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# **Share price deviations from fundamentals**

By

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## **Abstract**

Financial markets play a vital role in the allocation of funds for investment at all levels of economic activity. Therefore, an understanding of the functioning of financial markets is a critical business skill. Yet, history proves financial markets to be erratic creatures.

The purpose of this research report was to determine whether stock prices always reflect fundamentals or whether they display persistent deviations from their long-run equilibrium fundamental values due to irrational investor behaviour. The research was limited to earnings and dividends in terms of fundamentals and under- and overreaction in terms of investor behaviour.

A two-regime non-linear dynamic model was applied to quarterly data of stock price, dividends and earnings for companies listed on the JSE Securities Exchange (“the JSE”) from 1980 to 2007.

The results of the study demonstrate that although the South African equity market is not totally extreme, it contains quite substantial short-term noise. This outcome provides a compelling case for value investing. Against this backdrop, recommendations were made to individual investors and corporate managers.



## **Declaration**

I declare that this research project is my own work. It is submitted in partial fulfilment of the requirements for the degree of Master of Business Administration at the Gordon Institute of Business Science, University of Pretoria. It has not been submitted before for any degree or examination in any other University.

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**Elpiniky Catrakilis-Wagner**

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## Chapter 1

### 1. Introduction

#### 1.1. The role of financial markets

Financial markets play a vital role in the allocation of funds for investment at all levels of economic activity. For instance, financial markets play a central role in facilitating international capital flows between countries. Relevant examples are the rush of funds out of Asia during the late 1990s and into China over the course of the past decade; in turn, the Chinese have played a central role in supporting the United States bond market by being substantial buyers of that country's government debt in recent years.

Similarly, and at the other extreme, financial markets assist decision-making at the level of the firm. For example, one of the principal means by which companies finance new investments is by placing equity with investors. This process can occur through a variety of mechanisms, but it is dominated by the listing of equity on public stock exchanges. According to research conducted by Ernst & Young, the volume of initial public offerings on the JSE increased by 200 percent in the third quarter of 2007 and the outlook for the rest of the year promises to be even brighter (Nyamakanga, 2007). Therefore, whether viewed from a macroeconomic or microeconomic perspective, an understanding of the functioning of financial markets is a critical business skill. Yet, history proves financial markets to be volatile, impulsive and turbulent or, quite simply, erratic creatures resulting in share price deviations from the fair value derived from the business' underlying fundamentals. The dot.com bubble, the US\$7.4 trillion

decline in North American equity values recorded over the period 2000 to 2001, the current oil crisis and precious metals price spikes provide cases in point.

It is this volatility that has brought the legitimacy of the efficient market hypothesis under disrepute and prompted many to turn to behavioural theories in an attempt to understand these anomalous outcomes (Hong and Stein, 1999).

## **1.2. Research Problem**

Supporters of the efficient market hypothesis argue that markets are efficient because investors are highly informed, a large degree of consensus exists about securities' values and investment analysis is costly (Francis and Ibbotson, 2002; Saville, 2007). Moreover, it is pointed out by this group that even if sophisticated investors possess the ability to identify and time investment opportunities, these advantages are eroded by transaction costs and taxation, and potentially further diluted by the higher risks brought about by market timing (Saville, 2007).

Accordingly, sophisticated investors are unlikely to yield superior returns because, in the presence of a large number of knowledgeable investors, the prices of undervalued assets will be bid up quickly whilst the prices of overvalued assets will be forced down (Saville, 2007). If this holds, assets will be fairly valued at any time making excess returns impossible (Saville, 2007).

In addition, even if markets are semi-efficient, subscribers to the efficient market school of thought contend that competition for investment opportunities means that only serious analysis and uncommon investment techniques are likely to generate the differential insight needed to earn abnormal returns (Saville, 2007). Thus, the widely held view is that, to be successful, sophisticated investors must be “armed with the best research money can buy, and legions of well-trained, battle-hardened colleagues” (Dreman, 1998, 31; see also Saville, 2007).

Based on these arguments, supporters of the efficient market hypothesis hold that the optimal investment approach is to simply match the market’s performance because, over time, investors are unable to persistently beat the market (Ball, 1994; Summers, 1996; Saville, 2007). The bulk of the available evidence shows that over reasonable investment periods about three-quarters of professional fund managers are consistently beaten by the market (Saville, 2007). More detailed studies provide equally compelling evidence. Jensen (1968) investigated 115 mutual funds in the United States of America over the period 1955-1964 and found that no funds significantly outperformed a passive buy-and-hold strategy. Malkiel (1999) reached a similar conclusion. He studied every equity mutual fund in the United States of America from 1971-1991 and found that none of them managed to beat the market.

Considering the South African case, although the evidence is unfortunately thin, the data point to the same conclusion as the international evidence. Knight and

Firer (1989) found that between 1977 and 1986 just two of ten funds performed better than the overall market on a risk-adjusted basis.

### **1.2.1. When markets deviate**

If markets are efficient, as the above mentioned evidence implies, then events like market crashes and euphoria-driven bubbles are hard to explain (Saville, 2007). This is even more acute when the exuberance of the high-tech stock bubble and the crash of the late 1990s are still fresh in investors' minds (Goedhart, Koller and Wessels, 2005). The view that investors can fundamentally change a market's course through irrational decisions has moved into the mainstream (Goedhart *et al.*, 2005). Moreover, the historical episodes of widespread euphoric speculation, followed by steady and sometimes sharp declines in stock markets have made it easier for adherents of the behavioural school to spread the belief that markets can be something less than efficient in immediately distilling new information and that investors, driven by emotion, can indeed lead markets awry and result in the deviation of share prices from fundamentals (Goedhart *et al.*, 2005).

### **1.2.2. The implications**

The implications of share price deviation from fundamentals, which have already been briefly mentioned, are threefold. Firstly, it has implications for individual investors and fund managers. Equities constitute the top performing asset class, globally (Saville, 2007). However, over the past ten years 60 percent of equity funds based in the United Kingdom have underperformed the FTSE All-Share Index while 75 percent of global equity funds have lagged the

Morgan Stanley Capital International (“MSCI”) Index (Investec Asset Management 4Factor Equity Team, 2006). This is an unfortunate and expensive result for investors because it means that investors are able to only partially harness the powerful force of compound equity returns (Saville, 2007).

The second implication relates to corporate financial policy and the relevance of traditional valuation tools, such as the capital asset pricing model, the dividend discount model and the Q theory of investment, which presumes that asset prices can be used to reflect the present value of future earnings (Summers, 1986). The relationships that exist between the economy, asset markets and investment valuation methods are critical in determining how assets are valued and how investment decisions are affected in the business setting.

Thirdly, the deviation of share prices from fundamentals has macroeconomic implications particularly in view of the fundamental role financial markets play in the real economy (Santomero and Babbel, 1997). In combination, the various parts of the financial markets permit an economic system to allocate money to its highest and best use and therefore improve the use of an economy’s scarce resources (Santomero and Babbel, 1997).

### **1.3. Research Objective**

For these reasons, an empirical analysis is conducted on quarterly data of stock price, dividends and earnings for companies listed on the JSE. The objective is to determine whether financial markets are indeed efficient and always reflect fundamentals or whether they display persistent deviations from their long-run

equilibrium fundamental values due to irrational investor behaviour (Coakley and Fuertes, 2006). The research attempts to shed light on share price deviations from fundamentals by taking into account the stock market cycles and humans' ability to overreact (Cooper, Gutierrez and Hameed, 2004; Coakley and Fuertes, 2006).

In order to impose some discipline on the research process, the scope of the research is articulated by defining behaviour in terms of market cycles, namely bull and bear markets while fundamentals take the form of valuation ratios, that is the price-earnings (P/E) ratio and price-dividend (P/D) ratio (Coakley and Fuertes, 2006).

Chapter two provides a detailed review of the literature beginning with the efficient market hypothesis, the evolution thereof and the subsequent anomalous outcomes. With the absence of an efficient market outcome, the investment finance literature turned its attention to finding explanations, which lead to the birth of behavioural finance (Saville, 2007). To this end, the literature review concludes with a detailed overview of behavioural finance theory.

## Chapter 2

### 2. Theory and Literature Review

#### 2.1. Introduction

A number of behavioural theories have been developed to explain share price deviations from apparent fair value derived from fundamental factors (Cooper *et al.*, 2004). As a prelude to the behavioural theories, the literature review begins by examining the efficient market hypothesis, which successfully introduced competitive economic theory to the study of stock prices and paved the way for a flood of empirical research on the relation between information and stock prices (Ball, 1994).

The efficient markets hypothesis reached its height of dominance in academic circles around the 1970s (Shiller, 2003). At the time, the rational expectations revolution in economic theory was in its first rush of enthusiasm, a fresh new idea that occupied the centre of attention (Shiller, 2003). Prominent finance models of the 1970s related speculative asset prices to economic fundamentals, using rational expectations to tie together finance and the entire economy in one elegant theory (Shiller, 2003).

In spite of the theoretical revolution, the same decade saw the beginnings of some disquiet over these models and a tendency to push them aside in favour of a more diverse way of thinking about financial markets and the economy (Shiller, 2003). The literature review tracks the evolution and development of this thinking by focusing on investor behaviour and the impact thereof which is apparent in recent empirical evidence.

## **2.2. Efficient Market Hypothesis**

The proposition, that stock markets are efficient forms the basis for most research in financial economics (Summers, 1986). As such, voluminous literature has developed supporting this hypothesis (Summers, 1986).

A review of the literature by Ball (1994) confirms that little research had been done on stock prices before the theory of efficient markets was developed. The impetus for the development of a theory came from the accumulation of evidence in the middle 1950s and early 1960s that the behaviour of common stock prices and the prices of other similar asset prices could be well estimated by a random walk, implying that if new information develops randomly, then so will market prices (Fama, 1970; Malkiel, 2005). Faced with the evidence, economists felt compelled to offer some rationalisation (Fama, 1970).

### **2.2.1. Defining market efficiency**

The term “efficient market” was first used in the context of stock markets by Fama (1965, 4), who defined it as:

... a market where there are large numbers of rational, profit-maximisers actively competing, with each trying to predict future market values of individual securities, and where important current information is almost freely available to all participants ...

implying that, on average, competition will cause the full effects of new information on fundamental values to be reflected immediately in actual prices (Fama, 1965; Ball, 1994). Information was central in this definition and in the subsequent formal models that were developed (Fama, 1965; Ball, 1994).

The first attempt at a formal model of public information was formulated by Fama (1970) and was based on the concept of market information use (Fama, 1965). It was also based on the following conditions: (i) there are no transaction costs in trading securities, (ii) all available information is available free of charge to all market participants, and (iii) all agree on the implications of current information for the current price and distributions of future prices of each security (Fama, 1970). His clear intent was to formalise the “fully reflect” notion (Fama, 1970). He therefore argued that a market is called “efficient” if investors who possess information earn only an expected return from investing and that the information does not alter their expected returns (Fama, 1970; Ball 1994). This proposition gave rise to the fair game model, also referred to as the expected return model (Fama, 1970).

### **2.2.2. Expected Return or “Fair Game” Models**

The fair game model is based on the assumption that the conditions of market equilibrium can be stated in terms of expected returns (Fama, 1970). The conditional expectation however implies that the specific information set is fully utilised in determining equilibrium expected return. The information set is therefore, fully reflected in the price (Fama, 1970). To this end, the early empirical research on the theory of efficient markets was concerned with the issue of whether prices fully reflect particular subsets of available information. The initial studies were concerned with what is known as weak form tests in which the information subset is only historical price or return sequences (Fama, 1970).

### **2.3. The evolution of market efficiency**

According to Fama (1970), however, the empirical work began to evolve when extensive tests seemed to support the efficiency hypothesis at the weak form test level. Attention was turned to semi-strong form tests where prices are assumed to fully reflect all obviously publicly available information, for example, announcement of stock splits, annual reports or new security issues (Fama, 1970). Finally, subsequent research focused on strong form tests where prices are assumed to fully reflect all available information (Fama, 1970).

While this was the first recognition that efficiency must be defined with respect to a particular information set, it was unfortunately understood in terms of statistical rather than economic properties of information (Ball, 1994). As the concept and the modelling began to attract criticism, a sequence of papers followed, giving tighter specification to equilibrium in the context of market efficiency (Ball, 1994). Beaver (1968) refined the definition of market efficiency with respect to an information item to mean that prices act as if everyone knows the information (Beaver, 1968; Ball, 1994). As an extension to Beaver's work, Latham (1986) argued that it is logically possible for information to cause offsetting revisions in individual investors' portfolios, without any net effect on surplus demand and therefore prices (Latham, 1986; Ball, 1994). Information, for example, could cause two investors to make precisely offsetting buy and sell decisions (Ball, 1994). He therefore, defined efficiency relative to some information set if revealing it to all agents would change neither equilibrium prices nor portfolios (Latham, 1986; Ball, 1994).

The sequence of related research developed the efficiency construct down a different path to Fama's (Ball, 1994). Most noticeably, Fama speaks of the market using information to establish prices, whereas the more formal definitions are expressed in terms of individual investors' reactions to prices (Ball, 1994). Either way, the role of information remained pivotal to the definition. In particular, the cost of producing information, specifically because competitive markets allocate different returns to public and private information (Ball, 1994).

#### **2.4. The role of information acquisition and processing costs**

Fama, Fisher, Jensen and Roll (1969) pioneered a model that expanded the early empirical work to include publicly-available information such as stock splits or earnings (Ball, 1994). According to Fama *et al.* (1969) publicly-available information is defined as information that is accessible to all investors at precisely zero cost. While earnings reports, for example, are costly for firms to produce initially, once made public they are approximately costless for many investors to reproduce (Ball, 1994). Basic economic models, ignoring transaction costs, imply that average revenue and cost are equal in competitive equilibrium (Fama *et al.*, 1969; Ball, 1994). The implication of this theoretical construct is that if the cost of reproducing public information is zero, then so are the expected gains (Fama *et al.*, 1969; Ball, 1994). Security prices therefore should adjust to information at the first trade after it becomes publicly available (Ball, 1994). The consequential abnormal returns should be experienced entirely by owners of securities at the time of the announcement (Ball, 1994). In contrast, a competitive market would allow private gains from producing costly

private information, since there is no such thing as precisely costless economic good (Ball, 1994).

The economic construct of privately-costless public information in the early empirical research was only represented by announcements in, for example, the Wall Street Journal or on the New York Stock Exchange (“NYSE”) ticker tape (Ball, 1994). While such information is not precisely costless to acquire and process by investors, it is assumed to be so (Ball, 1994). If this assumption is approximately correct, then the competitive return for incurring information costs would be small relative to observed rates of return which are predicted to be zero (Ball, 1994).

