a consistent and comprehensive way.
- FSA to consider the standards of disclosure to apply and the extent to which these can be codified.

3.82 The Tiner Report

This was the document produced by the FSA entitled "The Future Regulation of Insurance" published October 2002.

The Baird report made several recommendations about the regulation of the insurance sector, some of which were detailed above. This meant that the system of insurance regulation inherited by the FSA needed change. The report sets out the steps for various changes and are highlighted in the Appendix of the report, which are cross referenced with those items highlighted in the Baird report.

3.83 Asbestos

We have included asbestos in this paper primarily because it was not included in the first paper. Asbestos is a distinct in that it is like a geophysical catastrophe where the actual losses are causing considerable problems to the US economy because of their size. The total estimated cost is currently about \$275 billion or more, most of which falls outside of the insurance market. This is creating real economic loss and problems in US companies which is being reflected in financial loss. This is a situation of watch this space.

3.84 Argentina

The recent economic problems in Argentina can be considered in the same light it as the economic problems that arose when the UK government had a fixed exchange rate against the US dollar or fixed against gold. There is undue optimism on behalf of both the people and the government that the fixed rate of exchange will be maintained for ever, but when reality strikes the consequences are similar to those that are seen in other bubbles, namely a crash of the stock market, the withdrawal of cash from banks (preferably in US dollars). To this extent the consequences are a similar to the 1929 Wall Street Crash

3.85 Conclusion

Most major financial catastrophes are difficult/ impossible to predict. For a vast majority of the time the market behaves in a rational manner. As such a six sigma approach to management gives good control. However as soon as the parameters move outside the 1-1.5 standard deviations, management and regulation becomes extremely difficult .

In most of the cases illustrated above, the assumptions of modern economic theory fall down. A market price for a security cannot be determined because of the lack of a willing buyer and willing seller, information becomes unreliable and very asymmetric leading to a number of players being taken to the cleaners, and optimism rapidly degenerates into pessimism, with the surviving players seeking security in cash. Regulation cannot protect this scenario.

Modern economic theory, and management controls based on such theory, tend to break down at the time of Extreme Events.

The critical factor is the a rapid change from one status to another. As, in general, the economic value does not change, this means there is a rapid reassessment of the risks adjusted discount rate to determined the financial value. These conclusions may help us in assessing methods to measure such risks..

4 Investing for the big one

- 4.1 The major question is whether there is a correlation between Financial risks and geophysical risks? In his book “ Sixty seconds that will change the world”, Peter Hadfield hypothesized the consequences of a major Tokyo earthquake on the world economy. Swiss Re recently estimated the financial loss of a Tokyo earthquake to be of the order of \$30 billion, although it should be remembered that a substantial portion of the earthquake losses are not insured.
- 4.2 The analysis highlights the possibilities of major communication disruptions in financial markets resulting in panic and selling due to uncertainty. The book was written in 1991, when the Japanese economy was in a different state to what it is today.
- 4.3 The analysis indicates that, in the most serious cases, where funds will be repatriated to Japan, US, UK and Canadian bonds could be vulnerable. Insurance companies would have been badly hit. Other industries that depend heavily on Japanese markets such as airlines, hotels and major department stores will also have problems. It is also assumed that most foreign stockmarkets will be hit by a general retreat in share prices. However, for the Japanese market itself the situation maybe more ambiguous as there is an opportunity to kick-start a good many parts of the economy as the reconstruction takes place.. Gold is a safe bet !
- 4.4 It is worth considering this conclusion against the demise of Baring bank (Nick Leeson), where a Japanese earthquake clearly had an influence on the stock market.
- 4.5 In the period preceding the Kobe earthquake, Japan was the key to understanding the Asian financial markets. The economy had a low interest rates and an export boom. Analysis had indicated that the Japanese yen would rise if an earthquake hit. It was also difficult to justify the fabulously high land and stock prices with rational economic models. In 1988 the Japanese cabinet decided to raise interest rates and the impact was that the stock market began to crack. Japanese and brokerage firms were trying to prop up the market by buying futures with low commissions. There were, as a result, substantial gains and losses on the index arbitrage market that eventually led to Yamaichi going bankrupt.
- 4.6 After this the Yen began to rally. Enter Nick Leeson. Leeson tried to corner the Japanese market from Singapore with 40 per cent of the market on the SIMEX. He basically sold strangles. In the beginning of 1995 the market started to fall and there was a substantive additional drop (10%) after the Kobe Earthquake. Barings loses heavily on the short puts, eventually losing \$1 billion and goes bankrupt.

However following the earthquake the Yen strengthens in line with the prediction.
- 4.7 Leeson first drew attention to himself by solving a problem in the Jakarta office in respect of a undelivered stock certificates and bearer bonds. He was

transferred to the Singapore branch, where he organised a team of traders, and passed his exams to trade on SIMEX. He was both head of the back office and also head trader, a position which and the face of it was a blatant conflict of interests.

- 4.8 He undertook a number of transaction, firstly transacting futures and option orders for clients or other firms within Barings, and secondly arbitrage pricing differences between Nikkei futures traded on and Japan's Osaka exchange. Leeson took unauthorised speculated positions and hid his tradings in an unused error account number 88888. He lost money from the beginning, and increasing his bets to hide the losses lost even more. By mid-February 1995 Leeson had accumulated half the open interest in the Nikkei future and 85 per cent of the open interest in a JGB future. The market was aware of this and traded against him. Prior to 1995 he had just made consistently bad bets! Throughout this Baring management was unaware of what was going on.
- 4.9 To continue trading, he needed cash for the margins. By falsifying accounts and making various misrepresentations, he was able to secure funding from Barings and from clients' accounts. His misrepresentations were often flimsy, as such as requiring to make a margin payment on behalf of clients, which was only a temporary measure, yet retaining the funding.
- 4.10 Barings had started to form a risk management function in the early 1990s, that this never have reached the Singapore office.
- 4.11 The question still remains open – how do you invest for the big one.

