Deviations from Market Efficiency; Behavioural Explanations and their Validity

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I. Introduction

Efficiency of financial markets implies that prices fully reflect all available information rapidly and in an unbiased manner. Thus, market prices should provide an unbiased estimate of fundamental value.

Despite strong empirical evidence supporting this theory, there are questions about its validity. In recent years, a significantly large volume of empirical research has been conducted to show predictability of asset returns using publicly available information. This is popularly referred to as the anomalies literature. These studies used different explanatory variables ranging from fundamental to technical factors and showed evidence of market inefficiency. The results indicate that returns exhibit trends of momentum in the short to medium term and reversal in the long term.

This paper argues for the development of a model that captures aspects of investor behaviour, like overconfidence, in a multi-factor asset pricing model as being the best way to proceed.

This survey has been divided into seven sections. Section-II provides a brief background of market efficiency. Section-III follows with a broad survey of the anomalies literature covering the classic studies along with some very recent work. Section-IV presents the general critique of this literature. Section-V provides a brief overview of some of the key behavioural explanations for the anomalies. Section-VI provides the limitations of the models presented. And finally Section-VII concludes the proposed argument.

II. Market Efficiency

A. Theoretical perspective

The underlying notion of market efficiency has its historic background from the concept of a fair game due to the similarities between

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financial markets and games of chance. The theoretical underpinnings were provided by Bachelier (1900). This concept is based on martingality, whereby conditional on current information, the expected change in prices is zero. This implies that the best predictor of tomorrow's price based on all historic information till today is today's price.

Since Bachelier's (1900) paper, no theoretical framework unified the "fair game" notion to expected return models until Samuelson (1965). The paper "Proof that Properly Anticipated Prices Fluctuate Randomly" provided the sound theoretical grounding that linked market efficiency to random walk models. This connection laid the grounds for countless empirical research to follow.

Fama (1970) defines a market as efficient if prices "fully reflect" all available information. The time taken for prices to adjust to market information defines the extent of efficiency. Delays would allow market participants to make economic profits based on the information that they have obtained. Jensen (1978) provides an alternate definition: "A market is efficient with respect to information set θ, if it is impossible to make economic profits by trading on the basis of information set θ".

Using the definitions provided by Jensen (1978) (above) and Roberts (1967), we define:

Weak-form Efficiency: here the information set θ refers to historic prices or returns which implies that no economic profits can be made based solely on this information.

Semi-Strong Form: In this case θ includes all public information (including historic prices/returns) available to all market participants.

Strong Form: Here θ includes all information, both public and private. Hence, information monopolistically available to certain market participants does not allow them to earn economic profits.

Strong form market efficiency, however, is not empirically possible since it requires that trading and information costs are zero. This point of view was put forth by Grossman and Stiglitz (1980) in their argument for relative efficiency in financial markets. This is based on the premise that if information is costly and if markets fully reflect all information then there is no benefit from gathering information. If, however, no one obtains information then prices will not be able to reflect information. Jensen (1978) found that the empirically feasible form of efficient market equilibrium was where the marginal costs of obtaining information equals

the possible benefits that can be derived from acting on that information. If prices fully reflect all available information rapidly then there is no incentive for any of the market participants to collect additional costly information.

B. Implications for investing strategies:

There is a direct implication on the success of traditional trading strategies based on Technical and Fundamental analysis. Weak-form efficiency implies that there are no economic profits possible from strategies based on technical analysis and semi-strong form stipulates no gains from pure fundamental analysis. Hence, economic profits from either type of analysis will have implications about market efficiency.

C. Empirical tests:

Cowles (1933) conducted the first non-parametric test for efficiency in financial markets. Subsequently a large volume of literature covering empirical tests of market efficiency has evolved based on the link between market efficiency and the Random Walk Hypotheses. This means that the more random the price changes are, the more efficient the market is. The three random walk hypotheses are based on the extent of "randomness" of price changes.

Research by Lo and McKinley (1988) and Poterba and Summers (1988) has shown that stock prices do not follow random walk models. They show that prices exhibit positive correlation in the short term and negative correlation in the long term. Analysis using the S&P data was conducted and similar results were found. They are attached as annex 1.

The main issue in testing market efficiency is the joint hypothesis problem – testing for efficiency is not possible without assuming some form of equilibrium asset pricing model. A rejection could be due to either a rejection of market efficiency or a bad asset pricing model.

Based on this background, in the next section, an overview of some of the main literature relating to the breakdown of market efficiency is provided.