Against this backdrop Ball (1994) argues that, from a theoretical angle, the more formal models seem to confuse properties of information with properties of markets, especially in the treatment of information that is publicly-available. Accordingly, information that is publicly available is costless for all investors to acquire and process (Ball, 1994). In reality however, not all investors can be expected to be fully informed free of charge (Ball, 1994). Correctly interpreted, this is a statement about information, not about market efficiency (Ball, 1994).

Privately-held information, on the other hand, is by definition costly and thus potentially valuable (Ball, 1994). In the formal models, all markets are therefore, logically inefficient (Ball, 1994). The existence of competitive rewards for effort implies that investors’ private information on average has positive value, so placing it in the public domain will alter prices (Ball, 1994). Thus, all

real world markets would be judged inefficient with respect to all valuable private information but only because the information is costly to produce, supply and obtain and not because of properties of the markets themselves (Ball, 1994). Even with privately held information, the proposed definition deals with properties of information and not of markets (Ball, 1994).

There are several costs to investors for acquiring and processing information. Ball (1994) distinguishes between two types of costs. First, there is the cost to an investor of re-producing information, including the costs of acquiring and processing it (Ball, 1994). This is relevant because competitive economics predicts a relation between costs and rewards (Ball, 1994). The concern, however, is with the validity of assuming that a particular historical datum was approximately costless to acquire and process, at the time (Ball, 1994). For example, is it valid to assume that a sophisticated computerised trading strategy developed from research available in 1990 was costless to process in for example, 1946, when information processing costs were orders of magnitude higher (Ball, 1994)? This assumption is implicit in using abnormal stock returns from the strategy during 1946 as evidence of inefficiency (Ball, 1994).

Moreover, the initial event studies considered simple, publicly available information that is widely distributed in the financial press, on the wire services, to analysts and to other investors (Ball, 1994). The cost to individual investors of acquiring public-domain information was assumed to be negligible (Ball, 1994). The information also assumed to be simple to use, with negligible processing cost (Ball, 1994). If there are competitive returns to negligible

information costs, then they will have a negligible effect on expected returns and will be lost in the noise of exogenous price variability (Ball, 1994).

The second cost is the cost of transacting on the basis of information (Ball, 1994). The cost of operating the market mechanism is relevant because the economic tradition underlying the prediction of a cost-reward equation assumes frictionless markets (Ball, 1994). From this perspective, it is unacceptable to view markets as being absolutely costless to operate (Ball, 1994). Although markets as an institution are cost-minimising, they are not cost-eliminating (Ball, 1994). In contrast, the basic economics that motivated the early work on stock market efficiency assumes that markets are frictionless (Ball, 1994). While markets are not made uncompetitive by information production costs, the roles of transaction and information production costs in the theory of efficient markets is far from clear (Ball, 1994). To this end, information acquisition and processing costs have received scant attention in the theory and empirical research on stock market efficiency, even though the subject of the theory is the market's reaction to information (Ball, 1994).

## **2.5. Heterogeneous information and beliefs**

A related area in which the efficient market hypothesis is deficient is its mechanical characterisation of markets as machines driven by objective information engines (Ball, 1994). According to the hypothesis, investor beliefs play no role, information is a homogenous commodity and hence the information variable carries no subscript allowing it to vary across individuals (Ball, 1994). Accordingly, publicly available information is not processed in

different ways by different investors, individuals and institutions included and thus it has identical implications for all (Ball, 1994). Private information is essentially unmodelled, because its production function is not specified (Ball, 1994).

## **2.6. The accomplishments of the Efficient Market Hypothesis**

The efficient market hypothesis was an audacious and welcome change from the comparative ignorance of stock market behaviour that preceded it (Ball, 1994). The early work on efficiency coincided with the emergence of interest in and respect for markets in general among economists (Ball, 1994). Therefore, the early empirical work assumed importance and attracted interest beyond its direct implications for stock markets (Ball, 1994). It influenced the worldwide move toward liberalising financial and other markets (Ball, 1994).

From an academic perspective, the primary accomplishment of the theory of efficient markets was opening up the stock market as a legitimate domain of scholarly research and in particular of economic thought (Ball, 1994). Characterising the market in terms of its reaction to information introduced economic theory to an important market that, until that time, had received little serious attention from economists (Ball, 1994). Together, the theory and evidence on efficiency demonstrated, for the first time, that share price behaviour could be viewed as an economic phenomenon (Ball, 1994). This proved to be an important breakthrough in influencing the climate for other financial-economic theories (Ball, 1994).

Consequently, three broad areas of financial-economic enquiry were pioneered at around the same time: efficient market theory; the Sharpe (1964) and Lintner (1965) models of asset pricing; and the theories of corporate financial policy of Miller and Modigliani (1961, 1966). The seemingly consistent evidence of market efficiency offered strong support for ideas that shared similar assumptions about the efficacy of financial markets (Ball, 1994).

Without the robust body of empirical research on efficiency as background, it is not clear why the equilibrium-based reasoning of the Sharpe-Lintner capital asset pricing model, and the Black and Scholes (1973) option pricing model, would have been so readily and quickly embraced (Ball, 1994). Efficiency theory and asset-pricing theory assumed rational behaviour in frictionless markets, and so the two bodies of thought closely overlapped at the time (Ball, 1994). Both studied stock returns, without reference to underlying factors such as consumption and aggregate production (Ball, 1994). A specific contribution of the early work on efficiency thus was setting a receptive climate for the Sharpe-Lintner model, on which much literature has been built (Ball, 1994).

Similarly, a considerable literature has been built on the work of Miller and Modigliani (Ball, 1994). Their “irrelevance propositions” were developed over approximately the same period as ideas on efficiency and both used the basic reasoning of competitive economic theory, yet only the efficiency ideas were easily testable (Ball, 1994). In this context, scholars were also more receptive to largely untested ideas as a result of the consistent evidence in the closely-related area of efficient markets (Ball, 1994).

At a more concrete level, the efficient market hypothesis has had a startling impact on the practice of finance (Ball, 1994). Among portfolio managers, the notion that stock markets are fiercely competitive helped initiate a range of performance measurement methods and services (Ball, 1994). Index funds, which simply buy the market bundle of securities on the assumption they are correctly priced relative to each other, are now familiar methods of investment but were unheard of, and would have been almost unthinkable, before the work on efficiency (Ball, 1994). The expanding volume of corporate hedging, a strategy which is based on correct pricing rather than speculations, owes much to the idea that private information is a valuable economic good that, like physical goods, can be stolen (Ball, 1994). This concept, together with an appreciation of how information flows into stock prices, has also influenced disclosure policies (Ball, 1994). It is now common for corporations to release between two and six different earnings numbers (Ball, 1994). For example, including and excluding earnings from businesses that were sold during the period leaving it to users to digest the full range of information (Ball, 1994). The pre-efficiency mentality, however, was for accountants not to trust users' decisions and thus to choose the earnings number for them (Ball, 1994).

Ironically, the one unachievable accomplishment of market efficiency research is an indisputable answer to the question of whether stock markets are efficient (Ball, 1994). As a model of how stock prices in a competitive market behave in relation to information, market efficiency has failed to fully explain how the market behaves (Ball, 1994). In spite of the rapid accumulation of much seemingly supporting evidence, the subsequent amassing of significant

anomalous evidence, directly or indirectly called the efficient market hypothesis into question (Ball, 1994). The documented anomalous evidence proved the underlying theory to be flawed (Ball, 1994).

## **2.7. From Efficient Markets Hypothesis to Behavioural Finance**

By the 1970s the anomalous evidence was being documented. Finance journals from that time show the beginnings of reports of anomalies that did not seem likely to square up with the efficient market hypothesis, even if they were not presented as significant evidence against the theory (Shiller, 2003). These included apparent under- and overreaction and the variation of expected returns as a function of day-of-the-week, month, size, market-to-book ratio, and dividend yield, earnings yield and other variables that were difficult to rationalise (Ball, 1994). The discounts on closed end mutual funds and the success of trading rules based on earnings announcements were treated as indications of the failures of the fair game model, rather than as evidence against the hypothesis of market efficiency (Summers, 1986).

In addition to the related anomalies, the efficient market model for the aggregate stock market had still never been supported by any study effectively linking stock market fluctuations with subsequent fundamentals (Shiller, 2003). This resulted in some disquiet over these models and a tendency to push them aside in favour of a more diverse way of thinking about financial markets and the economy (Shiller, 2003).

### **2.7.1. The 1980s and excess volatility**

The 1980s were a time of important economic discussion in terms of the consistency of the efficient markets model with specific reference to the aggregate stock market (Shiller, 2003). Of particular concern was whether markets show excess volatility relative to what would be predicted by the efficient markets model (Shiller, 2003).

The inconsistencies that had been discovered were considered, at worst, small departures from the fundamental truth of market efficiency, but if most of the volatility in the stock market was unexplained, it would call into question the basic underpinnings of the entire efficient markets hypothesis (Shiller, 2003). The challenge therefore became to construct a test for expected volatility that modelled dividends and stock prices in a more general way (Shiller, 2003). As these tests were developed, they tended to confirm the overall hypothesis that stock prices had more volatility than the efficient markets hypothesis could explain (Shiller, 2003). For example, West (1988) derived an inequality that the variance of innovation, which was defined as surprises in stock prices must be less than or equal to the variance of the innovations in the forecasted present value of dividends based on a subset of information available to the market (Shiller, 2003). Using long-term annual data on stock prices, West (1988) found that the variance of innovations in stock prices was four to twenty times its theoretical upper bound (Shiller, 2003).

The 1980s, therefore, provided a clear sense that while markets are not totally extreme, they contain quite substantial noise to the extent that noise dominates

the movements in the aggregate market (Shiller, 2003). Black (1986) defines noise in financial markets as the arbitrary element of expectation that leads to relative price changes. Noise traders irrationally believe that relative price changes are signals that carry information that will give them an advantage (Black, 1986). They therefore select their portfolios on the basis of incorrect beliefs rather than on fundamentals (De Long, Shleifer, Summers and Waldmann, 1990).

## **2.8. Behavioural finance**

By the 1990s, the focus of academic debate had shifted away from the econometric analyses of time series on prices, dividends and earnings toward developing models of human psychology as it relates to financial markets (Shiller, 2003). Researchers had seen too many anomalies and too little inspiration that the theoretical models captured important fluctuations (Shiller, 2003).

### **2.8.1. Feedback Models**

One of the oldest theories about financial markets is a price-to-price feedback theory (Shiller, 2003). When speculative prices go up, creating successes for some investors, this may attract public attention, promote word-of-mouth enthusiasm, and heighten expectations for further price increases (Shiller, 2003). The talk attracts attention to new era theories and popular models that justify the price increases (Shiller, 2003). Examples of new era theories are railroads in the 1870s, the Federal Reserve System in the 1920s and the Internet in the 1990s (Nofsinger, 2005). The expectation of further price

increases, in turn, increase investor demand and thus generate another round of price increases (Shiller, 2003). If the feedback is not interrupted, it may produce, after many rounds, a speculative bubble, in which high expectations for further price increases support extremely high current prices (Shiller, 2003).

Profitable investments undoubtedly contribute to a positive social mood and investor optimism. Nofsinger's (2005) view is that speculative bubbles are inflated by the unusually high optimism of investors because positive social mood influences investor optimism (Nofsinger, 2005). According to Nofsinger (2005) the peak of this social mood is characterised by emotional decisions, not rigorous evaluation. For example, Fisher and Statman (2002) surveyed investors in the late 1990s (Nofsinger, 2005). Individual investor forecasts imply they believed the market was experiencing a bubble, but they thought it would continue to inflate (Fisher and Statman, 2002; Nofsinger, 2005). This evidence explains why investors continue buying stocks and drive prices far above historical averages (Nofsinger, 2005). Individuals inevitably begin trusting this common view, even when it may be only superficially plausible (Shiller, 2002).

Eventually, the euphoric social mood begins to decline (Nofsinger, 2005). With the euphoria having abated, the influence of fundamentals is restored (Nofsinger, 2005; Coakley and Fuertes, 2006). Prices are viewed as too high, investors stop buying, or even sell and a stock market crash ensues (Nofsinger, 2005).

To the extent that the feedback model operates so dramatically, it can be inferred that it can be used to explain much of the inexplicable randomness that is apparent in financial market prices (Shiller, 2003). Despite its relevance, academic research has, until recently, hardly addressed the feedback model (Shiller, 2003).

Instead, the presence of such feedback is supported by some experimental evidence (Shiller, 2003). Psychologists Andreassen and Kraus (1988) found that when people are shown real historical stock prices in sequence and which they knew were real stock prices and invited to trade in a simulated market that displays these prices, they tended to behave as if they extrapolate past price changes when the prices appear to exhibit a trend (Shiller, 2003). The presence of such feedback is also supported by research in the cognitive psychology, which shows that human judgements of the probability of future events show systematic biases (Shiller, 2003). For example, psychologists Tversky and Kahneman (1974) have shown that judgements tend to be made using representativeness heuristic, whereby people try to predict by seeking the closest match to past patterns, without attention to the observed probability of matching the pattern (Shiller, 2003). By the same principle, people may tend to match stock price patterns into prominent categories such as dramatic and persistent price trends, thus leading to feedback dynamics, even if these categories may be rarely seen in fundamental factors (Shiller, 2003).

Daniel, Hirshleifer and Subrahmanyam (1998) have shown that the psychological principle of biased self-attribution can also promote feedback

(Shiller, 2003). Biased self-attribution, identified by psychologist Daryl Bem (1965), is a pattern of human behaviour whereby individuals attribute events that confirm the validity of their actions to their own high ability and attribute events that disconfirm their actions to bad luck or sabotage (Shiller, 2003). This relates to the notion of cognitive dissonance, in which individuals internally suppress information that conflicts with past choices (Daniel *et al.*, 1998). If an investor's trades are based on private signal, a later public signal confirms the trade if it has the same sign (good news arrives after a buy, or bad news after a sell) [Daniel *et al.*, 1998]. It is assumed that when an investor receives confirming public information his confidence rises, but disconfirming information causes confidence to fall only modestly, if at all (Daniel *et al.*, 1998). Thus, if an individual begins with unbiased beliefs about his ability, new public signals on average are viewed as confirming the validity of his private signal (Daniel *et al.*, 1998). This suggests that public information can trigger further overreaction to a preceding private signal (Daniel *et al.*, 1998). Daniel *et al.* (1998) show that such continuing overreaction to a preceding private signal causes momentum in security prices, but that such momentum is eventually reversed as further public information gradually draws the price back to fundamentals. Thus, bias self-attribution implies short-run momentum and long-term reversals (Daniel *et al.*, 1998).