5. The role of the regulator

An aside

`A FEW GOOD AUDITORS"

STARRING:

TOM CRUISE - LAWYER

JACK NICHOLSON - ARTHUR ANDERSEN AUDIT OFFICER

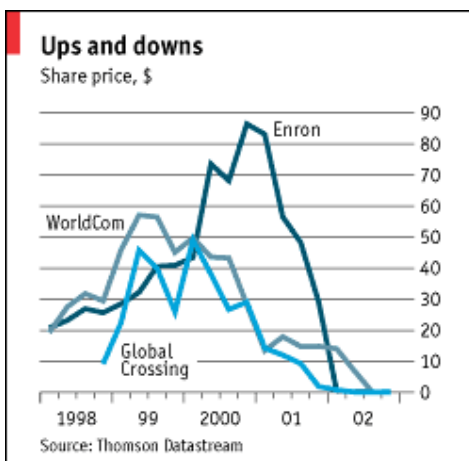
Tom Cruise: "Did you order the shredding?"
Jack Nicholson: "You want answers?"
Tom Cruise: "I think I m entitled."
Jack Nicholson: "You want answers!!"
Tom Cruise: "I want the truth!"
Jack Nicholson: "You can't handle the truth! Son, we live in a world that has financial statements. And those financial statements have to be audited by men with calculators. Who's gonna do it? You? Dept. of Justice? KPMG ? I have a greater responsibility than you can possibly fathom. You weep for Enron and you curse Andersen. You have that luxury. You have the luxury of not knowing what I know: that Enron's death, while tragic, occurred because we were trying to save investors. And my existence, while grotesque and incomprehensible to you, saves investors. You don't want the truth. Because deep down, in places you don't talk about at parties, you want me on that audit. You need me on that audit!
We use words like materiality, risk-based, special purpose entity, control reliance... we use these words as the backbone to a life spent auditing something. You use 'em as a punch-line. I have neither the time nor the inclination to explain myself to a man who rises and sleeps under the blanket of the very "risk-assurance" I provide, then questions the manner in which I provide it. I'd prefer you just said thank you and went on your way. Otherwise, I suggest you pick up a pencil and work on an audit. Either way, I don't give a damn what you think you're entitled to!!"
Tom Cruise: "Did you order the shredding???"
Jack Nicholson: "You're damn right I did!"

- 5.1 The Economist commented about Enron "Mr Lay had always described himself as "passionate about markets". That fervent belief in (Adam Smith's) invisible hand led him to spot one of the most powerful trends of the past decade: the deregulation of commodity markets. He would often forge ahead fearlessly into newly deregulating markets, bully recalcitrant regulators into speeding reforms

and develop clever financial vehicles that pressed to the very edge of the law. In the end, though, Enron appears to have overstepped the mark. The resultant backlash comes as a bitter reminder that the market forces that Mr Lay once worshipped can prove a double-edged sword.”

This is true of all markets.

- 5.2 Regulators work in a Six Sigma environment. Most management is focused around a central stable norm. But when mismanagement is detected the consequences often show that regulators are too slow to react. This is often the first time the type of event has occurred within their experience (it is extreme), and management skills which are suitable for a significant portion of cases is no longer applicable.
- 5.3 The movement to a self regulatory environment is often seen as an opportunity to push business to the limits.



Enron was not the only company to have dodgy accounting. Worldcom, an acquisitive telecoms company revealed that they had adjusted its accounts to the tune of \$3.8 billion. Global Crossing went insolvent after boosting its revenues by “capacity swaps” with other Telecom firms (apparently a common practice the telecoms and energy companies). The real issue was that these companies had set out to revolutionise their industries on the back of deregulation. In this they succeeded!

- 5.4 Over 250 American public companies had to restate their accounts, and received what can be considered as small fines by the Securities and Exchange Commission.
- 5.5 The new key buzz-phrase is “corporate governance”. With hindsight it has become clear that a significant number of companies neither had good management nor any reliable way of determining where it was going. In addition someone needed to be blamed, and auditors came into the firing line. Andersons just happened to be the auditors of some of the worst cases. In addition it had an unresolved conflict of interest between his auditing and consultancy business. It had “aggressive” accounting policies which were in fact tantamount cross-selling its other services. Andersen’s was by no means unique.