III. Review of Key Market Anomalies Literature

Over the years several studies have documented empirical anomalies which imply that either markets are not efficient or the underlying asset pricing model was inaccurate. This led to detailed scrutiny of asset pricing models such as the Capital Asset Pricing Model (CAPM) by Sharpe (1964) and Lintner (1965). It also led to the development of newer models. In this

section a few of the major studies detailing market anomalies are looked at and key findings referred to.

A. *Importance of Accounting numbers*

In their seminal study, Ball and Brown (1968) sought to examine the importance of the release of accounting information (specifically earnings) on stock prices. They looked at both the content and timing of earnings announcements and their impact on stock prices. Under their null hypothesis of market efficiency; all information, like the release of earnings data should be immediately reflected in prices. They forecasted earnings based on a time series process and separated firms into "good news" (positive difference between actual and forecasted earnings) and "bad news" (negative difference) categories. They used S&P data for the period 1946-66 and formed ten portfolios based on the degree or earnings surprises.

They found that about 50 per cent of all firm-specific information was contained in accounting data and between 85-90 per cent of that information was contained in prices already. Their analysis concluded that if earnings were higher than predicted (good news firms), abnormal earnings could be made. They found a low but statistically significant co-movement between earnings and stock prices. It is however difficult to conclude whether this relationship is due to a direct reliance of investors on earnings data or whether earnings are correlated with information that also affects security prices.

Most of the information contained in reported income is anticipated by the market before the annual report is released. The anticipation is so accurate that the actual income number does not appear to cause any unusual jumps in the share price in the announcement month. the drift upwards or downwards begins at least 12 months before the report is released and continues throughout the year and for approximately one month after the release of the report.

Subsequent to this study, several similar studies [e.g. Ou & Penman (1989)] have been conducted using different accounting and market based variables. They all lead to the same conclusion of the existence of a post-announcement drift implying market inefficiency.

B. *Price/Earning (P/E) Ratio Effect*

Basu (1977) first analysed the informational content of P/E ratios. His sample included over 1400 NYSE stocks over the period 1956-71. He

grouped stocks into 20 portfolios based on firms with the highest P/E and so on. He assessed portfolio performance at each year end and formed similar portfolios at the beginning of each following year.

Basu (1977) found risk adjusted returns on portfolios of low P/E stocks higher than those for high P/E stocks. He also studied incremental returns of low P/E stocks after adjusting for incremental search and transaction costs and differential tax rates. After these adjustments, the difference in risk adjusted returns between high and low P/E portfolios was not statistically different from zero.

He concluded that the "informational content" in P/E ratios is not "fully reflected" in security prices. This conclusion violates the efficient market hypothesis.

Other studies leading to similar results about the importance of the P/E Effect include Jaffe, Keim and Westerfield (1989), Chan, Hamao and Lakonishok (1991) and Fama and French (1992).

C. Size Effect

Banz (1981) found that size, measured by the market value of a company, is an important factor in explaining returns. This study was based on NYSE data for the period 1936-75. He used firm size as an explanatory factor. The size factor was based on the difference between the firm size and the average size of a firm on the NYSE. The coefficient of the size factor was zero under the null hypothesis.

Based on the results, he rejected the null and showed size to be a pervasive factor over the entire 40 year sample period in explaining returns. The relationship between size and return is strongly negative and non-linear as the difference in return between the average and large firms was negligible. This, again, is evidence of inefficiency.

D. Investor Overreaction to Information/Contrarian Strategies

DeBondt and Thaler (1985) (DT) explained market behaviour and investors' individual decision making psychology by testing their belief that investors overreact to new information. They believe "individuals tend to overweight recent information and underweight prior data" in violation of rational views which were based on Bayes' rule.

They only based decisions on past prices and returns. The two testable hypotheses formulated were (a) extreme movements in stock prices

would be followed by subsequent extreme price movements in the opposite direction and (b) the more extreme the initial price movement, the greater the impact of the subsequent adjustments.

They used NYSE data between 1926-82 and divided portfolios into "winner" and "loser" portfolios based on the stock's previous performance. They focused on stocks that experienced either extreme capital gains or losses over a period of up to 50 years. If the efficient markets hypothesis holds, there should be no excess returns from these portfolios.

Their results showed that loser portfolios outperformed winner portfolios by approximately 25 per cent over a 36 month time horizon. One noteworthy aspect of these results is that the excess returns on the loser portfolios were earned primarily between the 13th and the 36th month after formation.

Also, using stock beta as a measure of risk (i.e. assuming validity of the CAPM), loser portfolios were found to be less risky. Hence, they rejected the null hypothesis and concluded that in fact investors do overreact to information presenting a violation of weak form market efficiency. This study has been tested by several others including Chopra, Lakonishok and Ritter (1992) and has successfully stood its ground.

