CHAPTER 27

STOCK MARKET BUBBLES AND CRASHES

The objective of this chapter is to provide knowledge of:

1. Characteristics and causes of bubbles and crashes
2. The implications of behavioural finance for the understanding of bubbles and crashes.
3. The role of investor over-reaction.
4. The roles of borrowing and liquidity.
5. Portfolio insurance and its potential role.
6. Research using experimental markets.
7. Complexity theory as an explanation of bubbles and crashes.
8. The fractal market hypothesis.
9. Catastrophe theory as an explanation of crashes and surges
10. How crashes can generate banking crises.

The occurrence of stock market bubbles and crashes is often cited as evidence against the Efficient Market Hypothesis. It is argued that new information is rarely, if ever, capable of explaining the sudden and dramatic share price movements observed during bubbles and crashes. Samuelson (1998) distinguished between micro efficiency and macro efficiency. Samuelson took the view that major stock markets are micro efficient in the sense that stocks are (nearly) correctly priced relative to each other, whereas the stock markets are macro inefficient. Macro inefficiency means that prices, at the aggregate level, can deviate from fair values over time. Jung and Shiller (2002) concurred with Samuelson's view and suggested that waves of over- and under-valuation occur for the aggregate market over time. Stock markets are seen as having some predictability in the aggregate and over the long run.

Characteristics of Bubbles and Crashes

Bubbles and crashes have a history that goes back at least to the 17th century (MacKay 1852). Some writers have suggested that bubbles show common characteristics. Band (1989) said that market tops exhibited the following features:

1. Prices have risen dramatically.
2. Widespread rejection of the conventional methods of share valuation, and the emergence of new 'theories' to explain why share prices should be much higher than the conventional methods would indicate.
3. Proliferation of investment schemes offering very high returns very quickly.
4. Intense, and temporarily successful, speculation by uninformed investors.
5. Popular enthusiasm for leveraged (geared) investments.
6. Selling by corporate insiders, and other long-term investors.
7. Extremely high trading volume in shares.

Kindleberger (1989) and Kindleberger and Aliber (2005) argued that most bubbles and crashes have common characteristics. Bubbles feature large and rapid price increases, which result in share prices rising to unrealistically high levels. Bubbles typically begin with a justifiable rise in stock prices. The justification may be a technological advance, or a general rise in prosperity. Examples of technological advance stimulating share price rises might include the development of the automobile and radio in the 1920s and the emergence of the internet in the late 1990s. Examples of increasing prosperity leading to price rises could be the United States, Western Europe, and Japan in the 1980s. Cassidy (2002) suggested that this initial stage is characterised by a new idea or product causing changes in expectations about the future. Early investors in companies involved with the innovation make very high returns, which attract the attention of others.

The rise in share prices, if substantial and prolonged, leads to members of the public believing that prices will continue to rise. People who do not normally invest begin to buy shares in the belief that prices will continue to rise. More and more people, typically people who have no knowledge of financial markets, buy

shares. This pushes up prices even further. There is euphoria and manic buying. This causes further price rises. There is a self-fulfilling prophecy wherein the belief that prices will rise brings about the rise, since it leads to buying. People with no knowledge of investment often believe that if share prices have risen recently, those prices will continue to rise in the future. Cassidy divides this process into a boom stage and a euphoria stage. In the boom stage share price rises generate media interest, which spreads the excitement across a wider audience. Even the professionals working for institutional investors become involved. In the euphoria stage investment principles, and even common sense, are discarded. Conventional wisdom is rejected in favour of the view that it is 'all different this time'. Prices lose touch with reality.

One assumption of the Efficient Market Hypothesis is that investors are rational. This does not require all investors to be rational, but it does require that the rational investors outweigh the irrational ones. However there are times when irrational investors are dominant. A possible cause of market overreaction is the tendency of some investors (often small investors) to follow the market. Such investors believe that recent stock price movements are indicators of future price movements. In other words they extrapolate price movements. They buy when prices have been rising and thereby tend to push prices to unrealistically high levels. They sell when prices have been falling and thereby drive prices to excessively low levels. There are times when such naïve investors outweigh those that invest on the basis of fundamental analysis of the intrinsic value of the shares. Such irrational investors help to generate bubbles and crashes in stock markets.

Some professional investors may also participate on the basis of the greater fool theory. The greater fool theory states that it does not matter if the price paid is higher than the fundamental value, so long as someone (the greater fool) will be prepared to pay an even higher price. The theory of rational bubbles suggests that investors weigh the probability of further rises against the probability of falls. So it may be rational for an investor to buy shares, knowing that they are overvalued, if the probability-weighted expectation of gain exceeds the probability-weighted expectation of loss.

Maximising returns entails following prices upwards until they peak. Selling too soon causes a loss of potential profits. Someone pursuing such a strategy expects to be able to sell before the market falls, and hence the person must believe that he/she is more astute than other investors. Fisher and Statman (2002) surveyed investors during the high-tech bubble of the late 1990s and found that, although many investors believed stocks to be overpriced, they expected prices to continue rising.

Montier (2002) offers Keynes' (1936) beauty contest as an explanation of stock market bubbles. The first level of the contest is to choose the stocks that you believe to offer the best prospects. The second level is to choose stocks that you believe others will see as offering the best prospects. This is based on the view that price movements arise from buy and sell decisions of investors. A third level is to choose the stocks that you believe that others will expect the average investor to select. This is based on the view that others realise that buy and sell decisions of investors drive prices. A fourth stage might involve choosing stocks that you believe that others will expect the average investor to see as most popular amongst investors. In other words, the beauty contest view sees investors as indulging in levels of second-guessing other investors. Even if every investor believes that a stock market crash is coming they may not sell stocks. They may even continue to buy. They may plan to sell just before others sell. In this way they expect to maximize their profits from the rising market. The result is that markets continue to rise beyond what the vast majority of investors would consider to be the values consistent with economic fundamentals. It is interesting to note that Shiller's survey following the 1987 crash (Shiller 1987) found that 84% of institutional investors and 72% of private investors said that they had believed that the market was overpriced just before the crash. Shiller suggested that people did not realise how many others shared their views that the market was overpriced.

Abreu and Brunnermeier (2002, 2003) highlighted the difficulties faced by investors when trying to ascertain the thinking of other investors. It may be rational to buy overpriced stocks if the purchases of other investors will cause them to become even more overpriced (a rational bubble). Knowing the intentions of other investors, and knowing the degree of synchronisation of intentions, is problematic. Synchronisation is the tendency for an overwhelming majority to share an opinion about the direction of

price movement, and synchronisation can cause bubbles and crashes. If an investor is to change investment strategy that investor may feel the need to be certain that there is synchronisation of views about the direction of stock price movement. A switch from buying in an overpriced market to selling in such a market may require a conviction that there is synchronisation of views about the change in market direction. It is impossible to be certain about changes in market views, and about the extent of synchronisation, and hence an investor faces a source of risk. It is possible that relatively minor pieces of information can affect the perception of investor expectations, and the perception of the extent of synchronisation. If a piece of information causes a change in perception, say from synchronised bullishness to synchronised bearishness, the direction of the market could abruptly change. However for a switch from strong bullishness (a bubble) to strong bearishness (a crash) to occur the change in perception would have to be synchronised. Investors would have to share a view about each other's prospective behaviour. If investor views were dispersed (not synchronised), there would be neither strong bullishness nor strong bearishness.

The piece of information that causes changes in perceptions could be a change in direction of a stock index. Stock price movements could be interpreted as indicators of how other investors are thinking. The stage is set for an information cascade and positive feedback trading, which generate synchronisation of market views and investing behaviour. A change in direction of a stock index could cause a reversal of trading behaviour thereby reinforcing the change in direction and reinforcing the information that the new market direction is seen as providing. The question arises as to when investors can be sure that the change in direction is not a temporary aberration. Perhaps technical analysis tries to ascertain such matters. Technical analysis might provide the information, which investors see as indicating a synchronised change in investor views and hence change in market direction.

Social and Psychological Factors

As Hirshleifer (2001) points out, people have a tendency to conform to the judgments and behaviours of others. People may follow others without any apparent reason. Such behaviour results in a form of herding, which helps to explain the development of bubbles and crashes. If there is a uniformity of view concerning

the direction of a market, the result is likely to be a movement of the market in that direction. Furthermore, the herd may stampede. Shiller (2000) said that the meaning of herd behaviour is that investors tend to do as other investors do. They imitate the behaviour of others and disregard their own information.

Brown (1999) examined the effect of noise traders (nonprofessionals with no special information) on the volatility of the prices of closed-end funds (investment trusts). A shift in sentiment entailed these investors moving together and an increase in price volatility resulted. Walter and Weber (2006) found herding to be present among managers of mutual funds.

Walter and Weber distinguished between intentional and unintentional herding. Intentional herding was seen as arising from attempts to copy others. Unintentional herding emerges as a result of investors analysing the same information in the same way. Intentional herding could develop as a consequence of poor availability of information. Investors might copy the behaviour of others in the belief that those others have traded on the basis of information. When copying others, in the belief that they are acting on information, becomes widespread there is an informational cascade.

Another possible cause of intentional herding arises as a consequence of career risk. If a fund manager loses money whilst others make money, that fund manager's job may be in jeopardy. If a fund manager loses money whilst others lose money, there is more job security. So it can be in the fund manager's interests to do as others do (this is sometimes referred to as the reputational reason for herding). Since fund managers are often evaluated in relation to benchmarks based on the average performance of fund managers, or based on stock indices, there could be an incentive to copy others since that would prevent substantial underperformance relative to the benchmark.

Walter and Weber found positive feedback trading by mutual fund managers. In other words the managers bought stocks following price rises and sold following falls. If such momentum trading is common, it could be a cause of unintentional herding. Investors do the same thing because they are following the same strategy. It can be difficult to know whether observed herding is intentional or unintentional.

Hwang and Salmon (2006) investigated herding in the sense that investors, following the performance of the market as a whole, buy or sell simultaneously. Investigating the US, UK, and South Korea they found that herding increases with market sentiment. They found that herding occurs to a greater extent when investor expectations are relatively homogeneous. Herding is strongest when there is confidence about the direction in which the market is heading. Herding appeared to be persistent and slow moving. This is consistent with the observation that some bubbles have taken years to develop.

Kirman (1991) suggests that investors may not necessarily base decisions on their own views about investments but upon what they see as the majority view. The majority being followed are not necessarily well-informed rational investors. The investors that are followed may be uninformed and subject to psychological biases that render their behaviour irrational (from the perspective of economists). Rational investors may even focus on predicting the behaviour of irrational investors rather than trying to ascertain fundamental value (this may explain the popularity of technical analysis among market professionals).

There are theories of the diffusion of information based on models of epidemics. In such models there are ‘carriers’ who meet ‘susceptibles’ (Shiller, 1989). Stock market (and property market) bubbles and crashes are likened to the spread of epidemics. There is evidence that ideas can remain dormant for long periods and then be triggered by an apparently trivial event. Face-to-face communication appears to be dominant, but the media also plays a role.

The media are an integral part of market events because they want to attract viewers and readers. Generally, significant market events occur only if there is similar thinking among large groups of people, and the news media are vehicles for the spreading of ideas. The news media are attracted to financial markets because there is a persistent flow of news in the form of daily price changes and company reports. The media seek interesting news. The media can be fundamental propagators of speculative price movements through their efforts to make news interesting (Shiller 2000). They may try to enhance interest by attaching news stories to stock price movements, thereby focusing greater attention on the movements. The media are also prone

to focus attention on particular stories for long periods. Shiller refers to this as an ‘attention cascade’. Attention cascades can contribute to stock market bubbles and crashes.

Davis (2006) confirmed the role of the media in the development of extreme market movements. The media were found to exacerbate market responses to news, and to magnify irrational market expectations. At times of market crisis the media can push trading activity to extremes. The media can trigger and reinforce opinions.