Such human interactions, the essential cause of speculative bubbles, appear to recur across centuries and across countries and thus reflect fundamental parameters of human behaviour (Shiller, 2003).

Not all price deviations from fundamentals can be classified as speculative bubbles or as products of feedback theory. Investors incorrectly processing all the available information while forming expectations of a company's future performance can also result in price deviations from fundamentals (Goedhart *et al.*, 2005). Experimental evidence of Tversky and Kahneman (1981) confirms that subjects overreact to new information in making probabilistic judgements (Summers, 1986). Some investors, for example, attach too much importance to recent events and results, an error that leads them to overprice companies with strong recent performance (Goedhart *et al.*, 2005). Others are excessively conservative and under price stocks of companies that have released positive news (Goedhart *et al.*, 2005). Even if individual investors decided to buy or sell without consulting economic fundamentals, the impact on share prices would be limited (Goedhart *et al.*, 2005). Only when their irrational behaviour is also systematic (that is, when large groups of investors share particular patterns of behaviour) should persistent price deviations occur (Goedhart *et al.*, 2005). Patterns of overconfidence, overreaction and overrepresentation are common to many investors and such groups can be large enough to prevent a company's share price from reflecting underlying economic fundamentals (Goedhart *et al.*, 2005).

### **2.8.2. Contrarian investors versus ordinary investors**

According to Shiller (2003) theoretical models of efficient financial markets represent everyone as rational optimisers. He argues that nothing could be more absurd than to claim that everyone knows how to solve complex stochastic optimisation models (Shiller, 2003). For these theoretical models to

have any relevance to the stock market, it must somehow be the case that a smaller element of rational investors or smart money can offset the foolishness of many investors and make the markets efficient (Shiller, 2003). Therefore, when irrational optimists buy a stock, smart money or contrarian investors sell, and when irrational pessimists sell, smart money buys, thereby eliminating the effect of the irrational traders on market price (Shiller, 2003).

From a theoretical point of view, it is far from clear that smart money has the power to drive market prices to fundamental values (Shiller, 2003). For example, in one model with feedback traders and smart money, the smart money tends to amplify, rather than diminish the effect of feedback traders (De Long *et al.*, 1990; Shiller, 2003). They achieve this by buying in ahead of the feedback traders in anticipation of the price increases that feedback traders will cause (De Long *et al.*, 1990; Shiller, 2003). In a related model, smart money never chooses to offset all of the effects of irrational investors because they do not want to assume the increased risk (De Long *et al.*, 1990; Shiller, 2003).

To the extent that there are different types of investors, Goetzmann and Massa (1999) provided some direct evidence supporting the notion that there are two distinct classes of investors: feedback traders who follow trends and the smart money that move the other way (Shiller, 2003). Fidelity Investments provided the researchers with two years of daily account information for 91,000 investors in a Standard and Poor's ("S&P") index fund (Shiller, 2003). Goetzmann and Massa (1999) were able to sort these investors into two groups based on how they react to daily price changes (Shiller, 2003). There were both momentum

investors, who habitually bought more after prices were rising, and smart money, who habitually sold after prices were rising (Shiller, 2003). Individual investors tended to stay as one or the other and rarely shifted between the two categories (Goetzmann and Massa, 1999; Shiller, 2003).

### **2.8.3. Limits to arbitrage**

Recent research has focused on an important impediment to smart money offsetting the effects of irrational investors (Shiller, 2003). The smart money can always buy the stock, but if the smart money no longer owns the stock and has difficulty shorting the stock, then they may be unable to sell the stock (Shiller, 2003). Alternatively, some stocks could be in a situation where extremists have bought into a stock so much that only they own shares, and trade is only among extremists to the extent that they alone determine the price of the share (Shiller, 2003). One example is the 3Com sale of Palm near the peak of the stock market bubble (Lamont and Thaler, 2001; Shiller, 2003). In March 2000, 3Com, a profitable provider of network systems and services, sold to the general public via an initial public offering (“IPO”) 5% of its subsidiary Palm, a maker of handheld computers (Shiller, 2003). 3Com announced simultaneously that an IPO for the rest of Palm would follow later (Shiller, 2003). The price that the first Palm shares obtained in the market was so high that when the implied value of the remaining 95% of Palm was subtracted from the 3Com market value, the non-Palm part of 3Com had a negative value (Lamont and Thaler, 2001; Shiller, 2003). Because the worst possible price for 3Com after the Palm sale was completed would be zero, there was a strong incentive for investors to short Palm and buy 3Com (Shiller, 2003). However, the interest

cost of borrowing Palm shares reached 35% by July 2000, restricting the advantage to exploit the mispricing (Lamont and Thaler, 2001; Shiller, 2003). To this end, short-sale constraints could be a fatal flaw in the basic efficient markets hypothesis (Shiller, 2003).

Although the Palm example is an unusual anomaly because shorting stocks rarely become so costly, it highlights the limits to arbitrage (Shiller, 2003). Moreover, it brings to the fore the true cost of shorting stocks, which is much higher than the explicit interest cost of borrowing the shares, because of the psychological cost that inhibits short selling (Shiller, 2003).

The short selling of shares is widely reputed to involve some nuisances as well as some substantial risks (Shiller, 2003). For example, the short seller always stands the risk that the ultimate owner of the shares will want to sell the shares, at which time the short seller is forced to return the shares (Shiller, 2003). This detail may be little more than a nuisance, for the short seller can likely borrow them again from another lender, but it may feature largely in the minds of potential short sellers (Shiller, 2003).

A more important consideration that may weigh on the minds of short sellers is the unlimited loss potential that short sales entail (Shiller, 2003). When an investor buys a stock, the potential loss is no greater than the original investment (Shiller, 2003). When an investor shorts a stock however, the potential losses can greatly exceed the original investment. An investor can always terminate these losses by covering the shorts (Shiller, 2003). According

to Shiller (2003), however, this action typically brings considerable psychological anguish. Deciding to cover a short position by realising losses is psychologically difficult, given the evidence on the pain of regret (Shiller, 2003). Kahneman and Tversky's (1979) prospect theory suggests that individuals are far more upset by losses than they are pleased by equivalent gain; in fact, individuals are so upset by losses that they will even take great risks with the hope of avoiding any losses at all (Shiller, 2003). The effects of this pain of regret have been shown to result in a tendency of investors in stocks to avoid selling losers, but the same pain of regret ought to cause short sellers to want to avoid covering their shorts in a losing situation (Shiller, 2003). People prefer to avoid putting themselves in situations that might confront them with psychologically difficult decisions in the future (Kahneman and Tversky, 1979; Shiller, 2003).

It is perhaps because of this psychological state that remarkably few shares are sold short (Shiller, 2003). According to the New York Stock Exchange data, from 1977 to 2000 year-end short interest ranged from 0.14 percent to 1.91 percent of all shares (Shiller, 2003). According to Dechow, Hutton, Muelbroek and Stone (2001), less than two percent of all stocks had short interest greater than five percent of shares outstanding between 1976 and 1983 (Shiller, 2003). To this end, it is difficult to see how such a small amount of short selling could offset the effect on stock prices of the extra demand from investors who develop an irrational fixation on certain stocks (Shiller, 2003).

Summers (1986) elaborates on the limits of arbitrage. He suggests that irrational fads in investor sentiment create sustained deviations of stock prices from intrinsic valuations and that rational investors might not be able to arbitrage away the mispricing because of noise trader risk (Summers, 1986). Arbitrageurs' betting against mispricing run the risk, at least in the short run, that investor sentiment becomes more extreme and prices move even further away from fundamental values (Summers, 1986). The potential for loss and the arbitrageurs' risk aversion reduce the size of positions they are willing to take (Summers, 1986). Consequently, arbitrage fails to completely eliminate mispricing and investor sentiment affects security prices in equilibrium (Lee, Jiang and Indro, 2002; Summers, 1986). An example provided by Schaefer (1982) when considering the case of British gilts further highlights the point that asset values can diverge significantly from fundamentals without leaving a statistically discernible trace in the pattern of returns.

Complimentary research done by De Long *et al.* (1990) focuses on the limits of arbitrage dedicated to exploiting noise traders' misperceptions. The essential assumption used is that the opinions of noise traders are unpredictable and arbitrage requires bearing the risk that these misperceptions become even more extreme tomorrow than they are today. In addition, they classify arbitrageurs as risk averse and to have reasonably short horizons (De Long *et al.*, 1990). To this end, an important source of risk borne by short-horizon investors engaged in arbitrage against noise traders is the risk that the beliefs of noise traders will not revert to their average for a long time and might in the meantime become even more extreme (De Long *et al.*, 1990). The relevant

research shows that the risk created by the unpredictability of noise traders significantly reduces the attractiveness of arbitrage (De Long *et al.*, 1990). Particularly because arbitrageurs have short horizons and so are concerned about liquidating their investment in a mispriced asset, their aggressiveness will be limited (De Long *et al.*, 1990). In this case noise trading can lead to a large divergence between market prices and fundamental values (De Long *et al.*, 1990). The results suggest that much of the behaviour of professional arbitrageurs can be seen as a response to noise trading rather than as trading on fundamentals (De Long *et al.*, 1990). Many professional arbitrageurs spend their resources examining and predicting the signals noise traders follow in order to bet against them more successfully (De Long *et al.*, 1990).

## **2.9. Momentum and reversals**

Further to the above-mentioned conditions, two additional well-known patterns of stock market deviations have received considerable attention in academic studies during the past decade: long-term reversals in share prices and short-term momentum (Goedhart *et al.*, 2005). Behavioural finance argues that the effect of momentum is caused by an overreaction on the part of investors: when they put too much weight on a company's recent performance, the share price becomes excessively inflated (or deflated) (Goedhart *et al.*, 2005). As additional information becomes available, investors adjust their expectations and a reversal in price occurs (Goedhart *et al.*, 2005).

Behavioural finance theory suggests that this trend results from systematic underreaction: over conservative investors underestimate the true impact of

earnings, divestitures, and share repurchases, for example, so stock prices do not instantaneously react to good or bad news (Goedhart *et al.*, 2005).

In terms of momentum, Jegadeesh and Titman (1993) found that winning stocks (stocks that showed exceptionally high six-month returns) beat losing stocks (stocks that showed exceptionally low six-month returns) by 12 percent over the following year (Shiller, 2003). In contrast, over longer periods of time this momentum seems to reverse itself (Shiller, 2003). De Bondt and Thaler (1985) found that over the period 1926 to 1982, stocks represented on the Centre for Research in Security Prices data set of the University of Chicago whose returns had been in the top decile across firms over three years thus, winner stocks tended to show negative cumulative returns in the succeeding three years (Shiller, 2003). They also found that loser stocks whose returns had been in the bottom decile over the prior three years tended to show positive returns over the succeeding three years (Shiller, 2003). Thus, there is a tendency for stock prices to continue in the same direction over intervals of six months to a year, but to reverse themselves over longer intervals (Shiller, 2003).

A pattern like this is largely consistent with some combination of feedback effects and other demand factors driving the stock market largely independently (Shiller, 2003).

## **2.10. Conclusion**

It is apparent that the issue of whether stock prices reflect fundamentals have been at the heart of debate in financial economics ever since Shiller's seminal

study (Shiller, 1981; see also Coakley and Fuertes, 2006). More specifically, Shiller's (2000) argument that the 1990s dramatic increase in prices and valuation ratios was fuelled by investors' irrational exuberance and not by sustainable fundamentals further highlights this issue. The evidence is compelling. For example, US P/E and P/D series rose spectacularly during the course of that decade. The Standard and Poor's ("S&P") composite P/E ratio hit an all-time peak of 44.2 in December 1999 that was more than double its long-term average (Coakley and Fuertes, 2006). It is this price action that further supports the argument that prices can become decoupled from fundamentals (Coakley and Fuertes, 2006). It also suggests that the efficient market view that market prices represent a rational assessment of fundamental value should be approached with caution (Coakley and Fuertes, 2006).

The lesson from the literature review is therefore that markets can be less than efficient in immediately distilling new information and that investors, driven by emotion, can indeed lead markets awry (Goedhart *et al.*, 2005). For instance, Summers (1986) suggests that irrational fads in investor sentiment create sustained deviations of stock prices from intrinsic valuations and that rational investors might not be able to arbitrage away the mispricing because of noise trader risk (Coakley and Fuertes, 2006). More recently, Shiller (2000) argues that the 1990s hike in prices and valuation ratios was fuelled by investors' irrational exuberance (Coakley and Fuertes, 2006). Interpreting and theorising such extreme movements poses a challenge for financial economics (Coakley and Fuertes, 2006).

Over the past several decades, the arguments for such extreme movements are explained by behavioural principles such as feedback theory, herding, anchoring as well as under- and overreaction (Coakley and Fuertes, 2006).

In the context of the behavioural finance theory, Chapter 3 describes the specific research problems that will be addressed in terms of share price deviation from fundamentals.

## Chapter 3

### 3. Research Question

#### 3.1. Introduction

The issue of whether stock prices reflect fundamentals was given new urgency by the sustained 1990s run up in prices (Coakley and Fuertes, 2006). Several rationally based explanations for the hike in valuation ratios were adduced (Coakley and Fuertes, 2006). These included a decline in the equity premium, shifts in corporate payout policies and falls in the cost of stock market participation and diversification (Coakley and Fuertes, 2006). Other prominent explanations were factors such as noise trading, market sentiment and limits to arbitrage (Coakley and Fuertes, 2006).

Against this backdrop, this research paper attempts to shed light on the deviations from fundamentals by taking into account the stock market cycles (Cooper *et al.*, 2004; Coakley and Fuertes, 2006). The broad aim of the research is to determine whether stock prices always reflect fundamentals or whether they display persistent deviations from their long-run equilibrium fundamental values due to irrational investor behaviour (Coakley and Fuertes, 2006).

Behavioural theories are a departure from the classical assumptions of strict rationality and unlimited computational capacity on the part of investors (Hong and Stein, 1999). The difficulty with this approach however is that there is a potentially huge number of such departures (Hong and Stein, 1999).

In order to impose some discipline on the research process, the scope of the research is articulated by defining behavior in terms of market cycles, namely bull and bear markets. Behaviour in a bull cycle is synonymous with momentum while behaviour in a bear cycle is characterised by reversal (Cooper *et al.*, 2004). Momentum occurs when positive returns for stocks in recent months are followed by several more months of positive returns while reversal occurs when additional information becomes available and investors adjust their expectations by reversing inflated share prices (Goedhart *et al.*, 2005). More importantly, according to Lee *et al.*, (2002) bullish changes in sentiment lead to downward revisions in volatility and higher future excess returns and *vice versa* for bearish changes (Coakley and Fuertes, 2006).