- 5.6 One consequence of this was the Sarbanes-Oxley act. This legislation had one main aim, the clean-up of the auditing process. It sets up a public company accounting oversight board to oversee auditors, it makes it unlawful for accounting firms to offer a number of services to companies whose accounts they audit, and that directors sitting on companies audit committees be independent. There was also a proposal to force companies to rotate their auditors every five years, but this got diluted so that the lead audit partner is the only one rotated every five years
- 5.7 Another target is the top corporate executives, the boards that appointed them, and the rewards they got for apparent non performance. The New York Stock Exchange put forward a proposal that within two years the majority of any listed company's directors be independent of the company, that is have no material relationship with it.
- 5.8 Criticism of these proposals is that the wording is very loose and that it has been horribly drafted and will create some peculiar results. One thing is certain that it will be rich pickings for a lawyers in the future.
- 5.9 Viewed from a European perspective, the regulators originally were rather smug suggesting that such events couldn't happened here because of the different purpose of the accounts and the role of the chief executive. In Britain accounting is more art than science in that the accounts include a subjective opinion that the financial statements give a true and fair view of the state of affairs of the company. Contrast this with American auditors which affirm that accounts accord with the 144 (or more) GAAP rules In America the companies appoint a chief executive and tend to let him get on with it. Europeans take a different view.
- 5.10 The other issue with regulation is the use of interest rates to manage the market. The regulators rely on Modern Financial Theory, for example the efficient markets hypothesis (which assumes that prices reflect fundamental values and incorporate all relevant information). Prices are assumed to move only in a well defined way which permits no arbitrage and bubbles are not possible. If prices do rise above a certain levels it produces a " new economy", which is still alright. The events illustrated above in section 3 show that this is not the case.
- 5.11 As a consequence of this philosophy, Greenspan left US interest rates unchanged, and possibly gave a false feeling of wealth to the country. One consequence of the theory is that arbitrage by the informed against the uninformed is both riskless and costless. LTCM used this theory by betting that the prices of various securities would move closer together because the true value of different pairs of securities was the same. When they moved in opposite directions, and more collateral was required the big banks became reluctant to do business with LCTM. Markets are not the same as the theorists claim.
- 5.12 Thus interest rates are left largely to the market to determine, and the regulator does not necessarily intervene when required

- 5.13 The second of the regulators premises is that central bankers are supposed to control inflation and not set prices. They argue that the downside of a bubble burst far outweighs the cost of raising interest rates to stop the bubble rising in the first place. Recall that many bubble prices were inflated on the grounds that interest rates were falling. This leads to a reactionary regulation stance as opposed to proactive stance.
- 5.14 One consequence of this is that the regulator by his inaction has effectively overseen a fundamental transfer of wealth in the market which, if had been undertaken by government action would have been the subject to a heated debate and finger-pointing. One classic example is the state of the UK pensions industry, which was considered to be something that the UK was proud off and now has a reputation so that many people are no longer willing to save for their retirement.

5.15 Conflicts of Interest

Besides the accounting conflict of interest, many of the historic events have illustrated conflicts of interest within the investment banking community, starting naturally with the South Sea bubble and extending to the recent IPO offerings. Investment bankers have been shown to abuse privileged information and mislead clients and new share sales (IPO's) during the internet bubble. Self regulation was considered sufficient to stop any malpractice.

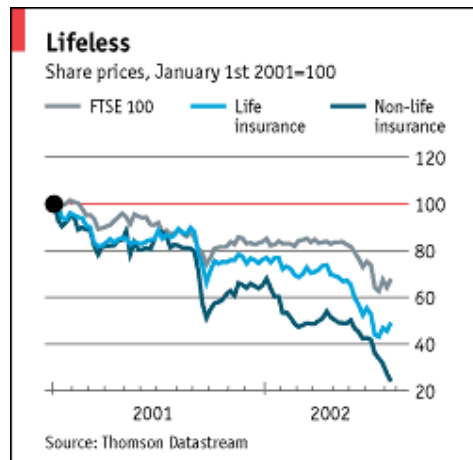
- 5.16 There was always a conflict of interest between the various practices within investment banks. Besides dishing out massive fines the SEC has drawn up plans to force investment banks to make their equity research more independent of their corporate finance business. The cynic may conclude that this is a cosmetic step in that it will not discourage the research analysis and investment bankers from recommending the same stocks, they will do so less blatantly. In any case, customers with any knowledge will tend to pay less attention to the headline recommendation and scan the analysis for information to draw their own conclusions.
- 5.17 The move can be seen as one of re-regulating the deregulated. However, punitive regulation is often long lived and inefficient. After the South Sea bubble there was a ban on setting up new stock companies for 100 years. After the Wall Street Crash of 1929, commercial banking was split from securities dealing (Glass Steagall Act) and restrictive rules continued to be made until 1940. On the other side, there has been an unprecedented era of deregulation which has led to potential conflicts of interest. For example in 1986 London's Big Bang allowed brokers and jobbers to deal under one roof. Glass-Steagall was abolished in 1999 because the banks had found ways of avoiding the regulations, and also needed to compete with their fully integrated European rivals.
- 5.18 Against this background the EC has introduced a directive on market abuse. This could restrict the way that firms used privileged information about their customers trading intentions and classified this as inside information, as it now includes clients pending orders as insider information which, if made public, might have a significant effect on prices.

5.19 Financial services authority

This unified regulatory authority was meant to be a model for other countries on how to regulate financial industries. The emphasis is on self regulation, but with many rules and documents. Is it the best or worst of both worlds?

5.20 Insurance Regulation

Insurance company shares have dropped nearly 70 per cent since their peak.



There is considerable stress from the market as certain categories of insurance (for example employers' liability) become priced out of the market or unavailable. The demise of Equitable Life and the slashing of payouts and increase penalties for other life insurers is also causing concern. Britain spends more on life insurance than any other European country.

5.21 Recall that British insurance companies were considered as the most successful in the world and were pre-eminent in the market. Since the early 1990s there has been a considerable turnaround. However by the end of the decade British insurance were still looking very good thanks to a bull market with some insurance companies investing in as much as 80 per cent of their assets in equities.

5.22 The demise of the bull market has meant that the financial regulator has had to change the rules to ensure that a number of insurers remain solvent. They were supposed to test against a 25 per cent drop in the stock market, however, today the regulator is more interested in a sustained fall as opposed to volatility.

5.23 Other insurance companies have also seen their share price plummet, for example AXA, the German insurers and in particular Munich Re and so on.

5.24 However, British insurers may be in deeper trouble than companies elsewhere because of their focus on winning business as opposed to managing risk. The FSA clearly cannot rely on self regulation in such an environment.