It has been suggested that memes may play a part in the process by which ideas spread (Lynch, 2001). Memes are contagious ideas. It has been suggested that the success of a meme depends upon three critical factors: transmissivity, receptivity, and longevity. Transmissivity is the amount of dissemination from those with the idea. Receptivity concerns how believable, or acceptable, the idea is. Longevity relates to how long investors keep the idea in mind.

Smith (1991) put forward the view that bubbles and crashes seem to have their origin in social influences. Social influence may mean following a leader, reacting simultaneously and identically with other investors in response to new information, or imitation of others who are either directly observed or observed indirectly through the media. Social influence appears to be strongest when an individual feels uncertain and finds no directly applicable earlier personal experience.

Deutsch and Gerard (1955) distinguish between ‘normative social influence’ and ‘informational social influence’. Normative social influence does not involve a change in perceptions or beliefs, merely conformity for the benefits of conformity. An example of normative social influence would be that of professional investment managers who copy each other on the grounds that being wrong when everyone else is wrong does not jeopardize one’s career, but being wrong when the majority get it right can result in job loss. This is a form of regret avoidance. If a bad decision were made, a result would be the pain of regret. By following the decisions of others, the risk of regret is reduced. This is safety in numbers. There is less fear of regret when others are making the same decisions.

Informational social influence entails acceptance of a group's beliefs as providing information. For example share purchases by others delivers information that they believe that prices will rise in future. This is accepted as useful information about the stock market and leads others to buy also. This is an informational cascade; people see the actions of others as providing information and act on that information. Investors buy because they know that others are buying, and in buying provide information to other investors who buy in their turn. Informational cascades can cause large, and economically unjustified, swings in stock market levels. Investors cease to make their own judgements based on factual information, and use the apparent information conveyed by the actions of others instead. Investment decisions based on relevant information cease, and hence the process whereby stock prices come to reflect relevant information comes to an end. Share price movements come to be disconnected from relevant information. Both of the types of social influence identified by Deutsch and Gerard can lead to positive feedback trading. Positive feedback trading involves buying because prices have been rising and selling when prices have been falling. This may occur because price movements are seen as providing information about the views of other investors. Price rises indicate optimism and hence encourage buying, conversely with price falls. Buying pushes prices yet higher (and thereby stimulates more buying) and selling pushes prices lower (and hence encourages more selling). Such trading behaviour contributes to stock market bubbles and crashes.

People in a peer group tend to develop the same tastes, interests and opinions (Ellison and Fudenberg 1993). Social norms emerge in relation to shared beliefs. These social norms include beliefs about investing. The social environment of an investor influences investment decisions. This applies not only to individual investors, but also to market professionals. Fund managers are a peer group; fundamental analysts are a peer group; technical analysts are a peer group. Indeed market professionals in aggregate form a peer group. It is likely that there are times when these peer groups develop common beliefs about the direction of the stock market. Common beliefs tend to engender stock market bubbles and crashes.

Welch (2000) investigated herding among investment analysts. Herding was seen as occurring when analysts appeared to mimic the recommendations of other analysts. It was found that there was herding towards the prevailing consensus, and towards recent revisions of the forecasts of other analysts. A conclusion of the research was that in bull markets the rise in share prices would be reinforced by herding.

Research on investor psychology has indicated certain features about the behaviour of uninformed investors, who are often referred to as noise traders in the academic literature. Tversky and Kahneman (1982) found that they have a tendency to over-react to news. De Bondt (1993) found that they extrapolate trends, in other words they tend to believe that the recent direction of movement of share prices will continue. Shleifer and Summers (1990) found evidence that they become overconfident in their forecasts. This latter point is consistent with the view that bubbles and crashes are characterised by some investors forgetting that financial markets are uncertain, and coming to believe that the direction of movement of share prices can be forecast with certainty. Barberis, Shleifer and Vishny (1998) suggested that noise traders, as a result of misinterpretation of information, see patterns where there are none. Lee (1998) mentioned that a sudden and drastic trend reversal may mean that earlier cues of a change in trend had been neglected. Clark and Statman (1998) found that noise traders tend to follow newsletters, which in turn are prone to herding.

It seems that many investors not only extrapolate price trends but also extrapolate streams of good or bad news, for example a succession of pieces of good news leads to the expectation that future news will also be good. Barberis, Shleifer, and Vishny (1998) showed that shares that had experienced a succession of positive items of news tended to become overpriced. This indicates that stock prices overreact to consistent patterns of good or bad news. Lakonishok, Shleifer, and Vishny (1994) concluded that investors appeared to extrapolate the past too far into the future.

There is evidence that the flow of money into institutional investment funds (such as unit trusts) has an impact on stock market movements. Evidence for a positive relationship between fund flows and subsequent stock market returns comes from Edelen and Warner (2001), Neal and Wheatley (1998),

Randall, Suk and Tully (2003), and Warther (1995). It has been suggested by Indro (2004) that market sentiment (an aspect of crowd psychology) plays an important role. Indro found that poll-based measures of market sentiment were related to the size of net inflows into equity funds. It appears that improved sentiment (optimism) generates investment into institutional funds, which in turn brings about a rise in stock market prices (and vice versa for increased pessimism). If stock market rises render market sentiment more optimistic, a circular process occurs in which rising prices and improving sentiment reinforce each other.

It has often been suggested that small investors have a tendency to buy when the market has risen and to sell when the market falls. Karceski (2002) reported that between 1984 and 1996 average monthly inflows into US equity mutual funds were about eight times higher in bull markets than in bear markets. The largest inflows were found to occur after the market had moved higher and the smallest inflows followed falls. Mosebach and Najand (1999) found interrelationships between stock market rises and flows of funds into the market. Rises in the market were related to its own previous rises, indicating a momentum effect, and to previous cash inflows to the market. Cash inflows also showed momentum, and were related to previous market rises. A high net inflow of funds increased stock market prices, and price rises increased the net inflow of funds. In other words, positive feedback trading was identified.

This buy-high / sell-low investment strategy may be predicted by the ‘house money’ and ‘snake bite’ effects (Thaler and Johnson 1990). After making a gain people are willing to take risks with the winnings since they do not fully regard the money gained as their own (it is the ‘house money’). So people may be more willing to buy following a price rise. Conversely the ‘snake bite’ effect renders people more risk-averse following a loss. The pain of a loss (the snake bite) can cause people to avoid the risk of more loss by selling investments seen as risky. When many investors are affected by these biases, the market as a whole may be affected. The house-money effect can contribute to the emergence of a stock market bubble. The snake-bite effect can contribute to a crash.

The tendency to buy following a stock market rise, and to sell following a fall, can also be explained in terms of changes in attitude towards risk. Clarke and Statman (1998) reported that risk tolerance fell dramatically just after the stock market crash of 1987. In consequence investors became less willing to invest in the stock market after the crash. MacKillop (2003) and Yao, Hanna and Lindamood (2004) found a relationship between market prices and risk tolerance. The findings were that investors became more tolerant of risk following market rises, and less risk tolerant following falls. The implication is that people are more inclined to buy shares when markets have been rising and more inclined to sell when they have been falling; behaviour which reinforces the direction of market movement. Shefrin (2000) found similar effects among financial advisers and institutional investors. Byrne (2005), when examining the behaviour of retail consumers of institutional investments, found that a positive outcome history led to a higher risk propensity; in other words market gains increased the inclination of investors to invest more. Grable, Lytton and O'Neill (2004) found a positive relationship between stock market closing prices and risk tolerance. As the previous week's closing price increased, risk tolerance increased. When the market dropped, the following week's risk tolerance also dropped. Since risk tolerance affects the willingness of investors to buy risky assets such as shares, the relationship between market movements and risk tolerance tends to reinforce the direction of market movement. During market rises people become more inclined to buy shares, thus pushing share prices up further. After market falls investors are more likely to sell, thereby pushing the market down further.

Projection bias is high sensitivity to momentary information and feelings such that current attitudes and preferences are expected to continue into the future (Loewenstein, O'Donoghue and Rabin, 2003). Mehra and Sah (2002) found that risk tolerance varied over time and that people behaved as if their current risk preference would persist into the future. In other words the current level of risk tolerance was subject to a projection bias such that it was expected to continue into the future. Grable, Lytton, O'Neill Joo and Klock (2006) pointed out that this interacts with the effects of market movements on risk tolerance. A rise in the market enhances risk tolerance, projection bias leads to a belief that current risk tolerance will persist, people buy more shares, share purchases cause price rises, price rises increase risk tolerance, and so forth.

A virtuous circle of rising prices and rising risk tolerance could emerge. Conversely there could be a vicious circle entailing falling prices and rising risk aversion.

The Role of Social Mood

People transmit moods to one another when interacting socially. People not only receive information and opinions in the process of social interaction, they also receive moods and emotions. Moods and emotions interact with cognitive processes when people make decisions. There are times when such feelings can be particularly important, such as in periods of uncertainty and when the decision is very complex. The moods and emotions may be unrelated to a decision, but nonetheless affect the decision. The general level of optimism or pessimism in society will influence individuals and their decisions, including their financial decisions.

There is a distinction between emotions and moods. Emotions are often short term and tend to be related to a particular person, object or situation. Moods are free-floating and not attached to something specific. A mood is a general state of mind and can persist for long periods. Mood may have no particular causal stimulus and have no particular target.

Positive mood is accompanied by emotions such as optimism, happiness, and hope. These feelings can become extreme and result in euphoria. Negative mood is associated with emotions such as fear, pessimism, and antagonism. Nofsinger (2005a) suggested that social mood is quickly reflected in the stock market, such that the stock market becomes an indicator of social mood. Prechter (1999, 2001), in proposing a socionomics hypothesis, argued that moods cause financial market trends and contribute to a tendency for investors to act in a concerted manner and to exhibit herding behaviour.

Many psychologists would argue that actions are driven by what people think, which is heavily influenced by how they feel. How people feel is partly determined by their interactions with others. Prechter's socionomic hypothesis suggests that human interactions spread moods and emotions. When moods and emotions become widely shared, the resulting feelings of optimism or pessimism cause uniformity in

financial decision-making. This amounts to herding and has impacts on financial markets at the aggregate level.

Slovic, Finucane, Peters and MacGregor (2002) proposed an affect heuristic. Affect refers to feelings, which are subtle and of which people may be unaware. Impressions and feelings based on affect are often easier bases for decision-making than an objective evaluation, particularly when the decision is complex. Since the use of affect in decision-making is a form of shortcut, it could be regarded as a heuristic. Loewenstein, Weber, Hsee and Welch (2001) showed how emotions interact with cognitive thought processes and how at times the emotional process can dominate cognitive processes. Forgas (1995) took the view that the role of emotions increased as the complexity and uncertainty facing the decision-maker increased.

Information can spread through society in a number of ways; books, magazines, newspapers, television, radio, the internet and personal contact. Nofsinger suggests that personal contact is particularly important since it readily conveys mood and emotion as well as information. Interpersonal contact is important to the propagation of social mood. Such contact results in shared mood as well as shared information.

Prechter suggested that economic expansions and equity bull markets are associated with positive feelings such as optimism and enthusiasm whereas economic recessions and bear markets correspond to an increase in negative emotions like pessimism, fear and anger. During a stock market uptrend society and investors are characterised by feelings of calmness and contentment, at the market top they are happy and enthusiastic, during the market downturn the feelings are ones of sadness and insecurity, whilst the market bottom is associated with feelings of anger, hostility and tension.

Dreman (2001) suggested that at the peaks and troughs of social mood, characterised by manias and panics, psychological influences play the biggest role in the decisions of investment analysts and fund managers. Forecasts will be the most positive at the peak of social mood and most negative at the troughs. Psychological influences can contaminate rational decision-making, and may be dominant at the extreme

highs and lows of social mood. At the extremes of social mood the traditional techniques of investment analysis might be rejected by many as being no longer applicable in the new era.

Shiller (1984) took the view that stock prices are likely to be particularly vulnerable to social mood because there is no generally accepted approach to stock pricing; different analysts use different models in different ways. The potential influence of social mood is even greater among non-professionals who have little, or no, understanding of pricing models and financial analysis. Nofsinger (2005a) saw the link to be so strong that stock market prices could be used as a measure of social mood.