Fundamentals will take the form of valuation ratios, that is the P/E ratio and P/D ratio (Coakley and Fuertes, 2006). Accordingly, valuation ratios exhibit distinct dynamics around constant long-run equilibrium levels depending on the phase of the stock market cycle (Coakley and Fuertes, 2006).

### **3.2. Research Questions**

1. To the extent that share prices are a function of valuation ratios, does momentum, apparent in bull market cycles, result in valuation ratios and therefore, share prices to increase beyond levels that can be justified by fundamentals?
2. By the same token, does reversal, apparent in bear market cycles, result in valuation ratios and therefore, share prices to fall beyond levels that can be justified by fundamentals?

### 3.3. Hypothesis Testing

In order to answer the two overarching questions, a sequential hypothesis testing approach is required. Different aspects of these questions are investigated through tests that are described below in terms of the null ( $H_0$ ) and alternative hypotheses ( $H_A$ ) (Coakley and Fuertes, 2006).

The following tests will be conducted sequentially, as proposed by Coakley and Fuertes (2006):

#### **Test 1A: Unit root persistence or mean reversion?**

$H_0$ : Valuation ratios have a unit root.

(A unit root is an attribute of a statistical model of time series whose autoregressive parameter is one (www.about.com:economics, [2006]). Auto regression is a generation of observations whereby the value of each observation is partly dependent upon the value of those which have immediately preceded it (Organisation of Economic Co-operation and Development (“OECD”), [2006]).

$H_1$ : Valuation ratios mean revert (non-)linearly.

(Two variables are linearly associated if a change in one is associated with a proportional change in the other, with the same constant of proportionality throughout the range of measurement (University of California, [2006]).

**Test 1B: What type of mean reversion?**

$H_0$ : Valuation ratios mean revert symmetrically.

(A distribution is said to be symmetric if the left half of the graph of the distribution is the mirror image of the right half (Usip, 2006).

$H_1$ : Valuation ratios mean revert asymmetrically.

**Test 1C: How do the ratios behave during bull and bear markets?**

$H_0$ : Valuation ratios do not mean revert in bull (bear) markets.

$H_1$ : Valuation ratios mean revert in bull (bear) markets.

The overarching research question of whether share prices always reflect fundamentals or whether they display persistent deviations from fundamentals has been narrowed by defining behaviour in terms of market cycles, namely bull and bear markets. Behaviour in a bull cycle is synonymous with momentum while behaviour in a bear cycle is characterised by reversal. Fundamentals will take the form of valuation ratios, that is the P/E ratio and P/D ratio.

Chapter 4 provides detail on the research method, the definition of the unit of analysis, the population as well as details of the data analysis process. The limitations of the research are also specified.

## Chapter 4

### 4. Research Method

#### 4.1. Rationale for proposed method

##### 4.1.1. Introduction

A number of behavioural theories have been developed to jointly explain the short-run momentum in stock returns documented by Jegadeesh and Titman (1993) and the long-run reversal in stock returns documented by De Bondt and Thaler (1985) (Cooper *et al.*, [2004]). Daniel *et al.*, (1998) and Hong and Stein (1999) employ different behavioural and cognitive biases to explain these anomalies (Cooper *et al.*, 2004).

##### 4.1.2. Overreaction theories of short-run momentum and long-run reversal

Daniel *et al.*, (1998) assume that investors are overconfident about their private information and overreact to this type of information (Cooper *et al.*, 2004). If investors also have a self-attribution bias, then when subsequent public information arrives, investors will react asymmetrically to confirming versus disconfirming pieces of news (Cooper *et al.*, 2004). In other words, investors attribute successes to their own skill more than they should and attribute failures to external noise more than they should (Cooper *et al.*, 2004). The consequence of this behaviour is that investors' overconfidence increases following the arrival of confirming news (Cooper *et al.*, 2004). The increase in overconfidence extends the initial overreaction and generates return momentum (Cooper *et al.*, 2004). The overreaction in prices will eventually be corrected in

the long-run as investors observe future news and realise their errors (Cooper *et al.*, 2004). Hence, the increased overconfidence results in short-run momentum and long-run reversal (Cooper *et al.*, 2004).

Hong and Stein (1999) also developed a behavioural theory to explain momentum (Cooper *et al.*, 2004). Their model is based on initial underreaction to information and subsequent overreaction, which eventually leads to stock price reversal in the long-run (Cooper *et al.*, 2004). Their model employs two types of investors: news watchers and momentum traders (Cooper *et al.*, 2004). The news watchers rely exclusively on their private information while momentum traders rely exclusively on the information in past price changes (Cooper *et al.*, 2004). The additional assumption that private information diffuses only gradually through the market place leads to an initial underreaction to news (Cooper *et al.*, 2004). The underreaction and subsequent positive serial correlation in returns attracts the attention of the momentum traders whose trading activity results in an eventual overreaction to news; prices revert to their fundamental levels in the long-run (Cooper *et al.*, 2004).

The theory of Daniel *et al.*, (1998) can be extended to predict differences in momentum profits across states of the market (Cooper *et al.*, 2004). Aggregate overconfidence should be greater following market gains (Daniel *et al.*, 1998; Gervias and Odean, 2001; Cooper *et al.*, 2004). Because investors in aggregate hold long positions in the equity market, increases in market prices will tend to be attributed unduly to investor skill and will result in greater aggregate overconfidence (Cooper *et al.*, 2004). If overconfidence is in fact

higher following market increases, then the overreactions will be stronger following these up markets generating greater momentum in the short run (Cooper *et al.*, 2004).

With the two psychological regularities of overconfidence (momentum) and attribution bias (reversal) as a base, this research will use stock market cycles, namely bull (up) and bear (down) market phases to measure stock price deviations from fundamentals (Cooper *et al.*, 2004; Coakley and Fuertes, 2006).

#### **4.1.3. Excess volatility**

The excess volatility issue has been investigated most thoroughly by Shiller (1981) using Miller and Modigliani's (1961) dividend discount model (De Bondt and Thaler, 1985). The dividend discount model links prices to fundamentals by comparing real stock prices with estimates of fundamental value, estimated as the present value of future dividends (Shiller, 1981). From this research it can be concluded that, at least over the last century, dividends do not vary enough to rationally justify observed aggregate price movements (De Bondt and Thaler, 1985; LeRoy and Porter, 1981).

The principal concern with Shiller's original work is the stationarity of dividends and stock prices (Shiller, 2003). Stationarity means that the joint probability distribution and the conditional probability distribution are invariant with respect to time (Pindyck and Rubinfeld, 1998). In his early work, Shiller followed a tradition in the finance literature of assuming that dividends fluctuated around a known trend (Shiller, 2003). However, Marsh and Merton (1986) argued that

dividends need not stay close to a trend and that, even if earnings followed a trend, share issuance or repurchases could make dividends depart from a trend indefinitely. In addition, if business managers use dividends to provide a smoothed flow of payouts from their businesses, then stock prices might be expected to shift more rapidly than dividends (Shiller, 2003). Marsh and Merton (1986) argue that such dividend smoothing could make stock prices non-stationary in such a way that in finite samples prices appear more volatile than the present values.

Another contested issue regarding the early work on excess volatility is the assumption that the efficient market model is best conveyed through an expected present value model in which the real discount rate is constant through time (Shiller, 2003). In addition, the variability of stock prices may also reflect changes in real interest rates (Shiller, 2003). If so, the price movements of other assets, such as land or housing, should match those of stocks. However, this is not actually observed (De Bondt and Thaler, 1985). As such, Shiller's findings are a result of his misspecification of the dividend process (Marsh and Merton, 1986).

Another crucial shortcoming of the dividend discount model is that, by imposing a transversality condition, non-rational behaviour is ruled out (Campbell and Shiller, 1988a; Campbell and Shiller, 1988b, Coakley and Fuertes, 2006). The transversality condition limits solutions to an infinite period dynamic optimisation problem (Michel, 1982). Therefore, there is a clear sense that the level of

volatility of the overall stock market cannot be well explained by looking at the present discounted value of future returns (Shiller, 2003; Nofsinger, 2005).

Given the shortcomings of the dividend discount model, this research will use economic theory to motivate asymmetric behaviour driven by bull and bear market phases and a two-regime, non-linear dynamic model will be used to test for it empirically (Coakley and Fuertes, 2006). The merit of the proposed two-regime, non-linear dynamic model is its provision of a prudent framework for simultaneously testing classical and behavioural hypotheses. On the one hand, it permits a test of the classical-theory prediction that stock markets adjust rapidly to news (Coakley and Fuertes, 2006). On the other, it can also test behavioural hypotheses that are related to distinct market phases. In bull markets, trend-chasing investors or noise traders may drive up valuation ratios irrespective of fundamental news (Coakley and Fuertes, 2006). The under-reaction hypothesis can be tested in such a phase while the adjustment or correction towards long-run equilibrium can be tested in a bear market phase (Coakley and Fuertes, 2006).

#### **4.1.4. Two-regime non-linear dynamic model**

Because standard linear time-series models of valuation ratios blend bull and bear market phases, the typical inference from them can be regarded as non-informative in two senses (Coakley and Fuertes, 2006). First, it reflects the average dynamics from distinct market phases (Coakley and Fuertes, 2006). Second, it leads to the dichotomy that either valuation ratios never mean-revert

or that they continuously adjust towards their long-run equilibrium levels (Coakley and Fuertes, 2006).

A non-linear framework is more flexible (Coakley and Fuertes, 2006). It captures the notion that the short-run dynamics of P/D ratios and P/E ratios may occasionally be dominated by mispricing effects stemming, for instance, from fads and waves of optimism (Coakley and Fuertes, 2006). The intuition is that the ratios would tend persistently to rise alongside prices during bull markets such as the late 1990s episode (Coakley and Fuertes, 2006). Formally, this is referred to as local non-stationarity (Coakley and Fuertes, 2006). Sooner or later however, there is a correction with the onset of bear markets as the influence of fundamentals is restored and hence, the ratios fall rapidly alongside prices. This correction ensures overall or global stationarity in valuation ratios (Coakley and Fuertes, 2006). In order to determine whether share prices continually reflect fundamentals, all variables will be tested for stationarity using the Augmented Dickey-Fuller (“ADF”) test (Dickey and Fuller, 1979; Collins, 2002). The ADF test involves fitting the data with the following model:

$$\Delta x_t = \rho(x_{t-1} - \mu) + \sum_{j=1}^k \beta_j \Delta x_{t-j} + \varepsilon_t \quad \varepsilon_t \sim iid(0, \sigma^2), \quad (1)$$

where  $x_t$  denotes a valuation ratio and the assumption is made that valuation ratios' current change is determined by the magnitude of the previous period's deviation from equilibrium, the speed of adjustment and innovation,  $\mu$  is the long-run equilibrium,  $\rho$  is the speed of adjustment and  $\varepsilon_t$  is an innovation or unexpected shock. In the present context bull and bear markets will be

characterised through a moving average of past changes (Coakley and Fuertes, 2006):

$$q_t(w, d) \equiv w_1 \Delta x_{t-1} + \dots + wd \Delta x_{t-d}, \quad (2)$$

where  $q_t(d) \equiv \Delta x_{t-d}$  and  $w' = (w_1, \dots, w_d) > 0$  are weights summing to 1 and  $d \geq 1$  is a finite integer lag.

However, such a regression is likely to be plagued by serial correlation (Stata Time Series Reference Manual, 2004). To control for this, the linear model (Equation 1) is reformulated into a two-regime Phillips-Peron model that belongs to the momentum threshold autoregressive (“TAR”) class (Coakley and Fuertes, 2006; Stata Time Series Reference Manual, 2004; Granger and Teräsvirta, 1993, Ng and Perron, 1995). This is a simple reformulation of an autoregressive model which allows for bull and bear markets (Enders and Granger, 1998; Hansen, 1997; Coakley and Fuertes, 2006). The reformulation permits  $x_t$  to adjust toward its long-run equilibrium differently depending on the direction of the market, either non-decreasing or decreasing, as follows:

$$\Delta x_t = \alpha + I_t \rho^c (x_{t-1} - \mu) + (1 - I_t) \rho^r (x_{t-1} - \mu) + \sum_{j=1}^k \beta_j \Delta x_{t-j} + \varepsilon_t, \quad (3)$$

where the speed of adjustment is measured by  $\rho^c$  in bull markets and  $\rho^r$  in bear markets (Coakley and Fuertes, 2006). The notation  $c$  and  $r$  is employed to reflect the assumption that bull and bear market phases are characterised by continuation or momentum and reversal, respectively (Coakley and Fuertes, 2006, Goedhart *et al.*, 2005).

The switching between bull and bear market phases is modelled through the indicator function:

$$I_t = \{1 \text{ if } q_t(w, d) \geq 0,$$

$$I_t = \{0 \text{ if } q_t(w, d) < 0,$$

where the transition variable  $q_t(w, d)$ , defined as in Equation 2, obeys one of two schemes (Coakley and Fuertes, 2006). One has exponentially decreasing weights where  $w_1 > \dots > w_d$  so that the more distant past changes are given less weight – reflecting gradual memory loss – which is consistent with feedback models (Campbell and Shiller, 1990; Coakley and Fuertes, 2006). The other scheme has exponentially increasing weights where  $w_1 < \dots < w_d$  and may be viewed as capturing the persistence in valuation ratios more appropriately (Coakley and Fuertes, 2006). These schemes were successfully employed in Coakley, Fuertes and Zoega (2001) to capture “fast-up” and “slow-down” unemployment phases (Coakley and Fuertes, 2006).

## **4.2. Unit of Analysis**

The unit of analysis is the valuation ratios.

## **4.3. Population, Sampling Method and Size**

### **4.3.1. Population**

The empirical analysis is based on quarterly data of stock price, dividends and earnings for companies listed on the JSE from the first quarter (“Q1”) of 1980 to the second quarter (“Q2”) of 2007.

#### **4.3.2. Sample**

The intention initially was to sample the top 40 stock price index (“J200”), dividends and earnings. The top 40 comprises 90% of the JSE (SATRIX, 2007). Despite a thorough analysis of several financial databases, including Bloomberg, I-Net Bridge, Reuters and McGregor BFA, the only sample period containing all the relevant data for the J200 was July 1995-July 2006. The relatively short sample period resulted in failure to reject the original null hypothesis that valuation ratios have a unit root in favour of the alternative hypothesis that valuation ratios mean revert non-linearly. To the extent that the hypothesis testing was sequential, failure to reject the original hypothesis rendered the findings uninteresting.