5.25 Overseas regulation

The demise of Credit Lyonnais, at a cost to the French taxpayer of well excess of \$ 20 billion indicates that regulation elsewhere also does not work. The reasons for the loss have been given as a lack of transparency, fraud, a dependency on a narrow elite, and statism. The governments saw the Bank as a means of financing important French companies, and relied and a small number of core civil servants to run it.

5.26 Conclusion

The one conclusion that can be drawn from all this is that regulation tends to fail at extreme events, and that there is then an over reaction (or no reaction at all if vested interests are concerned). There is often little concern for the individuals who have lost significant sums of money due to the malpractice. Regulators have, in effect, overseen a substantial transfer of wealth which, if had been government policy would certainly have received a considerable backlash from the public

6. Actuarial and Other Methods

6.1 We will start with a quote from “Wrong Guys Got Nobels” by Martin Hutchinson, UPI Business and Economics Editor, November 2002

“The Efficient Market Hypothesis is rigorous but false because it is an artifact of the early years of econometrics, in which economists sought to fit economic models into equations they could solve, possibly not realizing — being at best mediocre mathematicians — that linear and exponential equations, those soluble by mid-century economists, represented only a tiny fraction of the possible mathematical relationships that occur in nature. Only after 1970, with the “Catastrophe theory” of the late Rene Thom, followed by Mandelbrot’s fractals and chaos theory did the general public, including economists, come to realize that the simple equations they had studied in school adequately reflected reality in only a small fraction of situations. Like the ecological catastrophes predicted in the 1970s by the Massachusetts Institute of Technology and the “Club of Rome,” the Efficient Market Hypothesis rested on a number of assumptions, made to simplify the equations into solubility, that were in fact demonstrably untrue”.

6.1 Thom’s theory of catastrophes

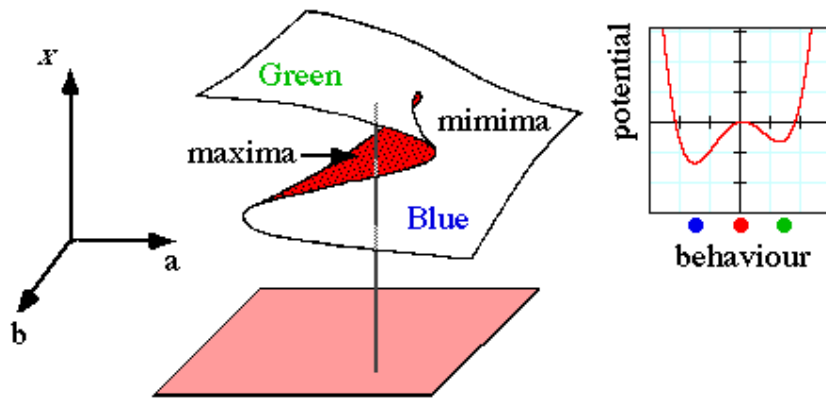
Originated by the French mathematician Rene Thom in the 1960s, catastrophe theory is a special branch of dynamical systems theory. It studies and classifies phenomena characterized by sudden shifts in behaviour arising from small changes in circumstances. Besides Thom’s original work and Arnold exposition, there are also popular works

6.2 Catastrophe Theory itself could be considered an intellectual bubble which exploded when alternative theories arose. However it is worth reconsidering as it really does symbolically explain what has happened

6.3 Catastrophes are bifurcations between different equilibria, or fixed point attractors. Due to their restricted nature, catastrophes can be classified based on how many control parameters are being simultaneously varied. For example, if there are two controls, then one finds the most common type, called a "cusp" catastrophe. If, however, there are more than five controls, there is no classification. For any system that seeks to minimize a function, only seven different local forms of catastrophe "typically" occur for four or fewer variables.

6.4 Catastrophe theory has been applied to a number of different phenomena, such as the stability of ships at sea and their capsizing, bridge collapse, and, with some less convincing success, the fight-or-flight behaviour of animals and prison riots

- 6.5 However, the cusp catastrophe gives a typical indication of a crash in that the behaviour of the market changes. Here the market can be seen to be in the green, but a small perturbation brings it back to the stable blue. In most cases the change is limited, but in extremes the market moves away from the cusp, and the instability produces a massive swing.
- 6.6 The problem with catastrophe theory is that it gives an approach without any clear method of (say) estimating the cusp and how far away. However methods of estimation have been developed by Chris Zeeman among others .



- 6.7 Zeeman in 1974 modelled stock market dynamics as reflecting the interactions of two different kinds of agents, *fundamentalists* who know what the true value of an asset is and who buy when the asset is below that true value and sell when it is above that value, and *chartists* who chase trends, who buy as prices rises and sell as prices fall. The formulation is somewhat different from most economic models in that what is modelled is the rate of change of price rather than the level of price.
- 6.8 This rate of change of price is J , the state variable. It is modelled as determined by the excess demands of the two groups, F for the excess demand of the fundamentalists and C for the excess demand of the chartists. These two are the control variables then for a cusp catastrophe in which F is the normal factor and C is the splitting factor. If all agents are fundamentalists, then the market will be well-behaved and stable, with a unique equilibrium, keeping in mind that this equilibrium is actually a rate of change of price, although if the equilibrium equals zero, then that will essentially coincide with the random walk model. As C increases and the cusp point is passed, the possibility of instability appears and of discontinuous changes in J . Zeeman's original paper involved C rising as the price accelerated until there was a crash, at which point C would decline as chastened investors reverted to more cautious fundamentalist behaviour.
- 6.9 From the analysis it is clear that other factors are in force , and that the model is too simple. However a close relative is models with multiple equilibria. These models can produce dynamic discontinuities as control parameters are varied in

ways that cause the system to cross bifurcation points that separate one equilibrium zone from a discretely different equilibrium zone i.e. a bubble.