Peaks and troughs of social mood are characterised by emotional decision-making rather than rational evaluation. Cognitive evaluations indicating that stocks are overpriced are dominated by a mood of optimism. Support for one's downplaying of rational evaluation receives support from the fact that others downplay rational evaluation. The optimism of others validates one's own optimism. It is often argued that the normal methods of evaluation are no longer applicable in the new era. Fisher and Statman (2002) surveyed investors during the high-tech bubble of the late 1990s and found that, although many investors believed stocks to be overpriced, they expected prices to continue rising.

Eventually social mood passes its peak and cognitive rationality comes to dominate social mood. Investors sell and prices fall. If social mood continues to fall, the result could be a crash in which stock prices fall too far. The situation is then characterised by an unjustified level of pessimism, and investors sell shares even when they are already under-priced. Investors' sales drive prices down further and increase the degree of under-pricing. Fisher and Statman (2000) provided evidence that stock market movements affect sentiment. A vicious circle could develop in which falling sentiment causes prices to fall and declining prices lower sentiment.

Perspectives from Psychoanalysis and Neuroscience

Taffler and Tuckett (2002) provided a psychoanalytic perspective on the technology-stock bubble and crash of the late 1990s and early 2000s, and in so doing gave a description of investor behaviour totally at

odds with the efficient markets view of rational decision-making based on all relevant information. They made it clear that people do not share a common perception of reality; instead everyone has their own psychic reality. These psychic realities will have varying degrees of connection with objective reality. Decisions are driven by psychic reality, which is a realm of feelings and emotions. Reason may be secondary to feeling. Feeling affects the perception of reality. People are seen as engaging in wish-fulfilment wherein they perceive reality so that it accommodates to what they want. People see what they want to see. Unpleasant aspects of reality may be subject to denial, which is the pretence that unpleasant events and situations have not happened. Denial reduces the ability to learn from unpleasant experiences, since unpleasant experiences are removed from conscious awareness.

The unconscious mind operates as a censor that keeps out unpleasant information. People are constantly bombarded by far more information than the human mind can handle. The unconscious mind reduces incoming information to a quantity that can be dealt with. Although much of this rejected information is rejected because it is peripheral to needs, some information may be rejected because it is unpleasant. The conscious mind, the mind of which we are aware, does not receive complete information. The efficient markets view of rational investors who base decisions on all relevant information does not sit comfortably with this psychoanalytic view of mental processes.

In relation to stock market bubbles, the psychoanalytic view of Taffler and Tuckett sees stocks as taking on significance for the unconscious mind, which reflects experiences of infancy. The unconscious mind has considerable influence over thinking and decision-making. Since people are not aware of their unconscious minds, they are not aware of the influence of the unconscious mind over decision-making. The unconscious mind may exclude uncomfortable aspects of reality from awareness. When the bubble bursts, and prices fall, it becomes impossible to completely exclude unpleasant aspects of objective reality from awareness. Feelings of anxiety, loss, panic and shame emerge. Selling the shares as quickly as possible could then become part of the process of denial.

In the view of Bargh and Chartrand (1999) people's goals, as well as their behaviours, are affected by factors outside conscious awareness. Investment behaviour is likely to be affected by emotions, which are outside conscious awareness (as well as by emotions of which the person is aware).

Peterson (2007) in a review of recent neuroscience literature concluded that the evidence indicated the existence of separate brain systems for risk-taking and risk-avoiding behaviours. Both systems entailed emotional responses. Excessive activation or suppression of either brain system could result in biased investment decisions. Recent financial gains or losses change investor behaviour. Investors who have recently experienced a loss may be subject to feelings of nervousness, sensitivity to possible future losses, and hesitancy about investing. Investors who have recently enjoyed gains may feel celebratory, self-confident and inclined to ignore prospective risks.

These emotional reactions to losses and gains could bias investment decisions in a way that reinforces bear and bull markets. In a falling market the losses engender anxiety, raise sensitivity to risk and increase risk-aversion. These feelings reduce purchases of stocks and increase sales, thereby reinforcing the downward market movement. When the market rises the gains being experienced might generate enthusiasm, overemphasis on potential returns and reduced attention to risk. Risks may be underestimated and risk-aversion reduced. These emotional responses to a rising market could induce further purchases of stock, thereby reinforcing the upward movement.

The Implications of Behavioural Finance for Understanding Bubbles and Crashes

Behavioural finance applies the psychology of decision making to investment behaviour. Psychological research has indicated that there are a number of systematic distortions that cause investors to deviate from the model of rationality typically assumed by financial economists. Some of these biases help to explain how stock markets can experience bubbles and crashes.

Representativeness and Narrow Framing

It is not difficult to see how behavioural finance concepts can be used in the explanation of stock market bubbles and crashes. For example the concept of representativeness helps to explain the apparent tendency for investors to chase the market. Many people seem to believe that recent price rises will continue into the future, likewise recent price falls. As a result they buy when they see that prices have been rising, causing prices to rise further, and sell when they see that prices have been falling, accentuating the price falls. DeBondt (1993) reported a study of 38,000 forecasts of stock prices and exchange rates. He found that non-experts expected the continuation of apparent past trends in prices. They were optimistic in bull markets and pessimistic in bear markets.

One interpretation of representativeness is that investments that have shown recent price rises are representative of longer term successes (and conversely for those showing recent price falls). Another way of looking at representativeness views it as suggesting that people see patterns and trends where they do not exist. Recent upward price movements are interpreted as an upward trend that will continue into the future (conversely with price falls).

Thus representativeness explains how opinions about price trends can emerge, and through affecting trading those opinions become self-fulfilling. The persistence of such opinions, and hence the resulting bubbles or crashes, may be explained by the concepts of conservatism and confirmation bias. Conservatism renders people unwilling to change their opinions in the light of new information, so they may adhere to a view about the direction of prices even when those prices have moved too far. Confirmation bias is the tendency for people to pay attention to information that supports their opinions, and to ignore contrary evidence. Again this causes them to persist with market views, and trading behaviour, even when evidence suggests that those views may be incorrect.

Narrow Framing suggests that investors focus too much on the short term. In consequence the very recent behaviour of share prices is focused upon and the longer term past is ignored. This reinforces the tendency of representativeness to lead to unjustified long term expectations on the basis of short term price movements.

These ideas are consistent with the emergence of stock price bubbles and crashes. Recent price increases cause expectations of future increases and investors buy shares. This pushes prices up further, hence generates expectations of more increases and leads to yet more buying. There is an upward spiral often referred to as positive feedback trading or as ‘chasing the market’. There is a corresponding, but opposite, pattern as the market falls.

Overconfidence

Psychological research has indicated that there is a self-attribution bias in decision-making. When an investment is successful, the investor believes that it is due to his or her skill. An unsuccessful investment is seen to fail as a result of bad luck or the actions of others. This self-attribution bias leads to overconfidence. Overconfidence is also reinforced by the hindsight bias, which is the false belief held by people who know the outcome of an event that they would have predicted the outcome. Overconfidence may be particularly characteristic of inexperienced investors who find that their initial investments are profitable. Their belief in their own skill leads them to invest more. So a bull market can generate overconfidence, which causes more investing thereby reinforcing the upward price movement. There is a Wall Street adage, which says: ‘Don’t confuse brains with a bull market’. However there are those who interpret their gains in a bull market as arising from their own skills. Overconfidence can cause investors to see certainty where there is uncertainty. This can lead them to invest beyond a rational level, and painful losses result when the market falls.

Overconfidence can arise from excessive confidence in the quality of one’s information and an exaggerated view of one’s ability to interpret that information. This leads to an unwarranted degree of certainty about the accuracy of one’s forecasts and a corresponding underestimation of risk (Barber and Odean 1999). In consequence overconfident investors are prone to invest to a greater extent than would be the case if they properly understood the quality of their forecasts. Barber and Odean have found that overconfident investors tend to take more risk than less confident investors.

During the late 1990s there was a bull market, particularly in technology stocks. During the bull market, individual investors increased their levels of trading. Investors allocated higher proportions of their portfolios to shares, invested in riskier (often technology) companies, and many investors borrowed money in order to increase their shareholdings (Barber and Odean, 2001). It is likely that, during the bull market, individual investors attributed too much of their success to their own expertise and became overconfident as a result.

A psychological bias that helps to produce overconfidence is the illusion of control. People often behave as if they have influence over uncontrollable events (Presson and Benassi 1996). A number of attributes have been identified as fostering the illusion of control. One of these is the outcome sequence. Positive outcomes early give a person more illusion of control than negative outcomes early. This is akin to the tendency for some people to become addicted to gambling if their first few bets are successful. In a rising stock market people investing for the first time will experience gains. This is likely to engender the illusion of control, overconfidence, and the inclination to invest more. If significant numbers of people invest more, prices will continue to rise thereby reinforcing these psychological biases.

Another attribute that fosters the illusion of control is the acquisition of information. Increased information increases the illusion of control and the degree of overconfidence. This has been called the illusion of knowledge (Nofsinger 2005; Peterson and Pitz 1988). The information may or may not be relevant to the investments. Particularly for investors with little knowledge of investment, information does not give them as much understanding as they think because they lack the expertise to interpret it. They may be unable to distinguish relevant and reliable information from irrelevant and unreliable information. However to the extent that stock market gains lead investors to seek information, the information obtained is likely to increase the illusion of control and the extent of investing. The resulting investment will help to perpetuate the share price rises and thereby the psychological biases.

In addition to the outcome sequence Presson and Benassi showed that choice, task familiarity, information, and active involvement foster the illusion of control. Barber and Odean (2002) pointed out that online

investors tend to experience these attributes. In particular they make choices, become familiar with the process of trading, and have access to large amounts of information. The implication is that the development of online trading is likely to enhance the illusion of control, and hence any market instability to which the illusion of control might contribute.

At the time of writing, the most recent bubble was in technology stocks. During 1999 and up to March 2000 such stocks rose dramatically in price. Novice investors piled in either through direct share purchases or via unit trusts specialising in technology stocks. Many people came to believe that they could make a living out of trading shares (as 'day traders'). It seemed that some people even believed that their profits were due to their investment skills (typically people with no prior knowledge of investment or financial markets).

Familiarity and Celebrity Stocks

Best (2005) investigated the internet stock bubble, which occurred in the late 1990s and burst in 2000. One conclusion was that internet stocks acquired a form of celebrity status. Their prices exceeded fundamental value just as the earnings of celebrities appear to surpass the talent of the individuals concerned. Just as the perception of celebrities has an emotional dimension, investors in internet stocks were seen as having an emotional attachment to them. Just as the media promotes celebrities, and the cult of celebrity, the media promoted internet investing and a culture of internet investing.

Part of the reasoning of the analysis provided by Best is similar to the familiarity bias of behavioural finance. The familiarity bias leads people to prefer to invest in things they think they know and understand. At the time of the internet stock bubble large numbers of people were beginning to use the internet, which therefore felt familiar to them. The internet was new, exciting and appeared to offer huge potential. It is possible that internet stocks, by association with the internet itself, came to be seen as exciting investments with huge potential.

Arguably an internet culture was emerging, wherein the internet came to be seen as symbolic of a new age; the information age. A social mood emerged amongst internet enthusiasts. People who identified with the information age saw use of the internet as an expression of their personalities; they saw themselves as part of the new era. Investment in internet stocks was an extension of their personal attachment to the internet. This parallels celebrity cults. The celebrities with whom a person identifies become part of that person's perception of self. To a fan, a celebrity is more than an actor or singer. To many buyers of internet stocks, the shares were more than financial investments. Another comparison might be with supporters of a football team; such supporters identify with the team and have an emotional attachment such that association with the team helps to describe them as individuals. Cassidy (2002) suggested that people want to become players in an ongoing drama in which ownership of stocks gives them a sense of being part of a social movement. People invest because they do not want to be left out of the exciting developments. Behavioural finance has identified both familiarity, and emotional involvement, with particular investments as influences on financial decision-making. It seems likely that these factors were influential during the internet stock bubble of the late 1990s.