In order to validate the research approach in terms of the population and sample, previous research was consulted for guidance. It was found that similar empirical studies have analysed the entire population. For example, the empirical analysis conducted by Coakley and Fuertes (2006) was based on monthly data of the Standard and Poor’s (“S&P”) Composite stock price index, dividends and earnings, which spans the period 1871 to 2001. In light of this and in order to document findings that were meaningful, the analysis was conducted on the entire population and based on the JSE All Share stock price index (“ALSI”), dividends and earnings for the period 1980:Q1-June:Q2.

### 4.3.3. Data gathering process

DataStream was used to source the quarterly ALSI stock price index, dividend yield and P/E ratios. Given that the P/D ratio is the inverse of the dividend yield, the P/D ratios were calculated manually using the dividend yield.

## 4.4. Analysis Approach

### 4.4.1. Hypothesis testing

Most empirical studies of valuation ratios address the issue of persistence versus mean-reversion by means of standard unit root tests (Coakley and Fuertes, 2006). Hence, it was important to revisit the persistence versus mean-reversion debate in a more general framework that allows for symmetric and asymmetric (regime-sensitive) adjustment (Coakley and Fuertes, 2006).

The following hypothesis testing was conducted, as proposed by Coakley and Fuertes (2006):

#### **Test 1A: Unit root persistence or mean reversion?**

$H_0$ : Valuation ratios have a unit root.

$H_1$ : Valuation ratios mean revert (non-)linearly.

The Phillips-Peron version of the ADF test was used to test for unit root because it applies Newey-West (1987) standard errors to account for serial correlation (Stata Time Series Reference Manual, 2004). A rejection of test 1A suggested mean reversion. However, the issue remaining was whether the

adjustment mechanism was uniform throughout or regime-sensitive instead (Coakley and Fuertes, 2006). This motivated the following test:

**Test 1B: What type of mean reversion?**

$H_0$ : Valuation ratios mean revert symmetrically.

$H_1$ : Valuation ratios mean revert asymmetrically.

In this case the alternative hypothesis sought to reflect the potentially distinct behaviour of ratios during bull and bear markets (Coakley and Fuertes, 2006). A rejection of the above test prompted the question of which is the precise type of dynamics in each regime (Coakley and Fuertes, 2006). In order to determine which type of dynamic was relevant in each regime, the following was formulated (Coakley and Fuertes, 2006):

**Test 1C: How do the ratios behave during bull and bear markets?**

$H_0$ : Valuation ratios do not mean revert in bull (bear) markets.

$H_1$ : Valuation ratios mean revert in bull (bear) markets.

Classical theories of market efficiency imply that prices rapidly reflect changes to fundamentals and accordingly, findings should discover mean-reversion in valuation ratios in bull and bear market phases such that  $\rho^c < 0$ ,  $\rho^r < 0$  (Coakley and Fuertes, 2006). In contrast, behavioural theories predict mean reversion in bear markets only ( $\rho^c = 0$ ,  $\rho^r < 0$ ); see, for example, Coakley and Fuertes (2006). The economic intuition is that market sentiment or fads, together with limits to arbitrage will induce short-run continuation or momentum in bull

markets and so prices can regularly deviate from fundamentals (Coakley and Fuertes, 2006). In the two-regime framework, a valuation ratio exhibits underreaction in bull markets if it randomly drifts upward ( $\alpha > 0$ ) with no pull from its long-run equilibrium ( $\rho^c = 0$ ) (Coakley and Fuertes, 2006).

#### **4.5. Research Limitations**

The research is limited in a number of ways.

1. Fundamentals are restricted to dividends and earnings. The relation between other fundamentals such as turnover, cashflow, net asset value, operating profit margin, balance sheet ratios and other financial ratios such as current ratios and return on equity are not considered in this research.
2. The research is confined to an analysis of the effect of over- and underreaction in terms of behaviour. Other behavioural principles such as prospect theory, regret and cognitive dissonance and mental compartments are not considered. In addition, the impact of other behavioural principles such as the dysfunction effect, gambling behaviour and speculation, perceived irrelevance of history, magical thinking, quasi-magical thinking, attention anomalies, the availability heuristic, culture and social contagion, and global culture on valuation ratios and hence, share prices are not explored in this research (Shiller, 1999).
3. The research is limited to bull and bear market phases over the sample period and does not specifically analyse the impact of shocks to valuation

ratios and in turn share prices. The research also does not test for long-lasting or permanent effects (Coakley and Fuertes, 2006).

Despite these limitations, the research facilitates tests for the presence of non-fundamental factors without having to specify an asset pricing model and explains the existing evidence in a parsimonious and unified way (Hong and Stein, 1999; Coakley and Fuertes, 2006). Furthermore, the research focuses on the significant role of non-fundamentals in explaining valuation ratio dynamics over the course of the stock market cycle, which points to the importance of market sentiment and noise trading (Coakley and Fuertes, 2006).

The deviation of share prices from fundamentals is analysed by taking account of the stock market cycle (Coakley and Fuertes, 2006). Economic theory is used to motivate asymmetric behaviour driven by bull and bear market phases and a two-regime non-linear dynamic model is applied to test for it empirically (Coakley and Fuertes, 2006). The following chapter presents the results of the analysis with reference to the relevant hypotheses.

## Chapter 5

### 5. Empirical results

#### 5.1. Data analysis

The empirical analysis is based on quarterly data for the ALSI composite stock price index, dividends and earnings from the first quarter of 1980 to the second quarter of 2007. The earnings are smoothed to proxy the long-run path of earnings and provide a fixed point of reference (Coakley and Fuertes, 2006). This is done by determining the log version of each data point. In what follows, P/D denotes the log price-dividend ratio which spans the period 1980:Q1-2007:Q2 giving 109 observations ( $T=109$ ). The P/E series is defined similarly. The data, before taking logs and the log version, is tabled in Appendix A.

#### 5.2. Descriptive Statistics

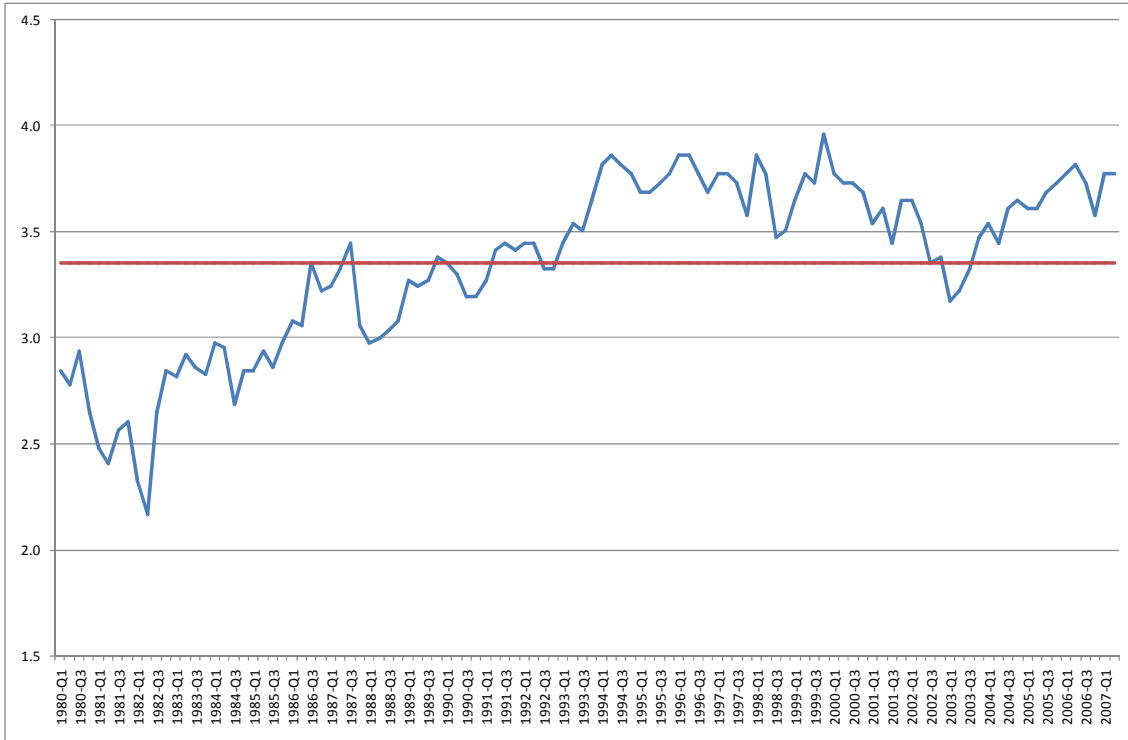
Table 1 reports descriptive statistics for the two series and Figures 1 and 2 plot the valuation ratios and historical means.

**Table 1: Summary statistics for ALSI Composite index valuation ratios**

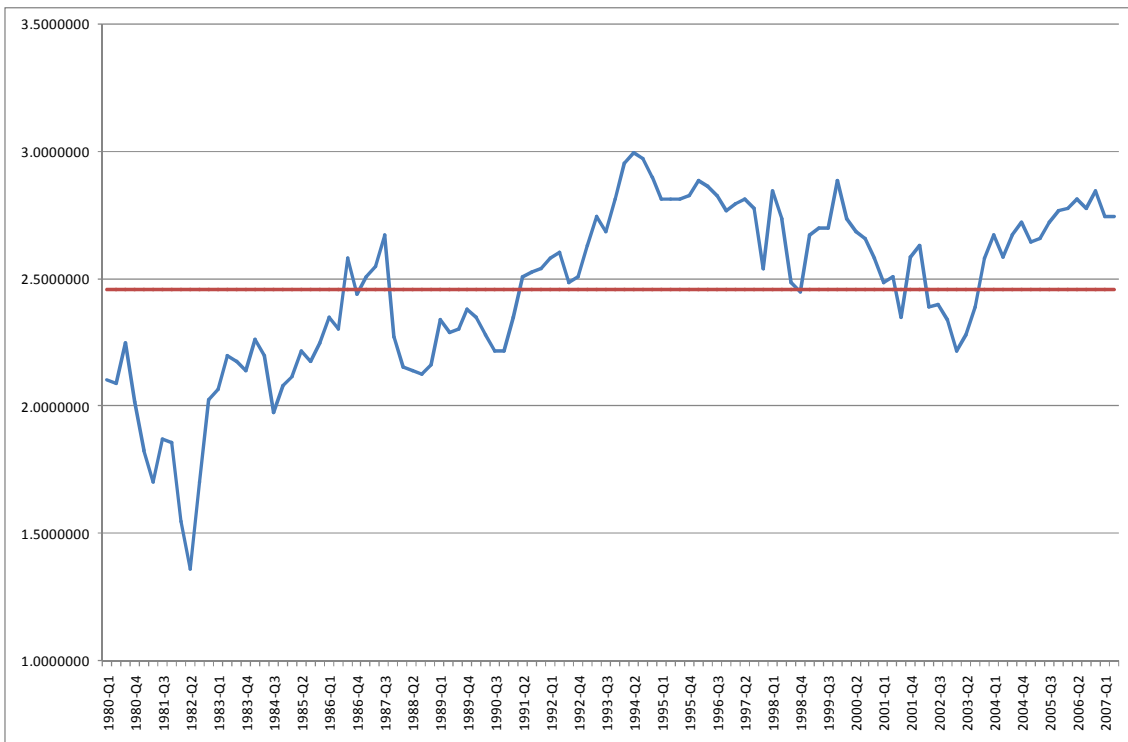
Series	Mean	Median	St. dev	Min.	Max.	SK	KU	JB-Chi Square
P/D	3.350610	3.44362	0.4046667	2.163323	3.96272	-0.700	2.69463	9.398530317 [0.000]
P/E	2.460899	2.5096	0.3280607	1.360977	2.99573	-0.751	3.35638	10.92229556 [0.000]

SK and KU are the skewness and kurtosis coefficients, respectively. The average P/D and P/E is 3.350 and 2.460, respectively. The JB-Chi Square is the Jarque-Bera test statistic for the normality null with asymptotic  $p$ -values in brackets (Coakley and Fuertes, 2006; Park, 2006). Figures 1 and 2 show the evolution of the logged monthly P/D and P/E valuation ratios.

**Figure 1: ALSI Composite P/D ratio 1980:Q1-2007:Q2**



**Figure 2: ALSI Composite P/E ratio 1980:Q1-2007:Q2**



The slope of the line in Figures 1 and 2 shows a clear uptrend implying that both series exhibit an obvious business cycle or bull-bear market pattern

(Coakley and Fuertes, 2006). One prominent instance is the sharp rise in the 1990s relative to the historical mean and the subsequent correction (Coakley and Fuertes, 2006).

### 5.3. Unit root persistence or mean reversion

Tables 3 and 4 report the adjusted ADF test results for the P/D and P/E ratios, respectively. The Phillips-Peron version of the ADF test was used to test for unit root because it applies Newey-West (1987) standard errors to account for serial correlation (Stata Time Series Reference Manual, 2004).

**Table 2: Adjusted ADF test results for P/D ratios**

Series	P/D					
T	109					
Newey-West lag (k)	4					
	Test Statistic	MacKinnon approximate p-value	Interpolated Dickey-Fuller			
			1% Critical Value	5% Critical Value	10% Critical Value	
Z( $\rho$ )	-23.744		-27.460	-20.736	-17.530	
Z(t)	-3.638	0.0268	-4.037	-3.449	-3.149	
log P/D	Coef.	Std. Err.	t	P> t	95% Conf. Interval	
Beta	0.7590844	0.0633329	11.99	0.000	0.6335209	0.8846480
trend (up or down)	0.0023312	0.0008103	2.88	0.005	0.0007247	0.0039376
constant	0.6849649	0.1803350	3.80	0.000	0.3274333	1.0424970

**Table 3: Adjusted ADF test results for P/E ratios**

Series	P/E				
T	109				
Newey-West lag ( <i>k</i> )	4				
			<b>Interpolated Dickey-Fuller</b>		
	<b>Test Statistic</b>	<b>MacKinnon approximate p- value</b>	<b>1% Critical Value</b>	<b>5% Critical Value</b>	<b>10% Critical Value</b>
Z( $\rho$ )	-16.244		-27.460	-20.736	-17.530
Z(t)	-2.909	0.1593	-4.037	-3.449	-3.149
<b>log P/E</b>	<b>Coef.</b>	<b>Std. Err.</b>	<b>t</b>	<b>P&gt; t </b>	<b>95% Conf. Interval</b>
Beta	0.8534626	0.0507815	16.81	0.000	0.7527834 0.9541418
trend (up or down)	0.0010283	0.0005276	1.95	0.054	-1.77E-05 0.0020743
constant	0.3095731	0.1072504	2.89	0.005	0.0969387 0.5222075

The results in Table 3 are based on Equation 1. The null hypothesis in the Phillips-Peron version of the ADF test is unit root persistence ( $\rho = 0$ ) against mean reversion ( $\rho < 0$ ) (Test 1A). The P/E ratios do not mean revert at the 10 percent, five percent or one percent levels of significance resulting in failure to reject the null hypothesis. The P/D ratios mean revert at the 10 percent and five percent levels of significance. Therefore, in terms of P/D ratios, the null hypothesis of unit root persistence is rejected in favour of mean reversion.