- 6.10 Applying above we conclude that the Zeeman model works better with the parameters of optimism and pessimism in the population as a whole.

6.11 Chaos and Complexity Theory

“Chaos Theory” deals with physical processes that superficially appear random because of their variability, but are patterned in hidden ways. Chaos theory is used to find order in presumably random processes. Though determined, chaotic processes are not predictable past a short time because the slightest variation initial conditions changes the outcome.

“Complexity Theory” relates to dynamical systems that generate paths of how a system evolves. Of particular interest are self organising systems.

Chaos theory is also of interest because of the introduction of stable functions as explanations, (Cauchy and Levy-stable) giving wider tails

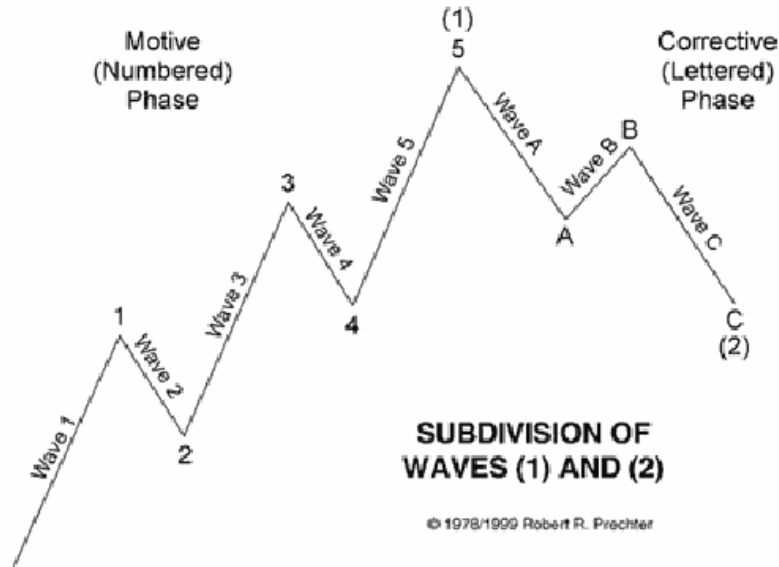
- 6.12 One particular theory that has been around for many years is that the stock market and economic systems follow self similar wave patterns, the most famous of which is the Elliot Wave. A brief description of Elliot waves is given in the Socionomics web site.

“This illustration below shows the basic pattern of the Wave Principle. Notice that there are two modes of wave development: motive and corrective.

A motive wave (also called a “five”) has a five-wave structure, and its subwaves are denoted by numbers (in this case, 1, 2, 3, 4, 5). The structures are called motive because they impel the market.

A corrective wave (also called a “three”) has a three-wave structure or a variation thereof. Its subwaves are denoted by letters (in this case, A, B, C). The structures are called “corrective” because each one appears as a response to the preceding motive wave yet accomplishes only a partial retracement of the progress it had achieved, “correcting” its extremity.”

The main principle is that within each wave there is self similar waves. The number of waves is limitless in Chaos Theory!



- 6.13 Elliott defined waves in terms of what makes them identical, thereby allowing for their variability in some aspects of detail within the scope of those definitions. He was even able to define some of the patterns' variable characteristics in probabilistic terms. Elliott's discovery of degrees in pattern formation, i.e., that a certain number of waves of one degree are required to make up a wave of the next higher degree, is vitally important because it links the building-block property of self-identical fractals to the Wave Principle, revealing an aspect of self-identity among waves that indefinite fractals do not possess. This was all done well before Mandelbrot.
- 6.14 Elliott unified his theory in 1940 when he recognized that the Fibonacci sequence was the mathematical basis for the Wave Principle. The Fibonacci sequence and its corresponding ratios govern both the numbers of waves in a completed Elliott pattern and the proportional relationships between the waves.

7 Entropy – the basis of all risk measurement?

- 7.1 In the above that it is clear that the use of standard deviation as a risk measure is in inappropriate. Yet this is the very measure used in financial mathematics in the Black Scholes equation. Is there another solution?
- 7.2 We would like to suggest at this stage that a closer look be made at entropy and relative entropy as at risk measures. The reasons for this are many fold. The entropy is a measure of the probability of a particular result, as well as being a measure of the disorder of a system. As such it is just as natural as, for example, a standard deviation. It has other good features in that it can be used to measure information per se as , and as such it can be used to measure none financial risks (for example management risk). It fits in with many ideas from Wang and others relating to risk measures

- 7.3 One important feature of relative entropy is that it can be used to reproduce a generalised Black and Scholes equation. This should give comfort to the economists.
- 7.4 One of the keys to understanding many of the papers on risk is the Transfer of distributions. For this see Reesors paper. Relative entropy is used to price risky financial assets in incomplete markets. Distortions, which are methods of transforming probability is each used to price insurance risks and risk management. among the latter are the Esscher transform her and the Wang transform.
- 7.5 Distorted risk measures that have desirable properties such as coherence can be easily generated via relative entropy.
- 7.6 Another approach is by what is known as the Choquet integral. It can be shown that in axiomatic approaches to insurance prices and risk measures that the Choquet integral is fairly fundamental. The use of the normal distortion to price financial and insurer via the Choquet integral was proposed by Wang in 2000. He showed that this distortion was able current reproduce and generalise the capital asset pricing model and to reproduce the Black Scholes formula and provided a symmetric treatment of assets and liabilities

The Esscher transform has been used by Gurber and Shia to price risk. This also falls approach falls out from relative Entropy

Other distortions such as the proportional hazard can be derived from what is known as the gamma beta distortion.