Cooper, Dimitrov and Rau (2001) found that companies which added 'dot.com' or 'dot.net' to their names during the internet stock bubble experienced share price increases of about 74% at the time of the change (even though nothing else about the businesses had changed). During the bear market of the early 2000s there were gains for firms which removed 'dot.com; or 'dot.net' from their names (Cooper, Khorana, Osobov, Patel and Rau; 2005). It has been suggested that internet-related names attracted positive affect (feelings and emotions) during the bull phase and negative affect during the bear phase (Statman, Fisher and Anginer 2008).

Hirschey, Richardson and Scholz (2000) reported evidence that internet users tended to be very naïve with respect to investments. In particular they appeared to be highly influenced by stock recommendations posted on the internet. Stock purchases on the basis of such recommendations may have provided additional impetus to the bubble in high-technology stocks.

Best emphasised the role of the media in talking up the prices of internet stocks, and the creation of celebrity status for such stocks. Shiller (2000) argued that the media had become more involved in reporting stock market news, and in generating an investment culture. In doing so the media has made the subject of investment more entertaining and exciting to many people. An investment culture has been promoted, with investment being seen as part of a lifestyle option. Within this context it is not surprising that the media focused attention on internet stocks since such stocks offered excitement and glamour. The media became part of the process of generating the internet stock price bubble (Lovink 2002). The media played an important role in the creation of the celebrity status of internet stocks, just as the media plays an important role in the creation of celebrity status for people.

Investor Over-Reaction

Empirical evidence on investor over-reaction over some time periods is consistent with these ideas from behavioural finance. De Bondt and Thaler (1985) found that stocks with very poor returns over a three-year period subsequently outperformed those with the highest returns. A portfolio comprising the 35 biggest losers earned a cumulative return 25% higher than the portfolio of the 35 biggest winners over the subsequent three years. This may be the result of investor over-reaction during the first three years.

This may be because of an extrapolation of news. Suppose that a company announces good news over the initial three years, such as profits that are repeatedly above expectations. It may be that investors come to expect more good news in the future and become excessively optimistic about the company's prospects. The stock price is driven up and the stock becomes a winner. However good news in the past is not an indicator of good news in the future, and as the expectations about the future prospects of the company shed the rosy bias of the extrapolation the stock price will move back down towards a more realistic level. The converse could be true of the effects of a run of bad news.

This phenomenon could take hold at the general market level. By early 2003 world stock markets had fallen over the previous three years. This may in part have been the result of an extrapolation of bad news. A sequence of negative news had occurred: the dotcom bubble burst; the global economy went into

recession; corporate profits fell; terrorism escalated on September 11th 2001; corporate scandals emerged from Enron, Worldcom, and Arthur Anderson; the likelihood of another gulf war appeared; and the consequent general fall in share prices was another form of bad news. Investors' reactions may have been to expect the flow of bad news to continue. If the extrapolation of bad news was an incorrect reaction, stock prices at the beginning of 2003 were reflecting too much negative news and should have shown an upward movement if the flow of negative news ceased. It is also to be noted that not all of the recent news had been negative, for example interest rates had fallen substantially over the previous two years. Confirmation bias may have caused investors to ignore, or at least give too little weight to, such positive news.

Another explanation of over-reaction is in terms of the retrievability (availability/recency) bias. People have a tendency to overweight recent information. When new information relevant to the price of an asset becomes available investors give disproportionate weight to this recent news relative to existing information. So they over-react to the new information. Subsequently, as the news becomes older, the weight attached to it declines. In consequence prices tend to move back to some extent. DeBondt and Thaler (1990) found that this psychological bias, and the resultant over-reaction, occurs amongst professional security analysts (and institutional investors) as well as individual investors.

Mood affects investment behaviour (Baker and Nofsinger 2002, Nofsinger 2002). It has been suggested that good moods make people less critical. Good moods can lead to decisions that lack detailed analysis. Determinants of mood include weather, and the number of hours of daylight. Research by Hirshleifer and Shumway (2003), and by Kamstra, Kramer and Levi (2003), has indicated that these factors affect investment behaviour. Good weather, and long hours of sunlight, appears to encourage net buying and market rises. Nofsinger (2002b) has suggested an optimism bias. Optimism reduces critical analysis during the investment process, and it causes investors to ignore negative information.

One factor that can affect mood, and the level of optimism, is the recent performance of stock markets. A market rise is likely to improve the mood of investors, and their degree of optimism. A positive feedback cycle could emerge. Price rises improve mood and increase optimism. In consequence there are net

purchases, so prices rise. These price rises positively affect mood and optimism. Such a positive feedback cycle could contribute to the development of a bubble. Conversely a downward vicious circle could arise with falling prices, worsening moods, and declining optimism.

The Crash

The bubble phase leads to share prices reaching unrealistic levels. These are share price levels far in excess of what can be justified by fundamental analyses using dividend discount models or price-earnings ratios (see the chapters on dividend discount models and ratio analysis). Indeed one feature of bubbles, identified by Kindleberger and Aliber (2005), is the emergence of 'new age' theories. New age theories are ad hoc theories that seek to justify why prices should be far in excess of what conventional share valuation models suggest.

There may then be an occurrence that causes prices to fall rapidly. One such occurrence might be the emergence of new companies. The new companies compete with existing ones and push down their profits. Also when the new companies float on the stock market, the additional supply of shares will help to depress share prices. Towards the end of the 1999-2000 technology stock bubble many new companies were issuing shares. This increased supply of shares overtook the growth in demand for shares. The result was that the prices of shares in the technology sector began to fall.

Rising interest rates could be another occurrence that leads to falling share prices. Bubbles often involve people borrowing money in order to buy shares. High interest rates could cause investors to sell shares in order to pay the interest. Such sales could set off a crash. In Japan in 1990 interest rates rose sharply. This was followed by collapses in the prices of both shares and property. Rising interest rates can also reduce the demand for shares by making alternatives such as bank deposits more attractive. Higher interest rates also reduce expenditure on goods and services and thereby lower corporate profits. Lower expected profits can cause a fall in share prices.

Other factors that can precipitate share price collapses include share sales resulting from negative statements by people who are looked upon as experts. These may be genuine experts such as governors of central banks, or self-appointed experts such as newspaper gurus. Also prospective investors may stop buying because they deplete their sources of money. The flow of new investors on to the market will eventually stop. These factors can start a crash by increasing sales of shares and decreasing purchases. Cassidy suggested that a crash could be precipitated by a random event, or have no apparent catalyst, if stock prices have reached sufficiently unrealistic levels.

Lux (1995) provided a model of bubbles and crashes in which the decline in the numbers of new investors plays an important part in the development of a crash. The model entailed contagion and herd behaviour pushing stock prices to excessively high, or excessively low, levels. Declines from bubbles, and recoveries from crashes, come about because fundamentals play a role in investment decisions. In particular as the rate of return on investments declines, due to the rate of price increase slowing, and the number of new buyers declines the market will turn down. The exhaustion of the pool of potential buyers is an important factor in the slowdown of stock price rises. The bubble is replaced by a decline, which becomes powered by contagion and herding. The decline ends in a crash, which is reversed in a manner similar to the ending of the bubble. A slowing rate of decline, and reduction in number of sellers, improves sentiment and provides the basis for a market rise. The market thus moves between over-valuation and under-valuation. An additional factor, not mentioned by Lux, would be the decline in the rate of dividend yield as prices rise, and the increase in yield as prices fall. Such changes in dividend yield could cause many investors to sell following market rises, and buy following market falls.

Experimental findings on bubbles from Caginalp and Ilieva (2008) appear to be broadly consistent with the model offered by Lux. The Caginalp and Ilieva analysis puts the emphasis on potential buyers running out of money rather than the supply of new buyers declining. Investor response to changes in the rate of increase in prices played a role in the Caginalp and Ilieva analysis as well as in the Lux model.

Caginalp and Ilieva found that some investors changed strategy between momentum (following market trends) and fundamental (believing that there is a correct price towards which the market will move). When the market was rising rapidly some fundamental investors switched to a momentum strategy, thereby reinforcing the upward trend in prices. When the rate of price increase slowed there was a tendency to switch back to a fundamental strategy, thereby reducing purchases and reinforcing the slowdown. At the peak of the market, momentum traders had no remaining cash for further investment and fundamental investors had no wish to buy at high prices. In consequence stock prices fell.

To the extent that shares are bought with borrowed money (leveraged buying), stock market crashes can cause banking crises. If investors are unable to repay their debts, banks may become bankrupt. This could result in depositors losing their money. The effects of leveraged buying worsened the 1929 stock market crash in the United States. That crash was also followed by a banking crisis in which banks failed and depositors lost money. Figure 27.1 illustrates the vicious circle that can emerge when shares are used as collateral against borrowing.

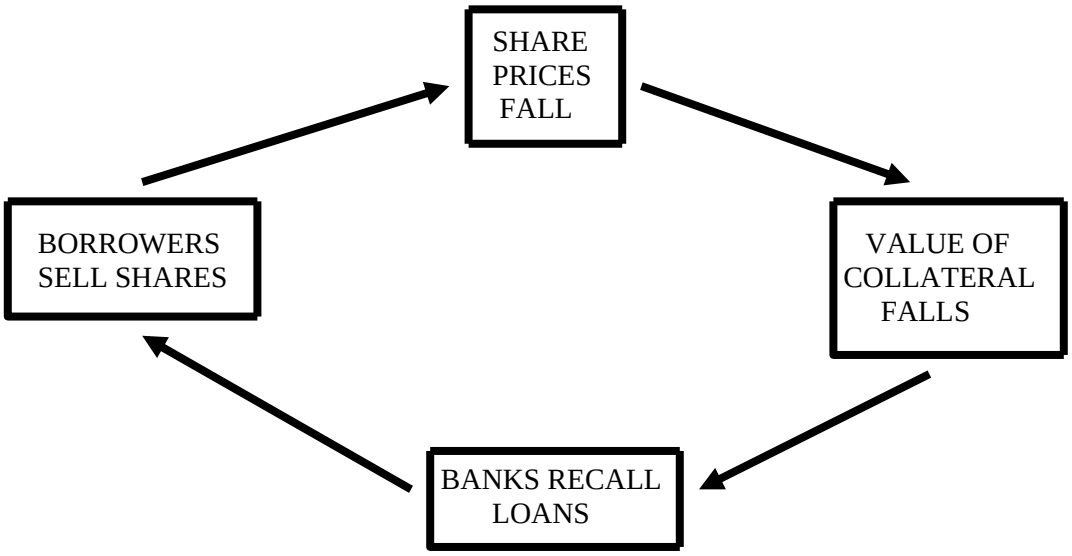


Figure 27.1

Allen and Gale (2000) suggested that bubbles have three phases. The first phase starts with monetary expansion, which leads to an increase in the prices of assets such as stocks and property. Continued monetary expansion leads to the emergence of a bubble in prices. The second phase is characterised by a bursting of the bubble and a collapse in asset prices. The third phase entails defaults on debts incurred to buy stocks or property at inflated prices. Widespread debt defaults entail losses for the banks, and a banking crisis ensues.

Post-Keynesian Perspectives on Stock Market Bubbles and Crashes

There has been a tendency for central banks to inject large amounts of money (usually referred to as liquidity) into the financial system following a crash. This may be to avert a banking crisis and may be for the purpose of stabilising the stock market. Some of that additional liquidity would be used for the purchase of shares, and would therefore slow or reverse the downward movement of share prices. Since this is equivalent to giving the stock market a put option, which gives protection against price falls, it has sometimes been called the Greenspan put (named after a past head of the US Federal Reserve, Alan Greenspan).

Raines, McLeod and Leathers (2007) highlighted the asymmetry involved. They pointed out that central banks take action to soften crashes but take no action to weaken bubbles. The monetary authorities behave as if they believe that markets are efficient during bubbles but inefficient during crashes. Raines, McLeod and Leathers supported this interpretation of central bank behaviour by making a number of references to the writings and speeches of Alan Greenspan. Such actions by monetary authorities lessen stock market risk, and could therefore serve to give an upward bias to stock prices.