#### 5.4. Types of mean reversion

The rejection of the unit root null hypothesis prompts the question of the type of mean reversion (Coakley and Fuertes, 2006). The non-linear TAR model (Equation 3) that allows for distinct adjustment in bull and bear market phases was fitted to the P/D ratios. Accordingly, this application tests the null hypothesis of linear adjustment against the alternative of asymmetric or regime-sensitive adjustment (Test 1B). Table 4 summarises the results.

**Table 4: Non-linear model estimates and inference results**

Series	P/D					
T	105					
Newey-West lag ( <i>k</i> )	4					
F-test	4.31					
Prob > F	0.0066					
R-squared	0.1107					
Adj R-squared	0.085					
		<b>Z(t) has t-distribution</b>				
			1%	5%	10%	
<b>Test Statistic</b>		<b>p-value</b>	<b>Critical Value</b>	<b>Critical Value</b>	<b>Critical Value</b>	
Z(t)	-1.964	0.0262	-2.365	-1.660	-1.290	
<b>log P/D</b>		<b>Coef.</b>	<b>Std. Err.</b>	<b>t</b>	<b>P&gt; t </b>	<b>95% Conf. Interval</b>
beta	-0.0848983	0.0432286	-1.96	0.052	-0.1707	0.0087660
lag 1	-0.252299	0.1120457	-2.25	0.027	-0.4746	-0.0299760
lag 2	-0.1109457	0.1278420	-0.87	0.388	-0.3646	0.1427206
lag 3	0.0699766	0.1273120	0.55	0.584	-0.1826	0.3225913
constant	0.3009008	0.1456700	2.07	0.041	0.1186	0.5899418

The test statistic in Table 4 rejects the linear mean-reversion at better than the five percent level. Hence, there is evidence to suggest that the behaviour of P/D ratios do not adjust uniformly throughout the market cycle but are regime-sensitive instead.

### 5.5. Valuation ratio behaviour in bull and bear markets

Evidence that P/D ratios mean revert throughout the market cycle is naturally followed by analysing the behaviour of P/D ratios in bull and bear markets. The switching between bull and bear market phases was modelled through the indicator function:

$$I_t = \{1 \text{ if } q_t(w, d) \geq 0,$$

$$I_t = \{0 \text{ if } q_t(w, d) < 0,$$

where the transition variable  $q_t(w, d)$  obeys one of two schemes (Coakley and Fuertes, 2006). One has exponentially decreasing weights where  $w_1 > \dots > w_d$  so that the more distant past changes are given less weight – reflecting gradual

memory loss – which is consistent with feedback models (Campbell and Shiller, 1990; Coakley and Fuertes, 2006). The other scheme has exponentially increasing weights where  $w_1 < \dots < w_d$  and may be viewed as capturing the persistence in valuation ratios more appropriately (Coakley and Fuertes, 2006).

Table 5 denotes the frequency at which P/D ratios were exponentially decreasing relative to exponentially increasing.

**Table 5: The switching between bull and bear markets**

log P/D	Frequency	Percent
Exponentially Increasing ( $I_t \geq 0$ )	45	40.54
Exponentially Decreasing ( $I_t < 0$ )	66	59.46
Total	111	100

The non-linear TAR model (Equation 3) that allows for distinct adjustment in bull and bear market phases was fitted to the valuation ratios. The model tests the null hypothesis of no adjustment in bull (bear) markets against the alternative of mean reversion in bull (bear) markets (Test 1C). The TAR estimation results reported in Table 6 shed light on the nature of the adjustment dynamics in bull markets.

**Table 6: Valuation ratio adjustment in bull markets**

Series	P/D					
T	66					
Newey-West lag ( $k$ )	4					
F-test	4.31					
Prob > F	0.0066					
R-squared	-0.1107					
Adj R-squared	0.0850					
log P/D	Coef.	Std. Err.	t	P> t	95% Conf. Interval	
$\rho^c$	-0.0886343	0.0425887	-2.08	0.040	-0.1730893	0.008766
lag 1	-0.3085266	0.1209278	-2.55	0.012	-0.5483309	-0.0902577
$I_t$	0.0610016	0.0439214	1.39	0.168	-0.2609620	0.1427206
constant	-0.0236728	0.0300192	-0.79	0.432	-0.0832021	0.5899418

The speed of adjustment coefficients suggests that the pull from the attractor,  $\rho^c$ , is significant in bull market phases. Indeed, the t-statistic and the corresponding p-value indicate statistical significance. Thus the null hypothesis in Test 1C of no adjustment in bull markets is rejected in favour of mean reversion.

Evidence that valuation ratios mean revert during bull market phases is inconsistent with behavioural theories that recognise the influence of investor sentiment or the interaction between noise traders and rational investors in generating momentum in stock returns following unexpected good news (Coakley and Fuertes, 2006). It is also contradictory to behavioural notions such as investors' trend chasing and biased self-attribution (Daniel *et al.*, 1998; Hong and Stein, 1999).

The TAR estimation results reported in Table 7 shed light on the nature of the adjustment dynamics in bear markets.

**Table 7: Valuation ratio adjustment in bear markets**

<b>Series</b>	P/D					
<b>T</b>	45					
<b>Newey-West lag (k)</b>	4					
<b>F-test</b>	6.60					
<b>Prob &gt; F</b>	0.0032					
<b>R-squared</b>	0.2391					
<b>Adj R-squared</b>	0.2029					
	<b>log P/D</b>	<b>Coef.</b>	<b>Std. Err.</b>	<b>t</b>	<b>P&gt; t </b>	<b>95% Conf. Interval</b>
	$\rho^c$	-0.1115161	0.0767575	-1.45	0.154	-0.2664189 0.0433868
	lag 1	-0.6615607	0.2385449	-2.77	0.008	-1.1429640 -0.1801576
	constant	-0.0706971	0.0437665	-1.62	0.114	-0.1590214 0.0176272

The t-statistic and the corresponding probability value indicate statistical insignificance. Thus the null hypothesis in Test 1C of no adjustment in bear markets cannot be rejected and there is no evidence of reversal or correction during bear markets. However, the F-test demonstrates significance while the probability of type-one error is smaller than the error probability related to valuation adjustment in bull markets (0.0032 relative to 0.0066). In addition, the R-squared and the adjusted R-squared also confirm statistical significance. It is therefore inferred that the insignificance confirmed by the t-statistic is as a result of the relatively low frequency of bear market phenomenon ( $I_t \leq 0 = 45$ ) and not as confirmation that valuation ratios do not mean revert in bear markets. Hence, there is evidence to suggest that the behaviour of valuation ratios in bear markets cannot be adequately analysed using this sample and that the inferences are biased due to the protracted bull market episode that characterised the ratios from the mid-1990s (Coakley and Fuertes, 2006).

## **5.6. Conclusion**

Behavioural finance argues that the effect of momentum is caused by an overreaction on the part of investors: when they put too much weight on a company's recent performance, the share price becomes excessively inflated (or deflated) (Goedhart *et al.*, 2005). As additional information becomes available, investors adjust their expectations and a reversal in price occurs (Goedhart *et al.*, 2005).

The empirical research found that valuation ratios and hence share prices, as a function of valuation ratios, do not display persistent deviations from long-run equilibrium fundamental values but mean revert to fundamentals eventually.

The results indicate that there is evidence of mean reversion with specific reference to P/D ratios in a bull market cycle. Evidence of mean reversion however, implies that valuation ratios and consequently share prices do not always reflect fundamentals.

The findings are consistent with the behavioural finance notions of under- and overreaction and with experimental evidence on the failures of individual judgment under uncertainty and trading patterns of investors in experimental situations (Barberis, Shleifer and Vishny, 1998). Although consistent with behavioural finance, the evidence presents a challenge to the efficient markets theory because it suggests that sophisticated investors can earn superior returns by taking advantage of underreaction and overreaction without bearing extra risk (Barberis *et al.*, (1998).

Chapter 6 provides a detailed discussion of the findings in the context of the research objectives and the literature.

## **Chapter 6**

### **6. Discussion of Results**

#### **6.1 Introduction**

The aim of the research is to shed light on the deviations of share prices from fundamentals by taking into account stock market cycles (Coakley and Fuertes, 2006). The empirical analysis is based on quarterly data of stock price, dividends and earnings for companies listed on the JSE from the first quarter of 1980 to the second quarter of 2007.

The overarching research questions are defined as follows:

1. To the extent that share prices are a function of valuation ratios, does momentum, apparent in bull market cycles, result in valuation ratios and therefore, share prices to increase beyond levels that can be justified by fundamentals?
2. By the same token, does reversal, apparent in bear market cycles, result in valuation ratios and therefore, share prices to fall beyond levels that can be justified by fundamentals?

The findings are discussed in relation to the research questions, the theory, as well as the outcomes of similar empirical research.

#### **6.2 Valuation ratio behaviour in bull market cycles**

According to the semi strong form of the efficient market hypothesis, share prices efficiently incorporate all public information (Shiller, 1999). Prices can

therefore be regarded as optimal estimates of true investment value at all times (Shiller, 1999). The efficient market hypothesis in turn is based on the primitive notion that people behave rationally, or accurately maximise expected utility, and are able to process all available information (Shiller, 1999).

In addition, the idea that share prices accurately reflect all current publicly available information implies that past share prices, or indeed any other attribute which is commonly known such as, P/E and P/D ratios should not be able to predict future share price performance (Investec Asset Management 4Factor Equity Team, 2006). However, over recent years academic work has found strong evidence to the contrary.

Basu (1977) was one of the forerunners in determining empirically the relationship between investment performance of equity securities and valuation ratios, with specific focus on P/E ratios (Basu, 1997). Basu (1977) found that while the efficient market hypothesis denies the possibility of earning excess returns, the price-ratio hypothesis asserts that P/E ratios, due to exaggerated investor expectations, may be indicators of future investment performance (Basu, 1977). The results of the research were consistent with the view that the P/E ratio information was not fully reflected in security prices in as rapid a manner as postulated by the semi strong form of the efficient market hypothesis (Basu, 1977). Instead, it found that disequilibria persisted in capital markets during the period studied, namely April 1957 to March 1971 (Basu, 1977).

The validity of Basu's findings is clearly established by the findings of this research. In terms of question one, the findings, as depicted in Table 3 indicate that P/D ratios mean revert in bull market cycles asymmetrically. More importantly, the fact that P/D ratios mean revert in bull market cycles implies that, on the assumption that a bull market is characterised by upward trending prices, dividends will increase by more than prices, eventually bringing stock prices back in line with long-run equilibrium values. In order for valuation ratios to mean revert they must have deviated from fundamentals to start with. As such, it is clear from the findings that market inefficiency leads share prices to deviate from fundamentals in the short term. However, it is also clear that deviations are not persistent because share prices eventually mean revert to long-run equilibrium fundamentals. According to the theory, this can be attributed to under- and overreaction.

### **6.3 Under- and overreaction**

Undoubtedly, investors are constantly exposed to a barrage of information in equity markets making the assimilation thereof extremely difficult (Investec Asset Management 4Factor Equity Team, 2006). Analysing all the information is impossible. Investors are therefore forced to make decisions based on rules of thumb, or heuristics. These heuristics lead to systematic mistakes and biases (Investec Asset Management 4Factor Equity Team, 2006). For example, when new information comes out investors react to it conservatively. They are unwilling to change their minds because they are overconfident in their own abilities and because they tend to analyse in relation to prior forecasts rather than starting afresh (Daniel *et al.*, 1998; Investec Asset Management

4Factor Equity Team, 2006). The heuristic of analysing new information on previous expectations is as a result of investors being anchored to prior points of view (Investec Asset Management 4Factor Equity Team, 2006). Although this provides a short-cut, which allows investors to look at less information but make equally accurate investment decisions for the most part, it leads to systematic errors such as underreaction (Investec Asset Management 4Factor Equity Team, 2006).

Specifically, underreaction means that stock prices do not react immediately and efficiently to new information and that earnings (in this case P/D ratios) will trend as investors gradually come round to a new point of view (Investec Asset Management 4Factor Equity Team, 2006).

It has been found that when people are asked to make quantitative assessments, their assessments are influenced by suggestions (Shiller, 1999). An example of this is found in the results researchers obtained (Shiller, 1999). These researchers often ask people about their incomes, using a questionnaire in which respondents are instructed to indicate which of a number of income brackets, shown as choices on the questionnaire, their incomes fall into (Shiller, 1999). It has been shown that the answers people give are influenced by the brackets shown on the questionnaire (Shiller, 1999). The tendency to be influenced by such suggestions is called anchoring (Shiller, 1999).

While anchoring undoubtedly has an information-response component in many circumstances, it has also been shown that anchoring behaviour persists even

when information is absent (Shiller, 1999). In one experiment by Tversky and Kahneman (1974), subjects were given simple questions whose answers were in percentages, for example, the percentage of African nations in the United Nations (Shiller, 1999). A wheel of fortune with numbers from 1 to 100 was spun before the subjects (Shiller, 1999). Obviously, the number at which the wheel of fortune stopped had no relevance to the question just asked (Shiller, 1999). Subjects were asked whether their answer was higher or lower than the wheel of fortune number, and then to give their own answer (Shiller, 1999). Respondents' answers were strongly influenced by the "wheel of fortune". For example, the median estimates of the percentage of African countries in the United Nations were 25 and 45 for groups that received 10 and 65 in the "wheel of fortune", respectively.