Similarly Lakonishok, Shleifer and Vishny (1994) (LSV) use fundamental factors to form portfolios rather than past price/returns data. They attempt to prove that "value" investing, (i.e. picking shares whose price is low relative to fundamental factors), can earn abnormal returns. They form portfolios using rankings of fundamental factors (like earnings, dividends, book value of equity and cash-flows). Those with low prices relative to fundamental factors were called "value" portfolios. Portfolios with stocks whose prices are high relative to fundamentals were called "glamour" portfolios.

The data set used was NYSE for the period 1960-90. Portfolio returns were evaluated on over a 5-year horizon. Actual growth rates of fundamental factors were found to be lower than market expectations for glamour stocks and higher than market expectations for value stocks. Their results show value-portfolios to earn size adjusted excess returns (over glamour-portfolios) of about 10-11 per cent per annum. Value-portfolios were less risky using measures like beta and standard-deviation.

This leads us to question why returns to value strategies persist. Possible explanations are; (a) individuals actually make errors in their forecasts which they extrapolate too far into the future leading to overvalued glamour/winner stocks; (b) institutional investors prefer glamour/winner

portfolios as they appear to be prudent investments making them easier to justify to clients in case of market downturn; and (c) most investors enter the market with shorter term investment horizons that the minimum required (3-5 years) for a successful value strategy.

La Porta et al. (1997) find evidence of overreaction in glamour and value-stocks defined using accounting variables. Specifically, glamour-stocks earn negative returns on the days of their future earnings announcements, and value-stocks earn positive returns. This evidence suggests that value or contrarian strategies earn excess returns as investors base their decisions by weighing recent information more heavily than past data implying market inefficiency.

E. Investor Under-reaction to Information/Momentum Strategy

Seemingly contradictory results were obtained by Jagadeesh and Titman (1993) (JT). They tested an investment strategy based on buying winners (stocks that earned excess returns over the past 1 to 4 quarters) and selling losers (stocks that performed poorly over a similar period) using NYSE data for the period 1965-82. They formed zero-cost portfolios based on the difference between the winner and loser portfolios and track returns over time. Under the efficient markets hypothesis the returns to these portfolios should be zero.

Their results indicate the momentum strategies earn excess risk adjusted returns over a three to twelve month period. The excess returns are reversed over the following 24 month period. This is driven by the market's short-term failure to recognise shifting trends. JT, claim that investors following the proposed strategy cause prices to move away from their long-run values temporarily thereby causing overreaction. Alternatively, markets may be under-reacting to information about short term prospects but overreacting to information about long term prospects, presenting another violation of market efficiency.

F. Importance of Book Value to Market Value Ratio (BV/MV)

Fama and French in their 1992 and 1993 papers run multi-factor models to explain stock and bond market returns over the period 1963-90. They use this data to form 25 portfolios sorted on both size and value based on the finding of low interaction between the two variables.

They conclude that used alone or in combination with other variables, beta does not have enough explanatory power. When used alone BV/MV, size and leverage have explanatory power implying that these factors

capture cross sectional variation in average stock returns. Their results validate the value/glamour stock prediction.

G. Informational content in analysts' forecasts

Barber et al. (2000) provide an empirical study covering over 360,000 analyst recommendations from 269 brokerage houses over the period 1986-96. They form portfolios of stocks ranked on the average of consensus recommendations of analysts in terms of most recommended and so on. They follow a strategy of buying most recommended stocks and selling least recommended stocks and rebalancing the portfolio daily based on new recommendations.

Their results show the possibility of earning abnormal returns (4.13 per cent, after controlling for market risk, size, book-to-market, and price momentum effects) using this strategy, but it requires high trading levels. After accounting for transaction costs the abnormal returns are not significantly different from zero. Overall their results show that there is some informational content in analysts' recommendations leading to a violation of market efficiency.

Similarly distinguishing risk and overreaction, La Porta (1996) sorted stocks using long-term growth rate forecasts of professional analysts and found evidence that their views were excessively bullish about stocks they were optimistic about and excessively bearish about stocks about which they are pessimistic. Furthermore, stocks with high growth forecasts earn negative returns when they subsequently announce earnings, and stocks with low growth forecasts earn high returns. This points to overreaction by analysts and also in prices, implying a violation of market efficiency.

H. Technical Analysis

Several studies have been conducted to analyse the usefulness of technical analysis, in effect testing the weak form efficient markets hypothesis. Initial studies indicated that wen accounting for transaction costs, technical trading rules did not produce superior returns to passive buy and hold strategies.