The discussion of stock market bubbles and crashes in terms of social and psychological factors seems to be broadly consistent with the post-Keynesian interpretation, which is particularly associated with Galbraith (for example, Galbraith 1988). Galbraith has focused on social mood and excessive optimism: the latter often manifesting itself as a belief that the stock market offers a means to ‘get rich quick’. Stock market speculation is seen as most likely to occur after a period of prosperity, which has allowed the

accumulation of a substantial amount of savings. Those savings are available for investment. The facility of borrowing in order to enhance the level of stock holding also strengthens the conditions for the development of a bubble. The role of the accumulation of money (liquidity) available for investment is a factor emphasised in both the post-Keynesian and monetarist traditions. The monetarist view gives the money supply the central role in the explanation of bubbles and crashes. The liquidity theory of asset prices could be seen as being in the monetarist tradition.

Buying on Margin and the Liquidity Theory of Asset Prices

A feature of bubbles is that share purchases are often financed with borrowed money. This is sometimes referred to as buying on margin, or leveraged buying. Shares are used as collateral for loans taken out for their purchase. There can be a circular process that entails rising share prices. This circular process is illustrated by figure 27.2.

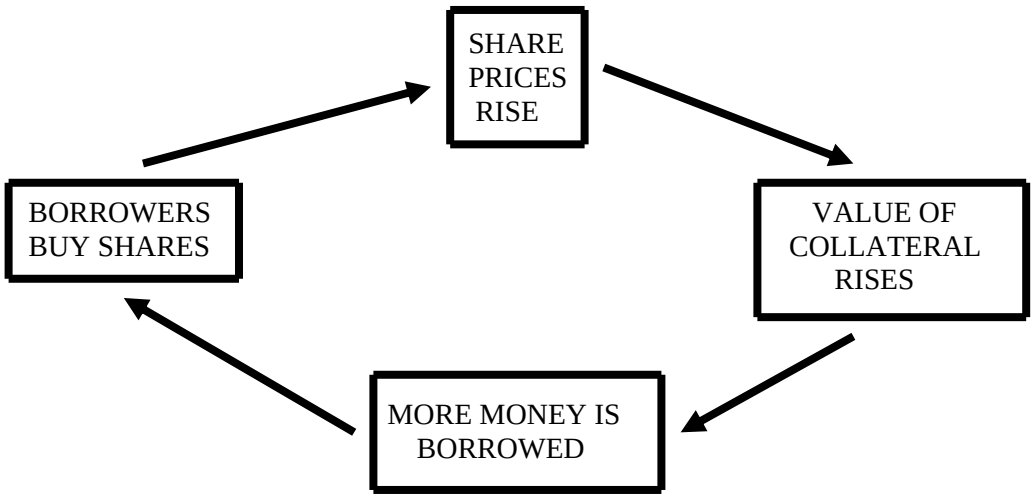


Figure 27.2

Pepper and Oliver (2006) have proposed the Liquidity Theory of Asset Prices. Their suggestion is that a major driver of stock markets is the amount of liquidity available for investment. In other words if people have more money to invest, they will invest more and thereby push up share prices. Money is created when loans are made. So the act of financing share purchases with borrowed money increases the money supply

(liquidity). The sellers of the shares then have money available for investment, and may use the money for the purchase of other shares thereby pushing share prices up. The people who sell those shares will receive money, some of which will be used for share purchases. This process can continue through a number of rounds, and at each round share prices are pushed up. The cumulative increase in expenditure on shares can be estimated by means of a multiplier equation:

$$I = E \times [1/(1 - k)]$$

where I is the cumulative increase in spending on shares, E is the initial expenditure on shares, and k is the proportion of receipts from sales of shares that is invested in other shares. A high rate of reinvestment (a high level of k) produces a large multiplier effect and a large cumulative expenditure on shares (a large I). There would be strong upward pressure on share prices. It should be borne in mind that decreases in liquidity can occur with consequent downward multiplier effects.

Caginalp, Porter and Smith (2001) provided evidence, from experiments, that was consistent with the liquidity theory of asset prices. The experiments entailed the provision of both shares and cash to participants. The average, and maximum, share prices attained during the experiments were both related to the provision of cash relative to the provision of shares. High levels of cash endowment relative to share endowment resulted in high share prices. The researchers also reported that initial under-valuation of shares resulted in larger price bubbles; this was interpreted as evidence for the effects of momentum.

Congdon (2006) demonstrated that institutional investors (life assurance and pensions) have a fairly stable demand for liquidity in the sense of the ratio of liquid assets to other assets. If the institutional investors experience a change in liquidity that moves the liquidity ratio away from the desired level, they will attempt to restore the desired ratio. Money is a form of liquidity. An increase in the money supply could disturb the liquidity ratio of institutional investors. The institutions attempt to restore their liquidity ratios to the desired values by spending the surplus liquidity on assets such as shares. This would drive share prices up. So long as the holding of liquidity exceeds the desired amount investment spending will continue. To the extent that each institution's expenditure is another institution's receipt of money, the attempt by each

institution to reduce its holding of liquidity does not reduce the aggregate holding of liquidity by institutions.

Some of the additional money will flow away from the institutions, for example to individual shareholders who sell to institutions, but much will remain with the institutions. If the institutions hold a high proportion of the total value of shares, most of the additional money may remain with the institutions. The desired ratio of liquidity to other assets is restored by a rise in share prices.

Suppose that institutional investors, in aggregate, hold £1,000 billion of shares. Also suppose that, on average, the institutions desire to hold liquid assets equal to 4% of non-liquid assets. Together they require £40 billion of liquid assets to match the shareholdings. If they receive additional money of £30 billion, they would have a liquid assets ratio of 7%. In aggregate they would not rid themselves of the surplus £30 billion, since the institutions would tend to pass the money between themselves as shares are bought from each other. Some of the money, say £10 million, would be lost to the institutions. This would reduce the aggregate holding of liquidity to 6% of the original value of shares. The institutions would still have £60 billion of liquid assets.

The desired ratio of liquid assets to shareholdings is restored by a rise in share prices. Share prices would rise until the desired ratio is restored. So long as the actual ratio exceeds the desired ratio spending on shares would continue, as would the resulting rise in share prices. Prices would rise until the total value of shares reached £1,500 billion. The liquidity ratio of 4% would then have been restored (£60 billion of liquid assets against £1,500 billion of shares). An initial £30 billion increase in the money held by the institutions leads to a £500 billion increase in the aggregate value of shares held by the institutions. This £500 billion increase results from a 50% rise in share prices. An initial reduction in liquidity would generate falling prices.

The amount of liquidity lost by the institutions in this process would be low if the institutions held a high proportion of the available shares. A low loss would entail a high rise in share prices. For example if all of

the £30 billion increase in the money supply remained with institutional investors, the aggregate value of shares would need to rise to £1,750 billion. The institutions would have liquidity amounting to £70 billion (the original £40 billion plus the new £30 billion) and the restoration of a 4% liquidity ratio would require share prices to rise until the total value of shares reached £1,750 billion. Share prices would rise by 75%.

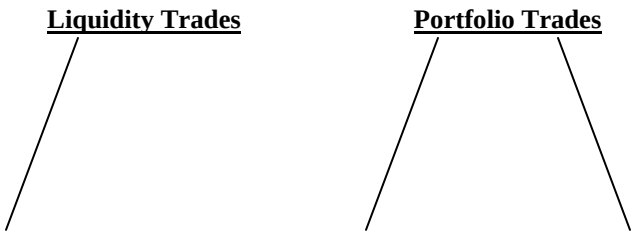
Types of Trade

Pepper and Oliver (2006) have suggested that stock market trades can be divided into portfolio trades and liquidity trades. They subdivide portfolio trades into information trades and price trades.

Portfolio trades are concerned with improving the prospective risk/return characteristics of a portfolio. They may entail selling some shares and buying others, or they may be switches between asset classes such as between cash and shares or between bonds and shares. Information trades are responses to news that has implications for share prices. Price trades are responses to price movements that are not justified by new information. Portfolio trades tend to ensure that share prices are efficient in the sense of accurately reflecting all relevant information.

Liquidity trades occur because investors have money to invest, or need to sell investments in order to raise money. Pepper and Oliver suggest that a major reason for liquidity trades is monetary imbalance in the sense of inequality between the demand for, and supply of, money. If people find that they are holding more money than they want, they may spend part of the surplus money on investments (shares, bonds, property). If they have less money than they need, investments may be sold in order to restore money holdings to the desired level. In these ways changes in the rate of increase of the money supply can affect share prices.

Liquidity and portfolio trades are depicted in figure 27.3**.**



Monetary Imbalance **Information trades** **Price trades**

Figure 27.3

Pepper and Oliver suggest that liquidity trades move the prices of shares (and other assets) away from their efficient levels so that prices no longer accurately reflect all available information. Price trades move prices back towards their efficient levels. Under-priced assets are bought, thereby pushing up their prices. Over-priced assets are sold, thereby pushing their prices down. Pepper and Oliver suggest that the volume of price trades is normally sufficient to restore prices to their efficient levels following disturbances arising from monetary imbalance.

Arguably this division of types of trade is incomplete. One omission is noise trading. This is trading based on irrationality, including trading based on irrelevant information or psychological biases. Figure 27.4 includes noise trading.

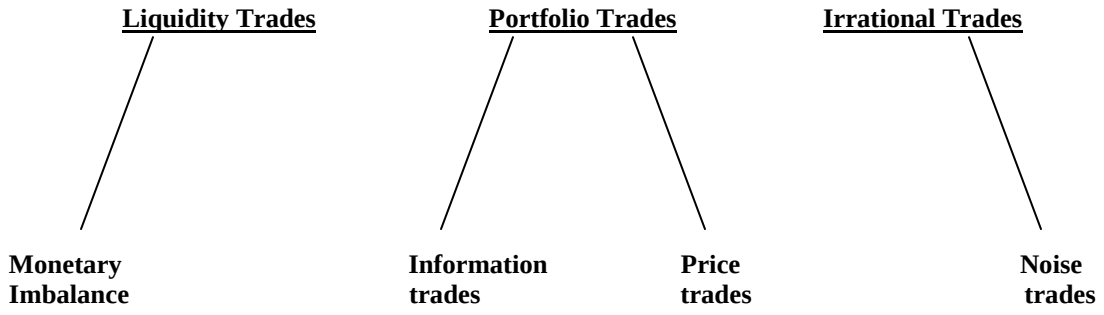


Figure 27.4

Noise trades might be regarded as irrational trades on an individual basis. Individuals may be affected by psychological biases such as the biases that lead to self-deception. Noise trading causes deviations of share prices from the efficient prices. Sometimes prices are above, sometimes below, dependent upon whether noise traders are net buyers or net sellers. The resulting movement of share prices around their efficient levels is noise. It may be that the prospective volume of price trades is sufficient to keep the level of noise to a low level. In other words price trading may be sufficient to prevent deviations from efficient prices becoming large.

Irrational trading is not always at an individual level. If investors operate as a crowd, herding can result. There can be synchronisation of investment behaviour. The irrational investors might be overwhelmingly buyers or overwhelmingly sellers. The result is powerful upward or downward pressures on markets. Price trades may be insufficient to offset the effects of herding with the result that there is a bubble or crash in share (or bond, or property) prices. Figure 27.5 adds herd trading to the diagram.