- 7.7 There are other connections which are important
There is a strong connection between the Fisher Information Criteria and Entropy.

A set out below is a series of references for the interesting reader to follow. The advantage of entry risk measures is that they can be used in an environment where real probabilities and distributions are not known fully and are therefore have used to measuring risk in a more abstract environment. This subject is much too deep to be covered in a paper of this nature.

8 Conclusions

Our broad conclusion is that Financial Extremes occur much more often than is predicted by theory; and are a response to changes in behaviour patterns as opposed to any other approach. Trying to measure these patterns is virtually impossible; and as such the regulator is effectively powerless. The use of a six sigma mind set does not help; and different risk measures are needed. We propose that the use of relative entropic measures which are also coherent are a starting step to understanding this issue

References and Additional Reading

1. Christophe Courbage and Patrick M. Liedtke
On insurability, its limits and extensions
The Geneva Papers
2. Berliner, B. (1982), *Limits of Insurability of Risks*, Englewood Cliffs.
3. Holsboer, J.H. (1995), "Insurability and Uninsurability: An Introduction", *The Geneva Papers on Risk and Insurance - Issues and Practice*, 20, N°76, 407-413.
4. Junichi Hirano *FINANCIAL REGULATIONS AND A "BUBBLE" ECONOMY A Study of the Glass-Steagall Act of 1933 and the Global Financial System*
March 2002
5. Kevin Dowd *Too Big to Fail? Long-Term Capital Management and the Federal Reserve*
Cato Institute Briefing Papers
6. Siddharth Prabhu *LONG-TERM CAPITAL MANAGEMENT: THE DANGERS OF LEVERAGE* Duke University May, 2001
7. Augusto de la Torre, Eduardo Levy Yeyati, Sergio L. Schmukler
Argentina's Financial Crisis: Floating Money, Sinking Banking .
8. Forecasting financial crashes: A catastrophe theory approach
Marcelo Fernandes Solvay Business School
9. Malcom Balen *A very English Deceit* Fourth Estate 2002
10. V I Arnold et al *Bifurcation Theory and Catastrophe Theory* Springer 1994
11. Charles MacKay *Extraordinary Popular Delusions and the Madness of Crowds*
1841
12. Bulgatz *More Extraordinary Popular delusions and the Madness of Crowds* 1992
13. Marcelo Cruz *Modelling, measuring and hedging operational risk* Wiley 2002
14. David Fischer *The Great Wave Price Revolutions and the Rhythm of History*
Oxford University Press 1966
15. Alligood et al *Chaos An Introduction to Dynamical Systems* Springer 1996
16. N Dunbar *Inventing Money* Wiley 2001
17. D Mills *Buy, Lie and Sell High* Prentice Hall 2002
18. R Thom *Structural Stability and Morphogenesis*

- 19 When Genius Failed
- 20 **Mark Reesor** University of Waterloo (Ph.D. Statistics)
Risk Measures, Relative Entropy, and Distortion
- 21 Philippe Artzner, Freddy Delbaen, Jean-Marc Eber, and David Heath. *Coherent measures of risk*. *Mathematical Finance*, 9(3):203{228, July 1999.
- 22` Shaun Wang. *A class of distortion operators for pricing financial and insurance risks*. *Journal of Risk and Insurance*, 67(1):15{36, 2000.
- 23 Implicit Distributions in Stock Markets - Estimation with a Maximum Entropy Procedure Wolfgang Kispert
- 24 Robert Pretcher *The Wave Principle of Human Social Behaviour and the New Science of Socionomics* New Classics Library 1999

Appendix 1

Tulipmania

Taken from History House

The U.S. Netherlands Flower Bulb Information Center provides the starting point to this week's story. It goes to great lengths to detail the thievery and skullduggery that accompanied the introduction of the tulip to Holland. In 1593, botanist Carolus Clusius brought tulips from Constantinople to the University of Leiden in Holland, planting the bulbs in a small garden for purposes of medicinal research. He was a right stingy gardener and refused to give or sell any to the locals. Some of his neighbors, looking to make a buck (or florin, or guilder, or whatever) on the exotic new flower from Turkey and disappointed with Clusius's lack of capitalistic fervor, broke into his garden, stole some bulbs, and started the Dutch tulip trade.

Soon enough, a few of the more well-to-do Dutch had tulip bulbs in their gardens with which to impress the ladies. Fads being what they are, the wealthy in Holland subsequently developed a rather inexplicable taste for them and for the next seventy years or so, tulips increased dramatically in popularity and price. As Charles MacKay notes in his Extraordinary Popular Delusions and the Madness of Crowds (written in 1841), "Many persons grow insensibly attached to that which gives them a great deal of trouble... upon the same principle we must account for the unmerited *economía* lavished upon these fragile blossoms." Before long, the normally judicious Dutch found themselves going into hock to populate their boudoirs and studies with little clumps of vegetable matter (the bulbs were quickly regarded as being far too valuable to actually plant). Vast amounts of property changed hands to procure tulip bulbs to display in one's home, much to the befuddlement of outsiders. A speculative bubble ensued, and tulip bulbs, while fairly ordinary in the eyes of flower mongers today, were wildly overvalued. Indeed, MacKay tells us

One would suppose that there must have been some great virtue in this flower to have made it so valuable in the eyes of so prudent a people as the Dutch; but it has neither the beauty nor the perfume of the rose....

For some fiscal perspective, another contemporary writer, Munting, outlines a transaction between two merchants for one (1) Viceroy tulip:

Two lasts of wheat
Four lasts of rye
Four fat oxen
Eight fat swine
Twelve fat sheep

Two Hogsheads of wine [commonly, a hogshead = 63 gals.]