A study by Brock, Lakonishok and LeBaron (1992) use simple technical analysis techniques of using moving averages and trading range breaks on the Dow Jones Industrial Average data for the period 1897-1986. Moving average rules generate buy/sell signals based on when a short-period moving average exceeds/goes below the long-period moving average. Trading

range breaks refer to rules that base buy (sell) signals on price going above (under) the resistance (support) level.

Their results show that using the above strategies, buy signals outperform the normal returns. Also, following a buy signal generated by these rules, the market increased at an annual rate of 12 per cent whereas following a sell signal the market decreased at an annual rate of 7 per cent. They found evidence that technical rules have predictive power however they did not incorporate transaction costs in their analysis.

They concluded that there could potentially be some form of non-linear relationship between stock prices/returns over times that more complicated trading rules could exploit. Hence contradicting the efficient markets hypothesis.

I. The Paradox

In trying to reconcile the results of overreaction (DT) leading to contrarian investment strategies and that of trend extrapolation [Brock Lakonishok and LeBaron (1992)] leading to positive feedback strategies, we should look at the results of JT and Poterba & Summers (1988).

As mentioned earlier, negative correlation has been documented by Lo and McKinley (1988) and Poterba and Summers (1988). Both find that returns over longer periods are negatively correlated between –0.25 to –0.40 over three to five years and returns are positively correlated over shorter time periods. Both results, however, lack statistical power but potentially indicate a violation of market efficiency. Hence, contrarian strategies work in the long term whereas the trend extrapolation strategy (momentum) works in the short term. Some of the other major related studies are listed in annex 2.

J. Excessive Volatility

This argument was put forth by Shiller, R. (1981) where he compares the low volatility in fundamentals (namely dividends) to the excessive volatility of stock prices, and concludes that this is evidence of market irrationality. Defining perfect foresight prices as prices that would prevail with constant realised returns, Shiller argues that the variance of the perfect foresight price should be greater than the variance of the actual prices. This relationship implies that stock prices should be less volatile than (the appropriate transform of) fundamentals (i.e. dividends) as the perfect foresight price is just a smoothened version of the dividend stream.

Shiller, R. (1981) used this methodology on the US stock market. He used S&P annual data from 1871-1979. He found the standard deviation of the actual S&P price data to be 50.1 whereas the standard deviation of the perfect foresight price was 8.9. This is an unambiguous violation of the variance bound implying market irrationality. Similar methodology was used in the US, UK and Japanese markets (amongst others) and similar results of irrationality were found.

Shiller, R. (2000) echoes similar views where he compares the increases in stock markets with the changes in basic economic fundamentals such as income, GDP and corporate earnings. He provides a detailed list of the behavioural factors that have resulted in the recent exuberance in the US stock markets. These have been presented in annex 3.

In the following section I provide a review of the criticism of the above mentioned studies.

IV. Anomalies Explained: Review of Critique of the Anomalies Literature

A. General Issues

Some of the main counter argument relates to the model mis-specification and the joint hypothesis problem. This problem exists for all the studies presented. The problem is exacerbated by these long term studies due to the assumption of normality of asset returns. While this is valid for short time periods, it is empirically unreasonable for long term returns as they exhibit fat fails. Another problem is the lack of validation of these asset return models over long time-periods.

One major issue relates to data snooping, wherein researchers use information from the data, to guide research, on the same or related data. This leads to results not being valid out of sample. Another issue is that of survivorship bias due to data availability automatically excluding companies that fail.

Fama (1998) (detailed below) shows that by using different rational asset pricing models, like the Fama and French's (1996) three factor model with differing factors, eliminates most of these violations. The only study found to be robust to changing asset returns models is the Ball and Brown (1968). Fama's (1998) view is that since overreactions are as common as under reactions this implies that both over-and under-reactions are chance events and that markets are in fact efficient. A list of the major studies separated by their results of both under and overreaction are listed in annex 4.

Yet another contentious aspect is that, with a few exceptions, testable alternative hypotheses are not specified in this literature. With an ambiguous alternate hypothesis like market inefficiency, it is next to impossible to test whether for example with the overreaction anomaly, under-reaction could also result.

B. Specific Issues

There is a vast amount of literature which followed the key studies mentioned earlier. Here, I seek to summarise some of the main concerns;

- Banz, (1981) and Reinganum, (1981) find P/E to be a proxy for size and hence conclude that the P/E as a factor is not priced. This implies that low P/E firms tend to be small. An explanation for size effect is with less information available about small caps, investors require higher returns. This problem, however, is not "visible" in an asset pricing model.