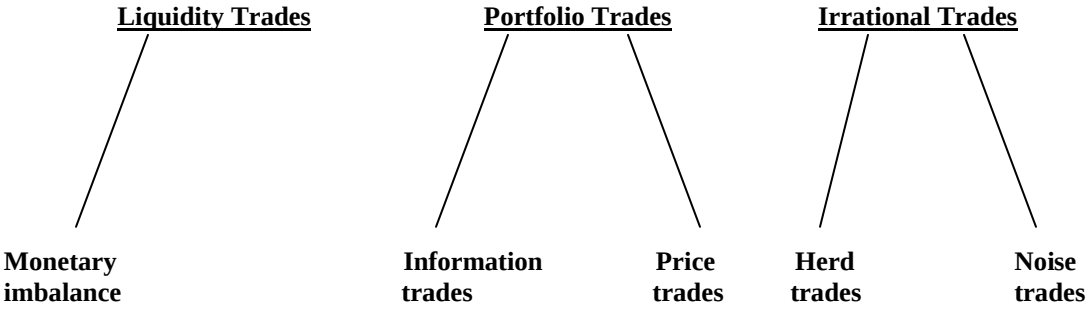


Figure 27.5

There may be another division to be made. Monetary imbalance is not the only source of liquidity trades. People save money and some of that saved money is invested. Savings provide a source of expenditure on investments. Net saving in an economy would tend to push up share prices. If the issue of new shares fails to keep pace, with savings available for investment in shares, the result would be an increase in share

prices. It is questionable whether price trades would offset a long-term accumulation of savings. Figure 27.6 includes net saving as a source of liquidity trades.

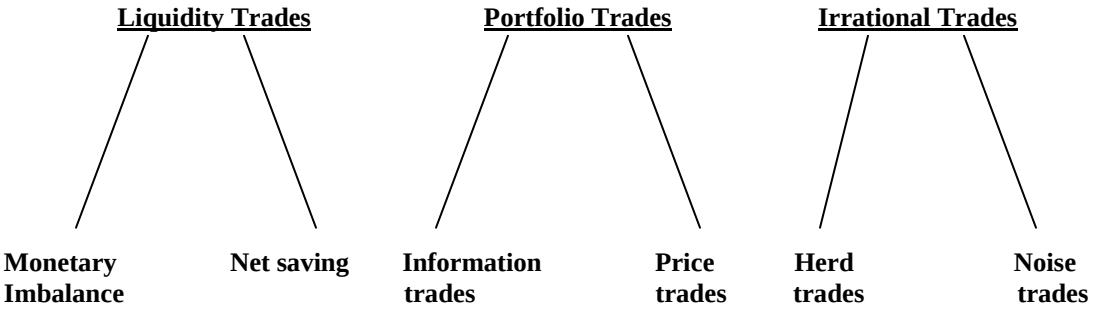


Figure 27.6

The portfolio trades tend to maintain market efficiency whereas the liquidity and irrational trades tend to disturb market efficiency. The maintenance of efficiency depends upon the relative power of these forces. In the case of long-term saving, a long-term upward trend in share prices and property prices (and fall in bond yields) might be expected if the cumulative level of net saving exceeds the cumulative issue of shares and bonds plus the cumulative construction of property.

Monetary Imbalance and Extrapolative Expectations

Pepper and Oliver suggest that, if monetary imbalance persists in one direction for a long period, extrapolative expectations can result. By extrapolative expectations is meant the tendency to expect that price changes will continue in the direction recently observed. Extrapolative expectations lead to momentum (positive feedback) trading with the effect that a price movement continues in a particular direction. The psychological bias of representativeness helps to explain the emergence of extrapolative expectations. If extrapolative expectations are widespread the result is herd trading, and herd trading can overwhelm any tendency for price trades to restore ‘efficient’ prices.

Price traders could become part of the momentum trading process. Maximising returns entails following prices upwards until they peak. Selling too soon causes a loss of potential profits. This is the idea of

rational bubbles, or the greater fool theory. It makes sense to buy overpriced investments if you expect that a greater fool will later buy at an even higher price. Rather than moderating price rises, price traders may accentuate the rises.

According to Pepper and Oliver a long period of rising prices is associated with an accumulation of investors who need to sell (since their holdings of money are less than the desired levels). Such investors may delay asset sales while prices continue to rise. A continuing rise in prices is likely to attract speculative investors who do not plan to hold the investments for the long term; Pepper and Oliver refer to their investments as being loosely held. A long period of rising prices would lead to many investors needing to sell shares in order to raise money for other purposes, and to many speculators with loosely held shares. When the expectation of price rises disappears, both groups of investors will sell. Share prices fall sharply.

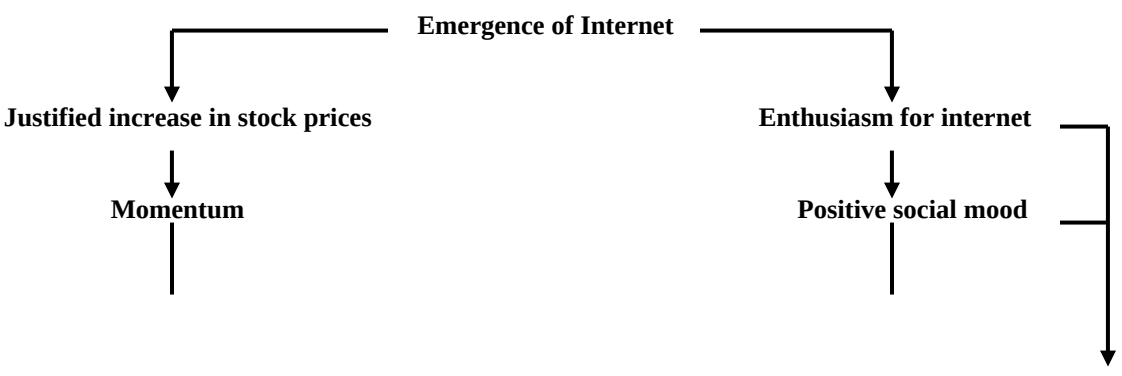
A Behavioural Model of the Dot.com Bubble and Crash

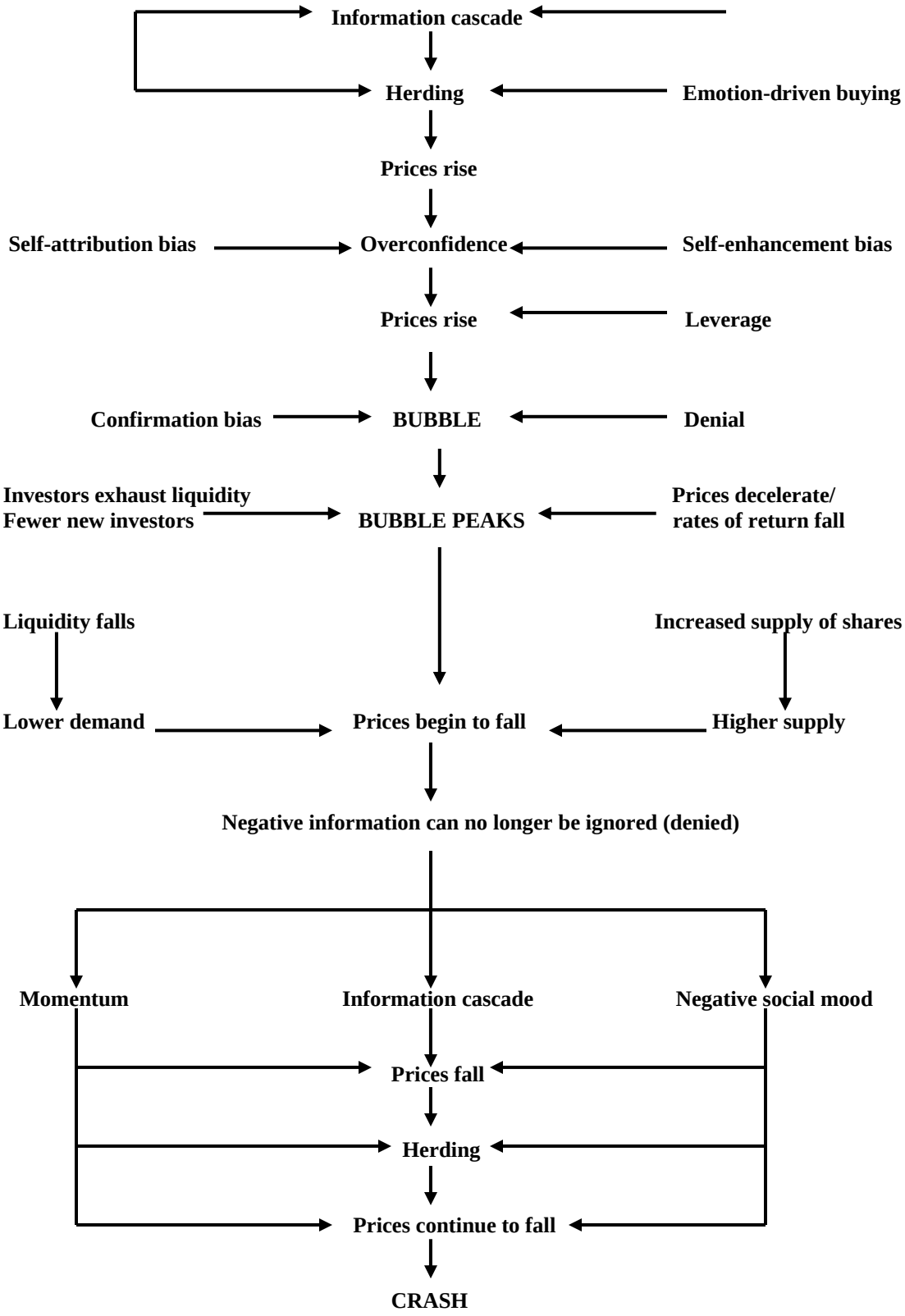
Exhibit 27.1 draws together ideas from this chapter, and from the chapter on the psychology of personal investment decisions, to suggest a description of the forces underlying the bubble and crash of the late 1990s and early 2000s. The bubble and crash was particularly clear in the case of technology stocks. The NASDAQ index, which focuses on technology stocks, rose more than six-fold between 1995 and early 2000. It then lost more than three quarters of its peak value by late 2002.

EXHIBIT 27.1

The following flow chart indicates how behavioural finance concepts could be used in an explanation of the dot.com bubble and crash of the late 1990s and early 2000s.

A BEHAVIOURAL MODEL OF THE DOT.COM BUBBLE AND CRASH




Information cascade
Herding
Emotion-driven buying
Prices rise
Self-attribution bias
Overconfidence
Self-enhancement bias
Prices rise
Leverage
Confirmation bias
BUBBLE
Denial
Investors exhaust liquidity
Fewer new investors
BUBBLE PEAKS
Prices decelerate/
rates of return fall
Liquidity falls
Increased supply of shares
Lower demand
Prices begin to fall
Higher supply
Negative information can no longer be ignored (denied)
Momentum
Information cascade
Negative social mood
Prices fall
Herding
Prices continue to fall
CRASH

The role of momentum in the development of the high-tech bubble was particularly significant according to Boswijk, Hommes and Manzan (2007). They divided investors into two groups. One group comprised fundamentalists who believed in the mean-reversion of stock prices towards a true (fundamental) value such that deviations from true values would be corrected. The other group consisted of trend followers who believed that a direction of price movement would continue. The proportions of investors in the two groups vary over time. The researchers found that in the late 1990s almost all investors were trend following, and that the dominance of trend followers persisted for several years. This is consistent with strong momentum in the formation of the bubble.

Portfolio Insurance

Portfolio insurance refers to the attempt to hedge a portfolio by simulating a put option. The purchase of a put option will provide the holder of the option with profits when stock prices fall. The decline in the value of a portfolio of stocks would be (at least partially) offset by profits from the option. The nature of a put option is such that the compensation for incremental falls becomes greater as the cumulative decline increases. Initially only a small part of the loss is covered, but after substantial falls the majority of any further falls are matched by gains on the option. Effectively the put option progressively reduces the exposure of the portfolio to the market as stock prices fall.

The same effect can be achieved by gradually selling stocks in response to falling stock prices with the effect that the exposure to the stock market is progressively reduced. This process is known as portfolio insurance, or dynamic hedging.

One effect of portfolio insurance is that falls in stock prices lead to sales of shares. Those sales cause further falls in the market and hence more sales. A vicious circle can develop. Price falls stimulate sales, which cause further price falls. This process can increase the intensity of a market decline, and possibly cause a crash.