That anchoring affects valuation, even by experts, was demonstrated by Northcraft and Neale (1987) in the context of real estate valuation. All subjects were taken to a house for sale, asked to inspect the house for up to 20 minutes, and were given a ten-page information pack about the house and about other houses in the area (Shiller, 1999). The same pack was given to all subjects except that the asking price of the property under consideration and its implied price per square foot were changed between subjects (Shiller, 1999). Subjects were asked for their own opinions of its appraisal value, appropriate listing price, and the lowest offer the subject would accept for the house if the subject were the seller (Shiller, 1999). The real estate agents who were given an asking price of \$119,900 had a mean predicted appraisal value of \$114,204, listing price of \$117,745, purchase price of \$111,454 and the lowest acceptable

offer of \$111,136, while the real estate agents who were given an asking price of \$149,900 had a mean appraisal value of \$123,818 (Shiller, 1999). The changed asking prices thus swayed their valuations by 11 percent to 14 percent (Shiller, 1999). Similar results were found with amateur subjects (Shiller, 1999). While this experiment does not rule out that the effect of the asking price was due to a rational response to the assumed information, the effects on the asking price are remarkably large, given that so much other information on the house was also given (Shiller, 1999).

The experimental results confirm a phenomenon known as conservatism (Barberis *et al.*, 1998). Conservatism states that individuals are slow to change their beliefs in the face of new evidence (Barberis *et al.*, 1998). This means that new expectations will be too conservative as they remain anchored to previous expectation sets resulting in underreaction (Investec Asset Management 4Factor Equity Team, 2006). Consequently, underreaction causes share prices to drift in a given direction rather than immediately correcting to a new level.

In terms of overconfidence, according to Daniel *et al.*, (1998) investors are overconfident about their private information and overreact to it (Cooper *et al.*, 2004). If investors have self-attribution bias, then when subsequent public information arrives, investors will react asymmetrically to confirming versus disconfirming pieces of news (Cooper *et al.*, 2004). In other words, investors attribute successes to their own skill more than they should and attribute failures to external noise more than they should (Cooper *et al.*, 2004). The consequence of this behaviour is that investors' overconfidence increases

following the arrival of confirming news (Cooper *et al.*, 2004). The increase in overconfidence furthers the initial overreaction and generates return momentum (Cooper *et al.*, 2004). The overreaction in prices will eventually be corrected in the long-run as investors observe future news and realise their errors (Cooper *et al.*, 2004). Hence, increased overconfidence results in short-run momentum and long-run reversal (Cooper *et al.*, 2004).

The theory of short-run momentum and long-run reversal can be extended to predict differences in momentum profits across states of the market (Cooper *et al.*, 2004). Aggregate overconfidence should be greater following market gains (Daniel *et al.*, 1998; Gervais and Odean, 2001; Cooper *et al.*, 2004). Because investors in aggregate hold long positions in the equity market, increases in market prices will tend to be attributed unduly to investor skill and will result in greater aggregate overconfidence (Cooper *et al.*, 2004). If overconfidence is in fact higher following market increases, then the overreactions will be stronger following these up markets, generating greater momentum in the short-run (Daniel *et al.*, 1998; Cooper *et al.*, 2004).

#### **6.4 The consequences of behavioural errors**

Under- and overreaction lead to new information being absorbed slowly into share prices, rather than immediately, as suggested by the efficient market hypothesis (Investec Asset Management 4Factor Equity Team, 2006). As a result, stocks trend as new information is incorporated gradually into the share price (Investec Asset Management 4Factor Equity Team, 2006). Moreover, these trends can continue into the medium-term, as one of the key

consequences of underreaction is the creation of serial correlation in earnings (Investec Asset Management 4Factor Equity Team, 2006). If investors reset their expectations too low, following a positive announcement, then the company automatically has an easier hurdle to overcome going forward (Investec Asset Management 4Factor Equity Team, 2006). An ongoing set of positive announcements, which are not immediately and efficiently responded to, will maintain the share price trend (Investec Asset Management 4Factor Equity Team, 2006).

Hong and Stein (1999) found that news does in fact travel slowly in the market, leading to share price trend strategies being successful (Investec Asset Management 4Factor Equity Team, 2006). Their model is based on initial underreaction to information and subsequent overreaction, which leads to stock price reversal in the long-run. The model features two classes of traders, news watchers and momentum traders (Hong and Stein, 1999). The news watchers make forecasts based on signals that they privately observe about future fundamentals (Hong and Stein, 1999). Their limitation is that they do not respond to current or past prices but work on performance and react to changes in the operating performance of the company (Hong and Stein, 1999). Momentum traders, on the other hand, respond to past price movements and react only to changes in the share price (Hong and Stein, 1999). Hong and Stein (1999) make a further assumption in terms of information. They assume that private information diffuses gradually across the news watcher population (Hong and Stein, 1999). This additional assumption leads to an initial underreaction to news (Hong and Stein, 1999; Cooper *et al.*, 2004). The

underreaction and subsequent positive serial correlation in returns attracts the attention of the momentum traders whose trading activity results in an eventual overreaction to news (Hong and Stein, 1999; Cooper *et al.*, 2004). Prices revert to their fundamental levels in the long-run (Hong and Stein, 1999; Cooper *et al.*, 2004).

From the above it is apparent that anomalies exist because investors either under- or overreact. This dovetails neatly with the work of De Bondt and Thaler (1985). They found that losers, defined as shares that had underperformed over the previous three years then tended to outperform over the next three years. They argued that investors became disenchanted with poorly performing stocks and therefore overreact because investors focus only on the bad news and do not correctly analyse the company's true potential. In its most exaggerated form this gives rise to the desire to "get out at any price". This overreaction creates a basket of cheap, incorrectly priced stocks, which then outperform relative to expensive stocks where expectations are by implication much higher. This period of outperformance can be prolonged, as investors are unwilling to admit to their mistake; another example of anchoring (De Bondt and Thaler, 1985).

In addition to this well-documented valuation anomaly, Investec Asset Management has found an additional example of anchoring, associated with the apparent undervaluation of recent winners (Investec Asset Management 4Factor Equity Team, 2006). These are companies which have exceeded expectations for a number of quarters, sometimes much longer, resulting in

strong relative share price performance. Yet at the same time investors have remained consistently skeptical about their near- to medium-term prospects, perhaps because they are attempting to call the top of a particular cyclical phenomenon or because they underestimate the long-term competitive advantage that a company has achieved. This creates an attractive investment opportunity where investors are presented with a stock which has discounted a downturn or the erosion of market share as it loses its competitive edge and which is therefore likely to see a major share price rise on any further improvement in operating performance (Investec Asset Management 4Factor Equity Team, 2006).

Investec Asset Management (2006) witnessed this exact phenomenon during the commodities bull run in August 2006. Analysts persistently assumed that commodity prices would see steep price falls and factored this into models as they attempted to call the cyclical top. However, in doing so they failed to realise the improved supply/demand dynamics in certain areas and as such they were forced to continuously upgrade expectations as their estimates proved too low (Investec Asset Management 4Factor Equity Team, 2006).

The findings of this specific research question blend neatly with other empirical analysis. More importantly, the theory of underreaction elegantly explains the deviation of share prices from fundamentals in a bull market cycle and the subsequent mean reversion.

## 6.5 Valuation ratio behaviour in bear market cycles

In terms of the second research question namely, to the extent that share prices are a function of valuation ratios, does reversal, apparent in bear market cycles, result in valuation ratios and therefore, share prices to fall beyond levels that can be justified by fundamentals, there is no evidence of reversal or correction during bear markets. However, the F-test demonstrates significance while the probability of type-one error is smaller than the error probability related to valuation adjustments in bull markets (0.0032 relative to 0.0066). In addition, the R-squared and the adjusted R-squared also confirm statistical significance. It is therefore inferred that the insignificance confirmed by the t-statistic is as a result of the relatively low frequency of bear market phenomenon ( $I_t \leq 0 = 45$ ) and not as confirmation that valuation ratios do not mean revert in bear markets. Hence, there is evidence to suggest that the behaviour of valuation ratios in bear markets cannot be adequately analysed using this sample and that the inferences are biased due to the protracted bull market episode that characterised the ratios from the mid-1990s (Coakley and Fuentes, 2006).

## 6.6 Conclusion

Based on the research findings, anomalies exist because investors overreact. They push prices down too far and up too high because they fail to timeously respond to meaningful information. Not only do investors overreact, they do so predictably and systematically (Dreman, 1998). Moreover, because investors “herd”, it follows that most (but not all) investors make the wrong decision together (Saville, 2007). The explanation behind this outcome is quite simple. As a result of feedback theory and overreaction, investors chase “winning

stocks”. As the herd stampedes into these highly sought after opportunities they push valuation multiples to increasingly stretched levels as more investors follow the stock higher. However, as multiples become increasingly stretched, the stock’s capacity to disappoint grows, and at some point “winners” invariably deliver a result that is shy of expectations (Saville, 2007). The result is inevitable: the stock price tumbles as investors’ overreaction on the upside is matched by overreaction on the downside (Saville, 2007).

By contrast, “loser” stocks drift listlessly on low multiples. However, this neglect means that ignored or depressed stocks have a greater propensity to surprise on the upside. Just as winners disappoint, so losers surprise. Critically, with positive surprise comes a rapid revival in investor interest and stock prices (Saville, 2007).

One of the best documented examples of consistent outperformance caused by investor overreaction is found in the pricing anomalies of value stocks (Saville, 2007). On this front, the investment approach adopted by value and contrarian investors hinges around identifying stocks which exhibit “value” characteristics, such as low price-earnings ratios, high dividend yields, high cash flow-earnings ratios, low price-net asset value ratios and high rates of return on equity and return on assets relative to market valuations (Saville, 2007).

Chapter 7 elaborates on value investing as an avenue to consistent outperformance based on the findings of the research and gives recommendations for future research.

## Chapter 7

### 7. Conclusion

Modern portfolio theory, which has dominated the world of investment finance since the middle of the twentieth century, is underpinned by the arguments of the efficient market hypothesis which holds that assets are priced fairly by the market (Saville, 2007). As such, subscribers to modern portfolio theory argue that active portfolio management is a futile activity (Saville, 2007). Despite the overwhelming support enjoyed by this school of thought, many investors devote their efforts to beating the market. Unfortunately and unsurprisingly, most fail (Saville, 2007).

For this reason, it is commonly concluded that the efficient market hypothesis is a valid proposition and that investors should resign themselves to the fate of matching the market's performance by investing in a passively managed investment portfolio (Saville, 2007). However, by using value factors such as low P/E ratios, it is possible to find and act on pricing anomalies and in so doing, beat the market (Saville, 2007).

To determine whether pricing anomalies exist in the South African equity market, empirical analysis was conducted on quarterly data of stock price, dividends and earnings for companies listed on the JSE from the first quarter of 1980 to the second quarter of 2007. A two-regime non-linear dynamic model was used to test whether valuation ratios mean revert. To the extent that they

did, the testing progressed to analyse the behaviour of valuation ratios in bull and bear market cycles.

The results of the study demonstrate that although the South African equity market is not totally extreme, it contains quite substantial noise to the extent that it dominates movements in the aggregate market in the short term (Shiller, 2003). More specifically the results indicate that P/D ratios, in particular and by implication, share prices, deviate from fundamentals in the short term but mean revert to fundamentals in the long-term. It is therefore safe to maintain that there is merit in taking advantage of short term pricing anomalies in order to achieve long-term market outperformance. This form of investment is known as value investing (Saville, 2007).

Before considering the case for value investing it is useful to provide a brief background.

### **7.1. Background**

Benjamin Graham, widely recognised as the father of value investing, believed that in the short term, capital markets are voting machines, with a security's price reflecting its popularity with investors on any given day (Auxier, 1994). In the long term however, the market is more of a weighing machine, aligning a security's price with its intrinsic value, or the true worth of the underlying business (Auxier, 1994).

For value investors, this means that a stock's price and its intrinsic value often detach from one another in the short term (Auxier, 1994). Because of the manic-depressive nature of the overall market, where sentiment can shift between sweeping, carefree optimism and over-whelming fear and uncertainty seemingly overnight, prices of securities tend to fluctuate much more than the true worth of the underlying investments they represent (Cannon Asset Management, 2007). This irrationality can materialise on the upside, lifting prices to dangerously lofty heights (Cannon Asset Management, 2007). It can also appear on the downside, dragging prices for select stocks to bargain levels (Cannon Asset Management, 2007).

Value investors target the latter situation, purchasing out-of-favour stocks that are trading at discounts to their intrinsic values, and then holding these stocks until the market recognises their true worth (Cannon Asset Management, 2007).

## **7.2. The merit of value investing**

Benjamin Graham distils the secret of sound investment into three words namely, margin of safety (Auxier, 1994).

Simply put, the margin of safety represents the difference between a company's stock price and its intrinsic value (Auxier, 1994). Value investors believe that the larger this margin, the safer the investment (Auxier, 1994). By scooping up stocks trading at substantial discounts to their estimated intrinsic values, value investors aim to build portfolios that can accommodate future uncertainty and demonstrate resilience in market downturns (Auxier, 1994). By confidently

approaching the short-term vagaries of the market with rational, objective analysis, investors can identify compelling investment opportunities and achieve solid long-term results (Cannon Asset Management, 2007). Time is an important aspect of the value investing model because some holdings will inevitably encounter the occasional stumbling block and a margin of safety provides protection against adverse conditions. Therefore, when it comes to results, value investors emphasise the accumulation of lasting wealth over the pursuit of potentially fleeting short-term gains (Auxier, 1994).

One of the most well known studies undertaken on the value effect is that conducted by Fama and French (1998) on equities listed on 12 exchanges and conducted over 20 years of data (1975-1995). They found that value stocks outperformed growth stocks (which is the term used for stocks that are in vogue and considered highly sought after opportunities) in all but one of the countries examined (Italy), with value stocks delivering an average return that outpaced growth stocks by more than five percentage points per annum over the 20 years (Fama and French, 1998; see also Saville, 2007).

### **7.3. Recommendations**

Against this backdrop, recommendations to individual investors and corporates are attempted as well as recommendations for future research.

#### **7.3.1. Recommendations to individual investors**

In essence, the value phenomenon arises because of peoples' tendency to overreact. The effect is compounded by the fact that people overreact when

assessing the merits and therefore pricing, of stocks (Saville, 2007). They tend to become too enthusiastic about the prospect for stocks that are in vogue, pushing prices above rational levels. At the same time, stocks that are considered to have poor prospects become neglected to the extent that their ratings and prices drift below fair levels. In short, so-called winners become too expensive and losers become too cheap. When the process of mean reversion sets in, the winners drift back to fair value whilst the losers catch up to fair value. Through this process the losers not only outperform the winners, but beat the market by a wide margin (Saville, 2007).

Therefore, if an investor is to do better than average, his or her investment policies should not be popular. Similarly, an investor who follows the crowd is unlikely to experience even average results (Auxier, 1994)

Betting against the crowd however, takes courage. To this end, it is recommended that individual investors use P/E ratios and dividend yield as the criteria for building a value portfolio of listed investments. The portfolio should preferably consist of stocks that have a low P/E ratio and a high average dividend yield. The criteria are discussed in more detail below.