- Campbell, Lo and McKinley (1998) explain the success of contrarian strategies through a lead lag correlation of returns between large and small companies. They find that the correlation between current returns of small stocks and past returns of large stocks are greater than the correlation between the current returns of larger stocks and past returns of smaller stocks. This cross effect, they claim, is the cause rather than the reversal of long term returns.

- A popular criticism of DT is based on closer analysis of the success of loser portfolios being concentrated in the month of January only. It is questionable that this necessarily implies investor overreaction. Fama and French (1992, 1996), on the other hand argue that using the appropriate measure of risk, glamour stocks are less risky than value stocks.

C. Multi-factor Explanations

Fama and French (1996) find that some of the anomalies listed can actually be explained through a rational asset pricing model without having to rely on behavioural explanations. In their three factor model they find that they are able to explain the anomaly of long term return reversals of DT and LSV.

The model, however, is not able to explain the short-term momentum results of JT. The factors that they propose include size,

earnings to price ratio, cash flow to price ratio, book value to market value ratio, past long-term returns and past short term returns.

They find priced risk factors that explain the difference between the returns of winner and loser portfolios. Hence their view is that an explanation to the entire anomalies literature can be provided through a correctly specified rational asset pricing model.

D. Excess Volatility

Shiller, R. (1981) sparked a huge debate and led to significant research in the area. One criticism of his views was presented by Flavin (1983, who said that due to the higher level of auto-correlation in the foresight prices (leading to a downward bias) and the finite sample, the variance bound will be violated. Kleidon (1986) used Monte Carlo experiments and showed that the variance bound was violated in approximately 90 per cent of cases. Marsh and Merton (1986) argue that managers use dividends to signal permanent earnings and hence dividends are set based upon past prices implying a reversal of the variance bound.

E. Implication for argued approach

Based on this analysis it is clear that further research needs to be targeted toward the development of better asset pricing models. This could lead to a significant reduction in the anomalies reported. Fama and French's (1996) approach of developing multi-factor asset pricing models is a step in the right direction even though its results were found to be inconclusive.

In the following section I analyse the various behavioural models that have been developed to explain these anomalies.

V. Alternate Explanations: A Look at Behavioural Models

Slovic, P. (1972), a psychologist, provided the basis of behavioural finance. He claimed that all market players are vulnerable to committing huge mistakes because of the way they try to predict financial outcomes. It, however, is not just that they are prone to error, but the reasons as to why they are prone to error that are important. He finds market players are likely to be overconfident in the accuracy of their own judgement. Further studies show the marginal increase in accuracy of investor forecasts with additional information to be far lower than the marginal increase in their confidence level, implying susceptibility to overconfidence.

Shefrin Hersh (1999) provides this perspective – "It is really behavioural finance that ultimately will tell you why a particular trading rule is likely to work......if you are looking for abnormal returns, then you have to be using the right technical trading strategies."

Modern finance assumes investors to behave with extreme rationality. Empirical evidence, however, proves otherwise and deviations from rationality often seem systematic. Behavioural finance relaxes these traditional assumptions by incorporating observable systematic departures from rationality into models of financial markets. Next, some of the key behavioural models and theory in attempting to explain anomalies are presented.

A. General Views about Behavioural Finance

Shefrin, H. (1999) challenged the assumptions of traditional finance and showed alternate behavioural explanations. He argued that both psychology and fundamentals have an effect on market prices and investing behaviour. He showed, contrary to common belief, that investors are not driven by greed and fear, but by hope, overconfidence and the need for short-term gratification. He claims that since it is common for humans to make mistakes, both individual and institutional investors make the same mistakes repetitively.

The following quote accurately summarises the general view about the subject – "Behavioural finance is everywhere that people make financial decisions. Psychology is hard to escape; it touches every corner of the financial landscape, and it's important. Financial practitioners need to understand the impact that psychology has on them and those around them. Practitioners ignore psychology at their peril."

A practitioner's viewpoint is presented in annex 5.

B. Barberis, Shleiffer and Vishny (1998) –
"A model of Investor Sentiment" (BSV)

BSV attempt to explain the empirical phenomenon of over/under-reaction by investors through a model with judgement biases. The model is based on two judgement biases found in cognitive psychology;

- Conservatism [Edwards (1968)]: implying a failure to accurately aggregate information in new earnings numbers with investors' own prior information to update an earnings estimate; and

- Representativeness bias of Kahneman and Tversky (1974): wherein investors disregard the fact that a history of high earnings growth is un likely to repeat and end up overvaluing.

Their model is based on a single representative consumer and a single asset that pays out 100 per cent of earnings as dividends. BSV assume earnings to follow a random walk, however, this empirically unjustified assumption does not alter their results. The investor is assumed to be unaware of the actual earnings process but believes the existence of one of two regimes, each with a different model determining earnings. Neither follows a random walk.