In the presence of portfolio insurance, market rises can be reinforced. Price rises stimulate share purchases and hence further price rises. A virtuous circle can develop. Rising prices encourage purchases, which further increase prices and hence yet more purchases. This process can contribute to the development of a stock price bubble.

Research Using Experimental Markets

Laboratory experiments have been used to throw light on the development of bubbles and crashes, and in particular on whether they are based on 'rational' fundamental factors or 'irrational' behavioural factors. One problem with attempts to resolve this issue is that fundamental values (for example based on dividend discount models) are not observable in real market environments. Laboratory markets have the advantage of providing unambiguous fundamental values. The results of laboratory experiments, in which fundamental values are observable, might provide insights into analogous real-world markets.

Caginalp, Porter and Smith (2000) surveyed results from laboratory experiments on stock trading. One study, whose results were typical, provided participants with a share whose fair (i.e. true) price was very easy to calculate on the basis of a dividend discount model. Participants were then asked to trade the shares over two hours, which were divided into a total of fifteen periods. Demand and supply were matched in each period.

Although the share had an unambiguous value in each period, based on future cash flows, the price at which it traded deviated substantially from that value. Bubbles and crashes emerged from the trading. For example the trading of a group of business executives produced prices that varied between 20% of fair value and 630% of that value. It appears from such experiments that deviations of actual prices from fair, or fundamental, value can be long lasting.

Dufwenberg, Lindqvist and Moore (2005) reported that laboratory experiments had shown that bubbles tend to occur with inexperienced traders but not with experienced traders. The extent to which this provides insights into the operation of real markets depends upon whether real markets are dominated by

experienced or inexperienced investors. Dufwenberg, Lindqvist and Moore conducted experiments with mixtures of experienced and inexperienced traders. They found that bubbles were eliminated if at least one-third of participants were experienced. Since experienced investors probably dominate real markets, the implication is that bubbles are likely to be rare and unlikely to be caused by the relatively small proportion of inexperienced investors. They observed that bubbles and crashes in real markets were unusual (for example US stock markets had experienced just three clear cases in the twentieth century). They suggested that markets might be understood as being based on fundamentals for most of the time, with occasional lapses.

In general, the evidence from experimental trading (Caginalp, Porter and Smith) has indicated that speculative bubbles are more likely to emerge where:

1. The proportion of inexperienced traders is high.
2. The uncertainty about true (fair or fundamental) value is high.
3. The investment promises a small chance of profit, but that profit would be very high.
4. It is possible to finance purchases by borrowing money.
5. Short selling is difficult (i.e. it is difficult to borrow shares for the purpose of selling them).

It is interesting to note how well these characteristics describe the market in high-tech shares in the few years up to 2000.

The point about short selling was confirmed by Haruvy and Noussair (2006) who found that, in laboratory situations, short selling tended to reduce stock prices. They found that when short selling was easy, prices rarely rose above fair value and then only by small amounts and for short periods. Conversely they found that easy short selling made downward deviations from fair value more frequent, and larger. So although the removal of restrictions on short selling reduced the likelihood of bubbles, it increased the likelihood of crashes. The laboratory experiments of Haruvy and Noussair also confirmed another finding of Caginalp, Porter and Smith, which was the relationship between the supply of cash and stock prices. An increase in the amount of cash in the system causes a rise in prices. This relationship exists even when there are no

restrictions on short selling. The conclusion might be that rapid monetary expansion makes bubbles more likely and unrestricted short selling makes crashes more likely.

Complexity Theory as an Explanation of Bubbles and Crashes

Complexity theory comes from physics and seems to be able to explain a wide variety of natural events. Montier (2002) quotes Langton's description of complexity:

'From the interaction of the individual components …emerges some kind of global property…something you couldn't have predicted from what you know of the component parts. And the global property, this emergent behaviour, feeds back to influence the behaviour of the individuals…that produced it.' (Pp 138-9)

Complexity theory predicts two features of systems (referred to as complex adaptive systems). The first is that a power law captures the distribution of the probability of an event. A power law may be represented by the equation:

$$N = 1/s^{\tau}$$

In the case of stock markets N might represent the number of stock market crashes of a particular size and s might represent the size of the crash. It will be noted that an implication of the power law is that small crashes are relatively frequent whilst large crashes are rare.

The other feature that is predicted by complexity theory is that a crash is preceded and followed by periods of high volatility involving oscillations of increasing frequency and falling duration. It is suggested that this reflects increasing synchronisation of investor behaviour and that the crash results from nearly complete synchronisation (i.e. nearly all investors think and behave in the same way). When the market is distant from the crash investors are not synchronised with the effect that buyers and sellers tend to balance out. As the crash approaches there is increasing synchronisation of views concerning the direction of the market. When nearly everyone takes the view that the market will fall sellers overwhelm buyers with the result that prices fall dramatically.

Vandewaller, Ausloos, Boveroux, and Minguet (1999) demonstrated that, in the context of stock markets, there is a tendency for volatility to cluster around stock market crashes. Volatility tends to be high just before, and just after, a crash. Johansen and Sornette (1999, 2001) found that the pattern of (increasingly frequent) oscillations is characteristic of market bottoms as well as market peaks.

Others take the opposite view about volatility. For example Olsen (1998) and Schwartz (1988) suggested that it is divergence of opinion that leads to share price volatility. This increase in divergence of opinion would emerge during periods characterised by increased differences in decision-making processes. Differences in data perception, selection, weighting, and analysis lead to variations in opinion among investors. Panchenko (2007) provided evidence that heterogeneity in views is associated with increased volatility (also Shalen 1993). Panchenko described periods in which investment analysts issue heterogeneous recommendations as “analysts’ wars” and found that volatility was about twice as high during such periods than in “peace” periods.

Olsen suggests that standard finance theory has difficulty in explaining divergences of opinion; for example the efficient market hypothesis sees rational investors using all relevant information to establish stock prices that reflect all relevant information. There seems to be little scope for differences in opinion unless some investors have less information than others; in other words asymmetric information might be the only explanation, for differences in opinion, offered by standard finance theory. Behavioural finance suggests that differences in opinion are to be expected.

If all investors were provided with exactly the same information there would be differences in opinion about the direction of stock prices because of differences in the perception and interpretation of the information, differences in views about the relative importance of pieces of information, and differences concerning the appropriate way to analyse the information.

Olsen took the view that investment analysis is an example of ‘Complex, ill-structured tasks’, which are common in the social sciences. Complex ill-structured tasks are characterised by a lack of agreement

concerning what is relevant information and how it should be analysed. The wide variety of approaches to investment analysis is symptomatic of a complex, ill-structured task. Experts do little better than novices when dealing with such tasks. The chapters providing evidence on the performance of investment analysts and fund managers indicate that professional analysts and managers show little, if any, tendency to outperform passive strategies such as index tracking.

Investment analysis, as a complex ill-structured task, gives rise to considerable variety in opinions partly because of the wide variety of techniques of investment analysis. Such tasks are also likely to be subject to the psychological biases, emotional and social influences described in the chapters dealing with behavioural finance and the psychology of decision-making. Those chapters also indicate that such psychological and social factors can be particularly important in times of great uncertainty.

Complexity theory extends observations made in the natural sciences to the explanation of the behaviour of financial markets. Increasing synchronisation may be an appropriate explanation of increasing volatility in the study of inanimate matter, but the view that increasing volatility in financial markets arises from increasing differences rather than increasing synchronisation has intuitive appeal. High price volatility suggests alternate episodes of net buying and net selling, which seems more consistent with differences in opinion than with a developing uniformity of opinion.

The Fractal Market Hypothesis

Peters (1994) suggested that the Efficient Market Hypothesis (EMH) should be replaced by a Fractal Market Hypothesis (FMH). One feature of fractal analysis is that it allows for a multiplicity of investment horizons. This contrasts with the Capital Asset Pricing Model, which assumes that all investors have the same investment horizon.

Peters offered some basic assumptions of the FMH, including:

1. The market consists of many individuals covering a large number of investment horizons. At one extreme is the day trader who changes the investment portfolio on a daily basis, whereas at the

other extreme may be a pension fund that changes its portfolio slowly and has a long investment horizon. However both types of investor trade in the market, and they both provide liquidity for the other.

2. Reaction to information depends upon the investment horizon. Short-horizon investors and long-horizon investors react to different types of information. Correspondingly they may use different types of analysis; perhaps technical analysis in the case of short-horizon investors and fundamental analysis in the case of long-horizon investors.
3. The stability of the market depends on depth and liquidity, and a large number of investors with many different investment horizons create depth and liquidity in the market. A market crash, as perceived by a short-horizon investor, may be a buying opportunity when seen by a long-horizon investor. The sales of the former provide the purchases of the latter, and stability ensues. If long-horizon investors shorten their investment horizons, perhaps due to increased uncertainty, the liquidity and stability from the variety of horizons is reduced. When horizons become uniform a market bubble, or market crash, could ensue as all investors react to the same news in the same way.
4. Prices reflect a combination of short-term technical trading and long-term fundamental valuation. The long-term trend in the market reflects changes in expected earnings, which are likely to be related to economic cycles. Short-term trends are more likely to reflect crowd psychology. Economic cycles are less volatile than trading activity, which makes long-term stock market returns less volatile than short-term movements (Rachev, Weron and Weron 1999).

Catastrophe Theory as an Explanation of Crashes and Surges

Catastrophe theory has used the possibility of a backward-sloping demand curve for shares as an explanation of stock market crashes. Figure 27.7 shows the form of demand-and-supply model used. The curves 1, 2, 3, 4, and 5 are demand curves with both downward and backward sloping sections. Good news moves the demand curve to the right, and bad news moves it to the left. The general level of the market is represented by ‘Price’, which might be looked upon as the value of a stock index.

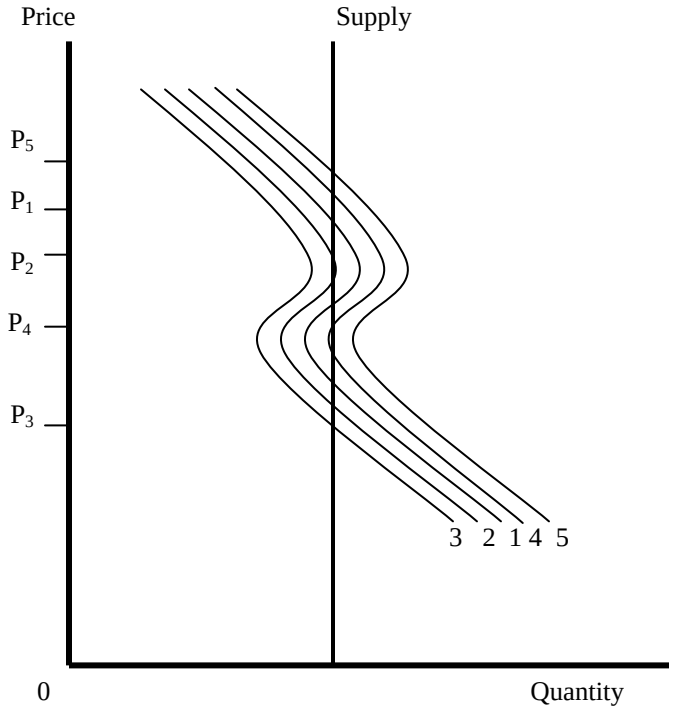


Figure 27.7

Starting from demand curve 1 and price P_1 (determined by the intersection of demand curve 1 with the fixed supply) bad news will move the demand curve to the left. When it has moved to the position of demand curve 2 the new price, P_2, is determined at the point of tangency of demand curve 2 and the supply function. Further bad news could produce demand curve 3 and a dramatic fall in price to P_3. The fall from P_1 to P_2 is gradual (continuous). When the demand curve moves to the left of curve 2 the fall in price to the new intersection of demand and supply functions is sudden (discontinuous). The jump in price from P_2 to P_3 constitutes a crash.