Four tuns of beer [commonly, a tun = 252 gals. That's 15 kegs per tun, for you frat boys]

Two tuns of butter

[One partridge in a pear tree -HH]

One thousand lbs. of cheese

A complete bed

A suit of clothes
A silver drinking-cup

Other than this list, MacKay offers an explanation of the price of tulips in Dutch florins, a rather dry notation which we here at History House will endeavor to replace. Noting that in 1636 one thousand lbs. of cheese cost 120 florins, we will use a price notation consisting of cheese tonnage. That makes the above Viceroy tulip worth about ten tons of cheese (2500 florins). MacKay notes "even an inferior bulb might command a price of 2000 florins," and that "a Semper Augustus was thought to be very cheap at 5500 florins [23 tons]." That's a lot of cheese. Today, the Netherlands exports 1.2 billion tulip bulbs annually (12 billion tons of cheese!). For the sake of completeness, we'll also note that the U.S. Netherlands Flower Bulb Information Center purports that a Semper Augustus cost the equivalent of \$2,250 contemporary U.S. dollars in 1636. That means, with their figures, you ought to be able to purchase all of the items on the above list for \$1,250 (twelve fat sheep!). Perhaps they ought to use the cheese method.

Fortunately, for our amusement, MacKay also notes that, "People who had been absent from Holland, and whose chance it was to return when this folly was at its maximum, were sometimes led to awkward dilemmas by their ignorance." He goes on to tell a story of a merchant who received good news of a shipment from a sailor, and, delighted, offered him breakfast in the form of a red herring.

The sailor had, it appears, a great partiality for onions, and seeing a bulb very like an onion lying upon the counter of this liberal trader, and thinking it, no doubt, very much out of place among silks and velvets, he slyly seized an opportunity and slipped it into his pocket, as a relish for his herring. He got clear off with his prize, and proceeded to the quay to eat his breakfast. Hardly was his back turned when the merchant missed his valuable Semper Augustus, worth 3000 florins [12.5 tons!] ... the sailor, simple soul! Had not thought of concealment. He was found quietly sitting on a coil of ropes, masticating the last morsel of his "onion".

He went to jail for months, of course. Fortunately, MacKay also puts this whole scene in perspective for us:

Anthony caused pearls to be dissolved in wine to drink the health of Cleopatra; Sir Richard Whittington was as foolishly magnificent in an entertainment to King Henry V; and Sir Thomas Gresham drank a diamond dissolved in wine to the health of Queen Elizabeth... but the breakfast of this roguish Dutchman was as splendid as either. He had an advantage, too, over his wasteful predecessors: their gems did not improve the taste or the wholesomeness of their wine, but his tulip was quite delicious with his red herring.

South Sea Bubble

The South Sea Bubble: A Short Sketch of Events

The South Sea [or plural "Seas] Bubble is the name given to the first great stock market crash in England in 1720. The word "bubble" has two meanings: it is synonymous with "cheat" and can mean something fraudulent; it also refers to an inflated body of air that can easily burst. Both meanings operate here. The South Sea Bubble is a fascinating story of mass hysteria, political corruption, and public upheaval. It is really a collection of thousands of stories, tracing the personal fortunes of countless individuals who rode the wave of stock speculation for a furious six months in 1720. The "Bubble year" as it is referred to, actually involves several individual "bubbles" as all kinds of fraudulent joint-stock companies sought to take advantage of the mania for speculation.

The beginning can be traced to 1711 when the South Sea Company was given a monopoly of all trade to the south seas. The real prize here was the anticipated trade that would open up with the rich Spanish colonies in South America upon the conclusion of the War of the Spanish Succession--a war that began in 1703 and would end in 1713 with a treaty that did favour England but not nearly to the extent that was hoped. In return for this monopoly, the South Sea Company would assume a portion of the national debt that England had incurred during the war. The scheme was originally promoted by Robert Harley who wanted to set up a financial establishment that could compete with the Whig Bank of England, which had been created in 1694. Hence, the South Sea Company was really a financial institution that used its monopoly primarily as a means of attracting investors. Some slave-trade voyages were made but these produced little profits. When Britain and Spain officially went to war again in 1718, the immediate prospects for any benefits from trade to South America were nil. What mattered to speculators, however, were future prospects, and here it could always be argued that incredible prosperity lay ahead and would be realized when open hostilities came to an end.

The early 1700s was also a time of international finance. By 1719 the South Sea directors wished, in a sense, to imitate the manipulation of public credit that the Scot John Law had achieved in France with the Mississippi Company, which was given a monopoly of French trade to North America; Law had connived to drive the price of its stock up, and the South Sea directors hoped to do the same. Many believed that some action was necessary to halt the diversion of English capital to France. In 1719 the South Sea directors made a proposal to assume the entire public debt of the British government. On April 12, 1720 this offer, sweetened somewhat, is accepted. A number of large bribes to influential Whig politicians like Stanhope and Sutherland and other influential people, including the royal mistresses Madam von Platen and the Duchess of Kendal (this might seem scandalous but the Duchess of Kendal took all kinds of bribes), had something to do with the result of the vote. The bribes were paid in fictitious holdings of stock. The Company immediately starts to drive the price of the stock up through artificial means; these largely take the form of new subscriptions combined with the circulation of pro-trade-with-Spain stories designed to give the impression that the stock could only go higher. (There perhaps is an analogy here between the stock of microcomputer companies in the early 1980s and the overseas-trading monopolies in the second decade of the eighteenth century. The potential for growth seemed limitless.) Not only did capital stay in England, but many Dutch investors bought South Sea stock, thus increasing the inflationary pressure.