Regime-1: Earnings are mean-reverting-Model 1. This captures the momentum impact as documented by JT and delays in the response of stock prices to earnings announcements as shown by Ball and Brown (1968). Earnings are mean reverting and any shocks are temporary.

Regime-2: Earnings trend, i.e., after an increase further increases are likely-Model 2. This captures long-term reversals of DT and contrarian strategies of LSV.

As underlying process is Markov, the occurrence of either regime depends only on the regime last period. Investors believe that Regime 1 is more likely to materialise than Regime 2.

For security valuation, the investor forecasts earnings based on earnings observed to date and his beliefs about which regime has generated earnings based on the regime-switching model. The investor uses the same model with the same regimes and probabilities throughout the forecast period.

Model-1: Due to the martingality of the earnings process, prices will show a delayed response and the investor will under-react to earnings changes (i.e. average return following a positive shock is greater than the average return following a negative shock) implying consistency with the conservatism bias.

Model-2: Based on earnings changes of the same sign, investors expect earnings to trend and will extrapolate this into the future causing prices to over-react which is consistent with the representativeness bias.

Based on the switching between the two regimes, the model is able to explain both anomalies of over-and under-reaction.

C. Daniel, Hirshleifer, and Subrahmanyam, (1998) "A Theory of overconfidence, self-attribution, and security market under- and over-reactions, (DHS)

DHS also uses concepts from psychology to explain investor over/under reaction. DHS divide investors into two groups – informed and uninformed. The uninformed have no biases. Informed investors have two biases namely, overconfidence and self-attribution.

In equilibrium, prices are determined by informed investors. Due to overconfidence they amplify their belief about the precision of their private estimate of stock value. Self-attribution leads them to discount public signals about value, especially when these signals oppose their own private estimates.

This overreaction to private information and under-reaction to public information will lead to short-term continuation and long-term reversals as public information eventually overcomes the behavioural biases over time. DHS also look at "selective events" which relate to instances where advantage can be taken of stock mis-pricing. Examples cited include announcements of a new stock issue when a stock price is high, or share repurchase when price is low. This public signal produces an immediate price reaction that absorbs some of the mis-pricing. This would lead to momentum; i.e. stock returns after an event announcement will tend to have the same sign as the announcement period return. This model also explains both anomalies of over/under-reaction.

D. Hong and Stien (1998) "A Unified Theory of under-reaction, Momentum Traidng and Overreaction in Asset Markets" (HS)

HS look at the impact of interaction between heterogeneous agents rather that the particular cognitive biases. The main assumptions behind their model are:

- Only two distinct groups; namely "newswatchers" – who forecast based on private information and do not condition on prices and "momentum traders" –who condition on price history;

- Agents are boundedly rational – they use only a subset of all available information; and

- Private information is diffused gradually across the newswatchers.

Using these assumptions DHS compare price behaviour by analysing interaction between agents. They look at extreme cases where only

newswatchers trade and conclude that prices will adjust slowly to new information and the investors will under-react. In this scenario over-reaction is not possible. Momentum traders, on the other hand, base decisions only on price history up to one period ago, causing prices to overreact. Equilibrium will occur based on trade between these two agents.

Their results indicate both short-run continuation and long-run reversals will be more pronounced for securities for which information is disseminated more slowly (have smaller stocks or those with lower analyst coverage). Equilibrium conditions suggest that information that was initially private is more likely to cause overreaction by investors rather than public information.

HS find that the relationship between the momentum trader's investment horizon and the pattern of return auto-correlation is that the shorter the investment horizon, the faster the auto-correlations begin to turn negative. hence, this model is consistent with the over and under reaction evidenced earlier.

E. Investor Overconfidence

Barber and Odean (2000) study the differences in investing habits of men versus women. This study is based on the hypothesis that overconfident investors trade excessively. This hypothesis was tested by Odean (1998). Over-confident investors are those who overestimate the precision of their knowledge about the value of a financial security.

Rational investors are expected to trade and purchase information only if this would increase their expected utility. Overconfident investors lower their expected utility by trading more and buying more information than rational investors with the same degree of risk-aversion.

To test this they use account date for 37,664 households from a large discount brokerage and segregate investors on gender. They find that in areas like finance which are dominated by men, men are more overconfident leading them to predict that men will trade more than women. Their results show that between February 1991 and January 1997, men trade 45 per cent more than women. This excessive trading results in additional trading costs reducing men's returns by 2.65 per cent as compared to a 1.72 per cent cost for women. They also find that women turnover their portfolio approximately 53 per cent annually versus men who turnover approximately 77 per cent. Since this difference can only be explained by rationality if the men earned higher returns than the women, which they found to be untrue, hence they argue in favour of their

behavioural explanation. Overall they find that individuals turnover 70 per cent annually.