If the news then improves, the demand curve will move to the right. However a full recovery in share prices is not achieved from a move back to demand curve 2, or even demand curve 1. Since the crash is not easily

reversible, it is referred to as a catastrophe. It is called a catastrophe because the size of improvement of the news needed to reverse the fall is much greater than the size of deterioration that caused the fall. Correspondingly the model is an application of catastrophe theory.

If the news continues to improve, demand curve 4 and price P_4 might be achieved. There would be a point of tangency between the demand and supply functions. A further improvement in the news would cause demand to exceed supply until the price has risen substantially. If the news produces a move to demand curve 5, the result would be a sudden jump in price to P_5. There is thus a surge in share prices. The rise in price from P_3 to P_4 is continuous (gradual), whereas the rise from P_4 to P_5 is discontinuous (there is a jump in price).

So allowing for a section of the demand curve to be backward sloping leads to the prediction that there will be sudden (discontinuous) jumps in the general level of share prices. The question arises as to why a section of the demand curve should be backward sloping.

Leland (1987) developed a model similar to the one described here. Leland suggested that the backward-sloping section of the demand curve might be due to dynamic hedging (portfolio insurance). Dynamic hedging involves investors reducing their shareholdings in response to falling share prices (perhaps in an attempt to simulate a protective put option). So price falls lead to reduced demand for shares. Conversely price rises cause the hedge to be unwound, which entails buying shares.

Behavioural finance may provide explanations. The backward-sloping demand curve could be the result of investors extrapolating recent price movements, perhaps as a result of the representativeness bias. Recent falls are seen as indicating future falls, so investors sell (reduce demand) in response to falling prices. Conversely price increases raise demand for shares since they are seen as indicative of further increases in price. These behaviour patterns are likely to be reinforced by other psychological biases such as over-confidence, conservatism, and confirmation bias.

Other explanations may run in terms of the use of technical analysis. Falling prices may trigger a sell signal. If a majority of charts point to a fall in the market, there will be selling of shares. So price falls may be the cause of a fall in demand for shares. Conversely rising prices could provide a buy signal with the result that a price rise stimulates additional demand.

Price Bubbles and Banking Crises

Crashes not only hurt investors, they can also damage banks. Slumps in stock prices can be detrimental to banks, particularly if banks have bought shares as well as lending to other buyers. The American stock market crash of 1929, and the Japanese stock market slump of the 1990s, involved stock price falls impacting on banks. However stock market crashes do not always severely damage banks.

Property price slumps nearly always damage the banks. This is because property speculation is primarily financed with money borrowed from banks. Bubbles in property prices are typically based on borrowing from banks. Property developers and speculators finance their purchases by borrowing. The purchased property is used as collateral for the loans.

So long as property prices continue to rise interest payments can be made, and loans repaid. When prices stop rising, problems appear. If interest is paid out of the profits from price rises (or from increased borrowing based on the enhanced collateral), a pause in the rises means that interest cannot be paid. Banks may then require loans to be repaid.

The developers and speculators may then sell property in order to pay off the loans. The property sales cause prices to fall. The fall in property prices reduces the value of the collateral. As a result banks demand repayment of loans. More property is sold, prices fall further, collateral declines further, and the banks demand more repayment. There is a downward spiral leading to bankruptcy of property developers and speculators. The values of their properties fall below the values of their debts. Such bankruptcies mean that bank loans are not fully repaid. The banks lose money. The Japanese property market slump and banking crisis of the early 1990s involved banks being severely weakened by such a process.

Banks lend money to each other. If one bank became bankrupt, the banks from which it had borrowed would lose money. There could be a domino effect wherein the collapse of some banks causes others to fail. This systemic effect could lead to a collapse of the whole banking system.

The prospect of banks failing might cause depositors to panic and attempt to withdraw their money. If depositors rushed to withdraw their money, banks could run out of cash and hence be unable to pay out the money. This is especially so since bank loans normally are not repayable on demand, and so banks cannot get their money back quickly. Failure to pay depositors would increase the sense of panic and encourage more attempts to withdraw cash. Such a run on the banks by depositors wanting to withdraw cash would hasten the collapse of the banks. Such behaviour by depositors was a feature of the American banking crisis that followed the Wall Street crash of 1929.

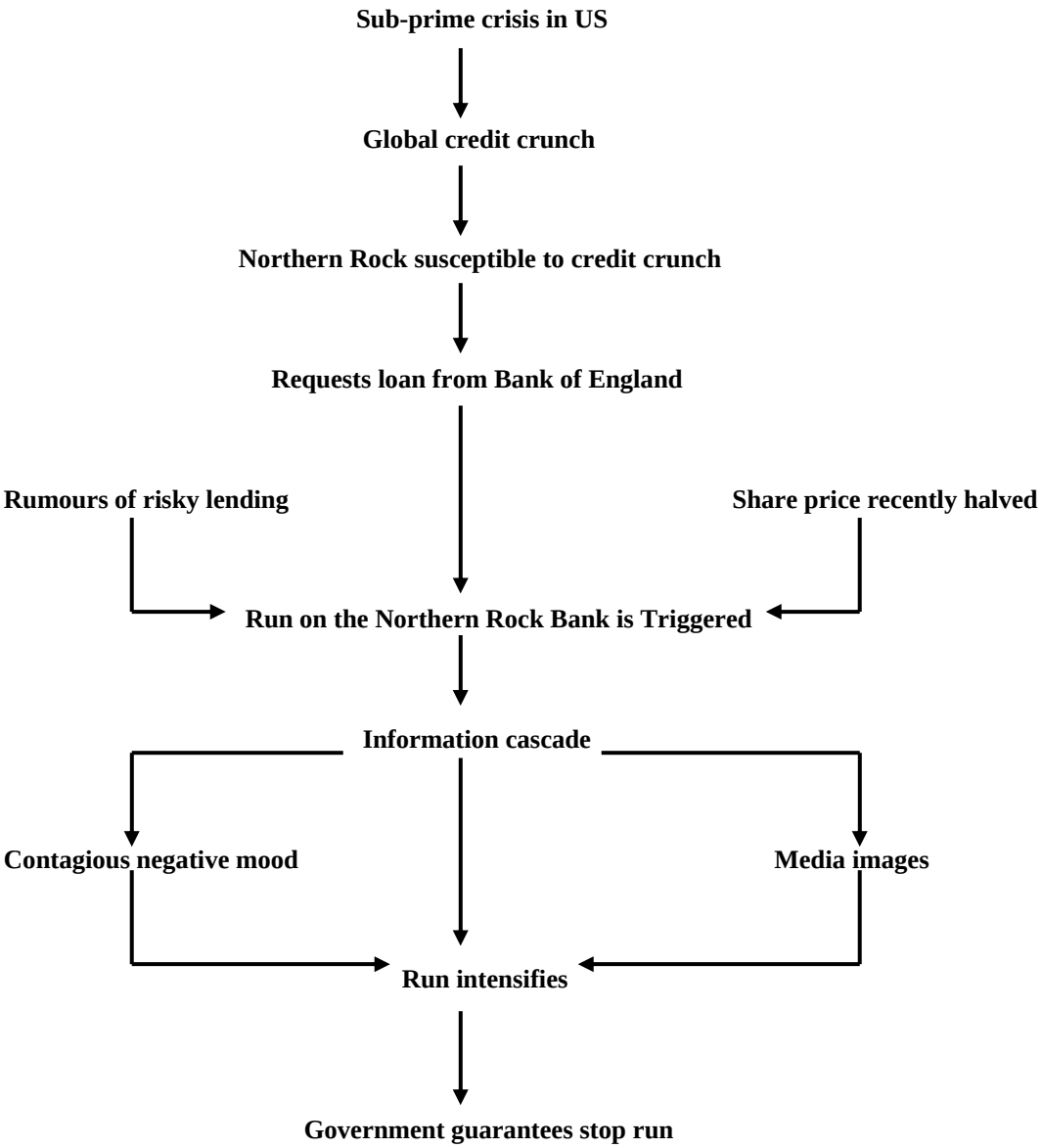
The possibility of a run on the banks is one reason why central banks, such as the Bank of England, act as lenders of last resort. This means that they will lend to banks in an emergency so that banks can pay their customers. Governments also often guarantee that bank deposits will be repaid in order to avoid the panic that leads to runs on the banks.

Even if banks do not collapse (and normally they do not), the effect of losses on their capital can cause a credit crunch. A credit crunch is a situation in which banks stop making new loans (or at least reduce the amount of new lending). A credit crunch may also entail the refusal to renew many loans, with the effect that the borrowers must repay the loans when those loans reach their maturity dates. Investors may become forced sellers if they need to sell assets in order to repay loans. If a fund has financed investments by means of borrowing from a bank, the refusal of the bank to renew the lending could force the fund to sell assets. Such forced selling puts downward pressure on asset prices and would exacerbate a crash. A credit crunch can bring about contagion between asset markets. For example in the summer of 2007 banks reduced lending, and refused to renew some maturing loans, because they feared that the borrowers held assets backed by subprime mortgages. Many borrowers became forced sellers since they needed to sell assets in

order to repay the borrowed money. The forced selling extended to stocks and the sales of shares contributed to sharp falls in stock markets.

EXHIBIT 27.2

THE RUN ON THE NORTHERN ROCK BANK IN AUGUST 2007



Conclusion

Arguably the strongest evidence against the Efficient Market Hypothesis is the existence of stock market bubbles and crashes. Whilst there is a wide variety of views about what causes, and what drives, bubbles and crashes few observers suggest that they are caused by new information coming into the market. Such is the width of explanations for bubbles and crashes that some explanations come from physics (phynance) and some from biology using models of disease contagion. Models of contagion seem to fit comfortably with the concepts of information cascades and herding as explanations of investor behaviour during bubbles and crashes.

The concept of 'rational bubbles' suggests that the emergence of stock market bubbles is consistent with rational behaviour. It may be rational for investors to buy shares, which they believe to be overpriced, so long as they expect to sell them at an even higher price. Weighing the expectation of profit against the possible loss in the event of price falls could lead to the conclusion that prospective profits outweigh possible losses (when both are weighted by probability of occurrence). It could be rational to buy in an overpriced market.

Another mechanism that does not depend on irrational behaviour is portfolio insurance. During the 1987 stock market crash some institutional investors simulated the purchase of put options. This simulation involved selling stock as the market fell, thereby reinforcing the downward movement in prices.

Behavioural finance suggests that the occurrence of stock market bubbles and crashes stems from irrational behaviour on the part of investors. The concept of positive feedback trading, reinforced by the representativeness bias, seems to provide a driving force that causes stock market prices to overreact. Laboratory experiments have shown that bubbles and crashes tend to emerge from trading behaviour, particularly in the presence of relatively naïve investors.

Another possible driving force comes from money supply changes. A bubble could be generated by a rapid growth in money supply. The additional money is partially spent on assets such as shares and property,

thereby producing asset price inflation in stock and property markets. The effect of money supply changes could then interact with positive feedback trading (based on extrapolative expectations) reinforced by representativeness.

A catastrophe is an event, which whilst caused by a minor occurrence is not remedied by a reversal of the minor occurrence. The application of catastrophe theory to the explanation of stock market bubbles and crashes requires the demand curve for shares to have a backward bending section. A backward bending section could be explained in terms of either portfolio insurance or behavioural finance.

Further reading.

Readers who would like to further pursue their studies of behavioural finance may find the following books interesting.

Montier, J. (2002), 'Behavioural Finance'. Wiley.

Montier, J. (2007). 'Behavioural Investing: A Practitioner's Guide to Applying Behavioural Finance', Wiley.

Nofsinger, J.R. (2005). 'The Psychology of Investing', (2nd Ed.). Pearson Education/Prentice Hall.

Shefrin, H. (2000). "Beyond Fear and Greed: Understanding Behavioral Finance and the Psychology of Investing". Harvard Business School Press.

Shiller, R.J. (2005). 'Irrational Exuberance', (2nd Ed.). Princeton University Press.