The middle of the Bubble story takes us from the offices of politicians and company directors to the crowded Exchange Alley and its famous coffee-houses (Jonathan's and Garraway's) or what we now would call the financial **district** of London between Cornhill and Lombard streets. The **contemporary atmosphere of Jonathan's**--i.e., the frenzy of trading and manipulation of news--is wonderfully brought to life in a scene from Susanna Centlivre's 1718 play *A Bold Stroke for a Wife*, written a little over a year before the Bubble. Exchange Alley (or Change Alley for short) runs between Cornhill and Lombard directly opposite of the Royal Exchange complex (present building was erected in the nineteenth century). Today you can find a **plaque** on the Alley wall indicating the exact location of Jonathan's (no reference, however, to the events of 1720). Moving west, we can catch a glimpse of the Chapter **House** in St. Paul's Churchyard, next to which stood the Bowles Print Shop where most of the South Sea prints were produced.

South Sea stock rises steadily from January through to the spring. And as every apparent success will soon attract its imitators, all kinds of joint-stock companies suddenly appear, hoping to cash in on the speculation mania. Some of these companies are legitimate but the bulk were bogus schemes designed to take advantage of the credulity of the people. Several of the bubbles, both large and small, had some overseas trade or "New World" aspect. In addition to the South Sea and Mississippi ventures, there was a project for improving the Greenland fishery, another for importing walnut trees from Virginia. Raising capital sums by selling stock in these enterprises was apparently easy work, and brokers, or "jobbers" as they were then called, had a field day. The projects mentioned so far all have a tangible specificity at least on paper if not in practice; others were rather vague on details but big on promise. The most remarkable was "A company for carrying on an undertaking of great advantage, but nobody to know what it is" (Mackay 55):

[the prospectus stated] that the required capital was half a million, in five thousand shares of 100 pounds each, deposit 2 pounds per share. Each subscriber, paying his [or her] deposit, was entitled to 100 pounds per annum per share. How this immense profit was to be obtained, [the proposer] did not condescend to inform [the buyers] at that time, but promised that in a month full particulars should be duly announced, and a call made for the remaining 98 pounds of the subscription. Next morning, at nine o'clock, this great man opened an office in Cornhill. Crowds of people beset his door, and when he shut up at three o'clock, he found that no less than one thousand shares had been subscribed for, and the deposits paid. He was thus, in five hours, the winner of 2000 pounds. He was philosophical enough to be contented with his venture, and set off the same evening for the Continent. He was never heard of again. (Mackay 55-56)

Such scams were bad for the speculation business and so largely through the pressure of the South Sea directors, the so-called "Bubble Act" was passed on June 11, 1720 requiring all joint-stock companies to have a royal charter. For a moment the confidence of the people was given an extra boost, and they responded accordingly. South Sea stock had been at 175 pounds at the end of February, 380 at the end of March, and around 520 by May 29. It peaks at the end of June at over 1000 pounds (obviously a psychological barrier in that four-digit number).

With credulity now stretched to the limit and rumors of more and more people (including the directors themselves) selling off, the bubble then bursts. To be accurate, it suffers a puncture and begins a slow, very slow at first, but steady deflation. By mid August the bankruptcy listings in the London Gazette reach an all-time high, an indication of how people bought on credit or margin. Thousands of fortunes are lost, both large and small. The directors attempt to pump-up more speculation. They fail. The full collapse comes by the end of September when the stock stands at 135 pounds.

The last part of the story may be told quickly. Investors scream foul against the South Sea directors. Parliament is recalled and George I hastens back to London. Mobs crowd into Westminster. A committee is formed to investigate the South Sea Company; by early 1721 it uncovers widespread corruption and fraud among the directors, company officials and their friends at Westminster. Unfortunately, some of the key players have already fled the country with the incriminating records in their possession. Those who remain are examined and some estates are confiscated. Robert Walpole then rises to power with some reasonable proposals to restore public confidence. They take effect but the "Bubble" affected the fortunes of several families and remained in the consciousness of the Western world for the rest of the eighteenth century, not unlike our cultural memory of the 1929 Wall Street Crash.

Mississippi Scheme

Mississippi Scheme, plan formulated by John Law for the colonization and commercial exploitation of the Mississippi valley and other French colonial areas. In 1717 the French merchant Antoine Crozat transferred his monopoly of commercial privileges in Louisiana to Law, who, with the sanction of the French regent, Philippe II, duc d'Orléans, organized the Compagnie d'Occident. Its shares first depreciated in value but rose rapidly when Law, director of the new royal bank, promised to take over the stock at par at an early date. In 1719 the company absorbed several other organizations for the development of the Indies, China, and Africa, and Law thus controlled French colonial trade. The consolidated company, renamed the Compagnie des Indes (but commonly known as the Mississippi Company), was given, among other privileges, the right of farming the taxes. It then assumed the state debt and finally was officially amalgamated (1720) with the royal bank. Public confidence was such that a wild orgy of speculation in its shares had set in. The speculation received a strong impetus from Law's advertising, which described Louisiana as a land full of mountains of gold and silver. One story told of a fabulous emerald rock on the Arkansas River, and an expedition promptly set out to find it. Overexpansion of the company's activities, the almost complete lack of any real assets in the colonial areas, and the haste with which Law proceeded soon brought an end to his scheme. A few speculators sold their shares in time to make huge profits, but most were ruined when the "Mississippi Bubble" burst in Oct., 1720. In the governmental crisis that followed, Law's financial system was abolished, and he fled the country (Dec., 1720). Although a failure in its financial aspects, the Mississippi Scheme was responsible for the largest influx of settlers into Louisiana up to that time.