Carhart (1997) finds similar results for mutual funds. Both show that individuals and mutual funds that trade most earn the lowest returns. They argue that this can only be explained by overconfidence.

Odean and Gervais (2000) layout a multi-period market model describing both the process by which traders learn about their own ability, and how a bias in this learning can lead to overconfidence. The show that both volume and volatility increase with the degree of a trader's overconfidence and that they behave sub-optimally earning lower profits. Based on this model they show that a simple bias in self evaluation is sufficient to create equilibrium market conditions with overconfident investors.

F. Institutional Investors

Institutional investors are believed, by some, to cause irrationality in prices due to herding and positive feed back trading strategies. As, in aggregate, these players hold a large proportion of the total market, the impact of such characteristics on the market could be large. According to Schwartz and Shapiro (1992) institutional investors own about 50 per cent of total equities in the US.

Herding, (correlated movement in prices across institutions), occurs because information about institutional trades is openly known amongst institutions whereas information about individuals is not freely known. Also, as money managers are evaluated against each other there is a tendency to hold similar portfolios in trying not to miss out on any opportunities others may have had. Another factor is that most institutions react similarly to market signals and hence may tend to herd. Evidence of herding per se may not necessarily imply price instability. Herding may help prices to adjust quicker to fundamentals. Institutional herding can also have a stabilising effect if they offset irrational decisions of individuals.

An empirical study conducted by Lakonishok, Shleifer and Vishny (1992) looks at the quarterly portfolios of 769 funds over the period 1985-89. No evidence of herding was their null hypothesis implying that changes in holdings of particular stocks would be evenly split or that a proportionate number of money managers would be buying or selling a particular security. They found that 52.7 per cent of the money managers were changing their holdings of a security in one direction and 47.3 per cent in the other. Based

on tests for stocks of different sizes, they found more evidence of herding in small stocks but the overall evidence was not strong enough to reject the null.

Positive feedback trading consists of strategies of buying past winners and selling past losers. Such a strategy could destabilise prices as institutions would buy overpriced securities and sell under priced ones, causing prices to move further away from fundamental values. In the same study evidence for positive feedback trading was evaluated by comparing excess demand (purchases minus sales) for winners and losers. Results indicate positive feed back trading for smaller stocks (excess demand –18 per cent of value for losers and 3.6 per cent for winners). Similar evidence for larger stocks was not found. Hence, the null of no evidence of positive feedback could not be rejected.

G. Implication for argued approach

Empirical studies have found the evidence of overconfidence which casts doubt on the validity of the investor rationality assumption which cannot be ignored. Also, there are several success stories about market practitioners making long term economic profits by using behavioural strategies.

Both these findings provide evidence contrary to the approach followed by modern financial economics. This shows that, despite criticism against behavioural finance (presented in the next section), there is a need to explore this approach further.

VI. Irrationality?: Assessing the Validity of Behavioural Models

Fama (1998) provide an evaluation criteria – "any new model should be judged on how it explains the big picture. The question should be: Does the new model produce rejectable predictions that capture the menu of anomalies better than market efficiency? For existing behavioural models, my answer to this question (perhaps predictably) is an emphatic no."

Looking at the BSV and DHS models, in using judgement biases they are also assuming homogeneity among consumers in that they are unable to distinguish the extent of the judgement biases for each type of investor. This can potentially lead to investors with significantly differing degrees of risk aversion being grouped together with the same degree of judgement bias.

All three models analysed (including HS) share similar problems with respect to empirical testing. They are only able to explain the anomalies that they are designed for and do not present a general equilibrium

perspective. These models and the other behavioural literature are unable to explain the size effect.

Looking at the criteria proposed by Hong & Stien (1998) stating that a model should:

a)   Be based on empirically plausible assumptions about investor behaviour;

b)   Explain the existing evidence; and

c)   Make predictions for "out-of sample" testing.

Using this criteria for both BSV and DHS models (due to their judgement biases of conservatism and overconfidence respectively) they predict long term reversals where as the empirical evidence indicates momentum is equally likely for certain anomalies like IPO studies [Ritter (1991)]. While they explain some anomalies, they cannot explain others, hence failing on counts (b) and (c) above.

Overall the performance of behavioural finance in explaining anomalies seems to be rather selective. Some models are able to explain certain anomalies but not others. There is no model that is able to provide an overall picture for an equilibrium asset pricing relationship. Hence the crucial test for these models remains their robustness in out of sample data.