#### **7.3.1.1. P/E ratios**

As discussed, market inefficiency leads share prices to deviate from fair value for long periods of time, and often by significant amounts. P/E ratios can be used to determine companies that are trading at a discount relative to their fundamental economic prospects. The P/E ratio is the ratio of the current stock

price to last year's earnings per share (Bodie, Kane and Marcus, 2005). The P/E ratio indicates how much investors must pay per rand of earnings that the firm generates (Bodie *et al.*, 2005). The P/E ratio is a reflection of the market's optimism concerning a firm's growth prospects (Bodie *et al.*, 2005). For example, when a firm has good investment opportunities, the market will reward it with a higher P/E ratio if it exploits those opportunities more aggressively by ploughing back more earnings into those opportunities (Bodie *et al.*, 2005).

For purposes of a value portfolio, in the use of a P/E ratio, investors must decide whether they are more or less optimistic than the market. If the investor is more optimistic than the market, the stock can be included in the portfolio (Bodie *et al.*, 2005).

#### **7.3.1.2. Dividend yield**

Dividend yield indicates the current income received by stock holders as a percentage of the price (Bodie *et al.*, 2005). To this end, investors should select stocks with a progressive dividend policy. Over the long term, the stock market will reward company's who have an ability to create wealth for shareholders (Investec Asset Management 4Factor Equity Team, 2006).

It is definitely not being argued that acquiring shares with low P/E ratios and high average dividend yields is a winning formula. The analysis approach should adopt greater rigour, particularly in terms of P/E ratios for a number of reasons. First, riskier stocks have lower P/E ratios (Bodie *et al.*, 2005). To this end, a low P/E ratio may not always indicate value. Second, the denominator in

the P/E ratio is accounting earnings, which are influenced by somewhat arbitrary accounting rules such as the use of historical cost in depreciation and inventory valuation (Bodie *et al.*, 2005). Accounting earnings are also subject to earnings management. Earnings management is the practice of using flexibility in accounting rules to improve the apparent profitability of the firm (Bodie *et al.*, 2005). Even generally accepted accounting principles (“GAAP”) allow firms considerable discretion to manage earnings (Bodie *et al.*, 2005). Given the available leeway in managing earnings, the justified P/E ratio becomes difficult to gauge.

The above mentioned criteria also do not factor in incompetent or dishonest management nor do they help identify a business that has a durable competitive advantage and owns a piece of the consumer’s mind (Buffet and Clark, 2006).

Nonetheless, the above mentioned model can serve as a starting point. By using P/E ratios and dividend yields as the initial filter, individual investors can shift away from the psychology that favours stocks on high ratings with widespread investment support. It will enable individuals to step away from the crowd and strip emotion out of the investment decision and put together a sustainable, market beating investment approach. Ultimately, however, the ability to adopt value investing hinges on discipline and patience (Saville, 2007).

#### **7.4. Recommendations to corporates**

Share price deviations from fundamentals have implications for corporate managers. Paradoxically, such market deviations make it even more important

for the executives of a company to understand the intrinsic value of the company's shares (Goedhart *et al.*, 2005). This knowledge allows listed corporates to exploit any deviations, if and when they occur, to time the implementation of strategic decisions more successfully (Goedhart *et al.*, 2005).

Corporate managers can take advantage of market deviations by issuing additional share capital when the stock market attaches too high a value to the company's share relative to the underlying value (Goedhart *et al.*, 2005). With regard to corporate activity, companies can elect to pay for acquisitions with shares instead of cash when the market overprices equity relative to the intrinsic value (Goedhart *et al.*, 2005). Corporate managers can consider divesting particular businesses at times when trading and transaction multiples are higher than can be justified by underlying fundamentals (Goedhart *et al.*, 2005).

Finally, corporates can repurchase shares when the market underprices them relative to their underlying value (Goedhart *et al.*, 2005). The repurchase of shares is relevant in a South African context specifically when considering Black Economic Empowerment ("BEE") deals. Most BEE transactions ultimately require the issue of shares and usually a significant amount. By closely monitoring equity markets, issuers can capitalise on short-term price deviations to repurchase their own shares. These shares can then be issued as part of the BEE transaction. By issuing existing shares rather than by issuing additional capital, the corporate avoids diluting existing shareholders.

Worth mentioning however, is that it is not recommended that companies base decisions to issue or repurchase shares, to divest or acquire businesses, or to settle transactions with cash or shares solely on an assumed difference between the market and underlying value of a company's shares (Goedhart *et al.*, 2005). Instead, these decisions must be grounded in a strong business strategy driven by the goal of creating shareholder value. Market deviations are more relevant as tactical considerations when companies time and execute such decisions, for example, when to issue additional capital or how to pay for a particular transaction (Goedhart *et al.*, 2005).

In addition, managers should be wary of analyses claiming to highlight market deviations (Goedhart *et al.*, 2005). The evidence should be compelling to the extent that deviations should be significant in both size and duration, given the capital and time needed to take advantage of the types of opportunities listed previously (Goedhart *et al.*, 2005).

### **7.5. Recommendations for future research**

This research was restricted to the JSE, which consists of large capitalisation firms. Evidence indicates that the share prices of small capitalisation firms are more vulnerable to volatility specifically because individual investors are more active in the shares of mid- to small capitalisation firms (Nofsinger, 2005). Individuals are inherently more emotional than institutional model traders (Nofsinger, 2005). To this end, an analysis of companies listed on the Alternative Exchange ("AltX") may be insightful.

The fundamentals of companies were restricted to dividends and earnings. The relation between other fundamentals such as turnover, cashflow, net asset value, operating profit margin, balance sheet ratios and other financial ratios such as current ratios and return on equity may provide a different perspective to share price deviations from fundamentals.

The research is confined to an analysis of the effect of over- and underreaction in terms of behaviour. Other behavioural principles such as prospect theory, regret and cognitive dissonance and mental compartments are not considered. In addition, the impact of other behavioural principles such as the dysfunction effect, gambling behaviour and speculation, perceived irrelevance of history, magical thinking, quasi-magical thinking, attention anomalies, the availability heuristic, culture and social contagion and global culture may provide insight to the volatility of the equity market and possible opportunities (Shiller, 1999).

The research is limited to bull and bear market phases. An analysis of the impact of shocks on share prices as well as the effects of long-lasting or permanent effects may prove valuable in designing investment strategies particularly for the South African equity market that is vulnerable to external economic shocks and foreign investor sentiment.

In terms of investor behaviour, the principle of overreaction can be tested in other asset classes with the South African residential property market being a topical case in point.

In conclusion, as long as people are guided by emotion, where rational thought and sensible actions are overruled by raw action, investors will continue to overreact (Saville, 2007). In turn, the persistence of overreaction ensures that pricing anomalies in equity markets will endure.

The researcher hopes that this study has positively contributed to the debate around the impact of investor behaviour and its role in causing share price deviations from fundamentals, especially in terms of the South African equity market, of which research is limited. Moreover, it is hoped that this research has contributed to a better understanding of financial market behaviour.

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## Appendix A

**Table 8: ALSI Composite Index P/D and P/E ratios for the period 1980:Q1-2007:Q2**

Date	P/D	P/E	log P/D	log P/E
1980:Q1	17.20	8.20	2.8449090	2.1041340
1980:Q2	16.10	8.10	2.7788190	2.0918640
1980:Q3	18.90	9.50	2.9391620	2.2512920
1980:Q4	14.10	7.50	2.6461750	2.0149030
1981:Q1	11.90	6.20	2.4765380	1.8245490
1981:Q2	11.10	5.50	2.4069450	1.7047480
1981:Q3	13.00	6.50	2.5649490	1.8718020
1981:Q4	13.50	6.40	2.6026900	1.8562980
1982:Q1	10.30	4.70	2.3321440	1.5475620
1982:Q2	8.70	3.90	2.1633230	1.3609770
1982:Q3	14.10	5.50	2.6461750	1.7047480
1982:Q4	17.20	7.60	2.8449090	2.0281480
1983:Q1	16.70	7.90	2.8154090	2.0668630
1983:Q2	18.50	9.00	2.9177710	2.1972250
1983:Q3	17.50	8.80	2.8622010	2.1747520
1983:Q4	16.90	8.50	2.8273140	2.1400660
1984:Q1	19.60	9.60	2.9755300	2.2617630
1984:Q2	19.20	9.00	2.9549100	2.1972250
1984:Q3	14.70	7.20	2.6878470	1.9740810
1984:Q4	17.20	8.00	2.8449090	2.0794420
1985:Q1	17.20	8.30	2.8449090	2.1162560
1985:Q2	18.90	9.20	2.9391620	2.2192030
1985:Q3	17.50	8.80	2.8622010	2.1747520
1985:Q4	19.60	9.50	2.9755300	2.2512920
1986:Q1	21.70	10.50	3.0773120	2.3513750
1986:Q2	21.30	10.00	3.0587070	2.3025850
1986:Q3	28.60	13.20	3.3534070	2.5802170
1986:Q4	25.00	11.50	3.2188760	2.4423470
1987:Q1	25.60	12.30	3.2425920	2.5095990
1987:Q2	27.80	12.80	3.3250360	2.5494450
1987:Q3	31.30	14.50	3.4436180	2.6741490
1987:Q4	21.30	9.70	3.0587070	2.2721260
1988:Q1	19.60	8.60	2.9755300	2.1517620
1988:Q2	20.00	8.50	2.9957320	2.1400660
1988:Q3	20.80	8.40	3.0349530	2.1282320
1988:Q4	21.70	8.70	3.0773120	2.1633230
1989:Q1	26.30	10.40	3.2695690	2.3418060
1989:Q2	25.60	9.90	3.2425920	2.2925350
1989:Q3	26.30	10.00	3.2695690	2.3025850
1989:Q4	29.40	10.80	3.3809950	2.3795460
1990:Q1	28.60	10.50	3.3534070	2.3513750
1990:Q2	27.00	9.80	3.2958370	2.2823820



Date	P/D	P/E	log P/D	log P/E
1990:Q3	24.40	9.20	3.1945830	2.2192030
1990:Q4	24.40	9.20	3.1945830	2.2192030
1991:Q1	26.30	10.50	3.2695690	2.3513750
1991:Q2	30.30	12.30	3.4111480	2.5095990
1991:Q3	31.30	12.50	3.4436180	2.5257290
1991:Q4	30.30	12.70	3.4111480	2.5416020
1992:Q1	31.30	13.20	3.4436180	2.5802170
1992:Q2	31.30	13.50	3.4436180	2.6026900
1992:Q3	27.80	12.00	3.3250360	2.4849070
1992:Q4	27.80	12.30	3.3250360	2.5095990
1993:Q1	31.30	13.90	3.4436180	2.6318890
1993:Q2	34.50	15.60	3.5409590	2.7472710
1993:Q3	33.30	14.70	3.5055570	2.6878470
1993:Q4	38.50	16.70	3.6506580	2.8154090
1994:Q1	45.50	19.20	3.8177120	2.9549100
1994:Q2	47.60	20.00	3.8628330	2.9957320
1994:Q3	45.50	19.60	3.8177120	2.9755300
1994:Q4	43.50	18.20	3.7727610	2.9014220
1995:Q1	40.00	16.70	3.6888790	2.8154090
1995:Q2	40.00	16.70	3.6888790	2.8154090
1995:Q3	41.70	16.70	3.7305010	2.8154090
1995:Q4	43.50	16.90	3.7727610	2.8273140
1996:Q1	47.60	17.90	3.8628330	2.8848010
1996:Q2	47.60	17.50	3.8628330	2.8622010
1996:Q3	43.50	16.90	3.7727610	2.8273140
1996:Q4	40.00	15.90	3.6888790	2.7663190
1997:Q1	43.50	16.40	3.7727610	2.7972810
1997:Q2	43.50	16.70	3.7727610	2.8154090
1997:Q3	41.70	16.10	3.7305010	2.7788190
1997:Q4	35.70	12.70	3.5751510	2.5416020
1998:Q1	47.60	17.20	3.8628330	2.8449090
1998:Q2	43.50	15.40	3.7727610	2.7343670
1998:Q3	32.30	12.00	3.4750670	2.4849070
1998:Q4	33.30	11.60	3.5055570	2.4510050
1999:Q1	38.50	14.50	3.6506580	2.6741490
1999:Q2	43.50	14.90	3.7727610	2.7013610
1999:Q3	41.70	14.90	3.7305010	2.7013610
1999:Q4	52.60	17.90	3.9627160	2.8848010
2000:Q1	43.50	15.40	3.7727610	2.7343670
2000:Q2	41.70	14.70	3.7305010	2.6878470
2000:Q3	41.70	14.30	3.7305010	2.6602590
2000:Q4	40.00	13.20	3.6888790	2.5802170
2001:Q1	34.50	12.00	3.5409590	2.4849070
2001:Q2	37.00	12.30	3.6109180	2.5095990
2001:Q3	31.30	10.50	3.4436180	2.3513750
2001:Q4	38.50	13.30	3.6506580	2.5877640
2002:Q1	38.50	13.90	3.6506580	2.6318890



Date	P/D	P/E	log P/D	log P/E
2002:Q2	34.50	10.90	3.5409590	2.3887630
2002:Q3	28.60	11.00	3.3534070	2.3978950
2002:Q4	29.40	10.40	3.3809950	2.3418060
2003:Q1	23.80	9.20	3.1696860	2.2192030
2003:Q2	25.00	9.80	3.2188760	2.2823820
2003:Q3	27.80	10.90	3.3250360	2.3887630
2003:Q4	32.30	13.20	3.4750670	2.5802170
2004:Q1	34.50	14.50	3.5409590	2.6741490
2004:Q2	31.30	13.30	3.4436180	2.5877640
2004:Q3	37.00	14.50	3.6109180	2.6741490
2004:Q4	38.50	15.20	3.6506580	2.7212950
2005:Q1	37.00	14.10	3.6109180	2.6461750
2005:Q2	37.00	14.30	3.6109180	2.6602590
2005:Q3	40.00	15.20	3.6888790	2.7212950
2005:Q4	41.70	15.90	3.7305010	2.7663190
2006:Q1	43.50	16.10	3.7727610	2.7788190
2006:Q2	45.50	16.70	3.8177120	2.8154090
2006:Q3	41.70	16.10	3.7305010	2.7788190
2006:Q4	35.71	17.20	3.5755508	2.8449090
2007:Q1	43.50	15.60	3.7727610	2.7472710
2007:Q2	43.50	15.60	3.7727610	2.7472710