VII. Conclusion

The studies covered in this paper indicate predictability of asset prices based on public information. The problem that needs to be addressed is (a) whether anomalies exist due to a bad-model and (b) whether the assumptions of rationality are too strong to explain the observed behaviour of investors.

With respect to the bad-model issue, empirical studies show that traditional models like the CAPM and ICAPM are unable to explain stock returns. This does not imply that no rational asset pricing model can explain stock returns. The work of Fama and French (1996), although not conclusive, is a clear step in this direction. It explains away certain key anomalies but fails on others.

On the other hand behavioural finance theory relaxes the traditional assumptions of financial economics incorporating departures from rationality and presents intuitively appealing and in some cases interesting approaches to explaining these anomalies. These models presently provide inconclusive

explanations to all the existing anomalies and fail on the same counts as the rational models (e.g. size effect). However, even if such a model is developed (which is not unlikely), its robustness in out of sample tests and its ability to address the concerns of the previous section will remain major issues. Furthermore, would such a model provide a valid asset pricing relationship? On the whole, current behavioural finance selectively provides only an interesting alternative to explaining asset pricing anomalies.

Importantly the message conveyed is that the empirical violations of rationality assumptions and those of the failure of behavioural models in explaining anomalies cannot be ignored. Based on this analysis, I argue that the only workable model will be one that incorporates investor behaviour, like overconfidence, in a multi-factor asset pricing relationship. This is an area for further research.

Annex-1: Empirical Tests Results

Test for market efficiency

Background:

The random walk hypotheses imply that variance is a linear function of the time lag (q). Using this relationship, the Variance Ratio (VR) test was developed. Linearity means that, for example, the one month variance in returns is four times the weekly variance. The general q period VR test statistic is:

$$\text{VR}(q) \equiv \frac{Var[r_t(q)]}{q \cdot Var[r_t]} = 1 + 2 \sum_{k=1}^{q-1} \left[1 - \frac{k}{q} \right] P(k)$$

where r_t is the log returns and $p(k)$ is the kth order auto-correlation coefficient of r_t. The null hypothesis test is that returns follow a random walk meaning that VR is not statistically different from 1.

Test:

The sample used was S&P weekly closing data (value weighted index) for the period January 03, 1966 to June 19, 2000. Weekly data was chosen to avoid the biases caused by the bid-ask spread, non-synchronous prices and non-trading. Both weekly and monthly VRs were calculated.

The results are as follows:

	n	Number q of base observations aggregated to form variance ratio			
		2	**4**	**6**	**8**
VR - Weekly	1,798	1.15	1.24	1.13	1.34
Test statistics*		2.66	2.34	2.02	1.45
VR – Monthly	449	1.03	1.16	1.09	1.13
Test statistics*		1.73	0.87	0.76	0.78

*Note: Test statistic values in boldface indicate that they are statistically different from 1 at the 5 per cent level of significance. The critical value at the 95 per cent level of confidence is 1.96.

The results indicate that using weekly VR the values are all significantly different from 1 (except for q=16) indicating a departure from the random walk hypothesis. Based on the understanding that, for any stationary time series, the population value of the variance ratio statistic VR(2) is simply one plus the first-order auto-correlation coefficient as,

$$VR\ (2) = \frac{Var[r_t(2)]}{2\ Var\ [r_t]} = \frac{Var\ [r_t + r_{t-1}]}{2\ Var\ [r_t]} = \frac{2\ Var[r_t] + 2\ Cov[r_t, r_{t-1}]}{2\ Var\ [r_t]} = 1 + p\ (1)$$

Hence, this shows that the first order auto-correlation coefficient is approximately 26 per cent. The VR is increasing in q but the test statistic values are not. This positive correlation is significant for the entire sample. Monthly numbers (VR of eight week returns to four week returns) indicate the only statistically significant value as the one month period value.

Conclusion

The results indicate a rejection for the random walk hypothesis over weekly returns and acceptance over monthly periods. This is consistent with other studies such as Lo and McKinley (1988). The rejections are weaker than those found using an equally weighted index.

Annex-2: Other Anomalies

Several other studies have been conducted which have looked at various other market anomalies. Amongst the numerous studies, listed below are some of the major ones:

- Asquith (1983) and Agarwal, Jaffe, Mandelker (1992) find returns to investors from companies that merge are statistically significantly negative over a five year period following merger.

- Loughran and Ritter (1995) conclude that over a five year period the returns to investors from buying share of companies that have had an initial public offering (IPO) or a seasoned equity offering (SEO) are only 70 per cent of those earned by investors following a passive buy and hold strategy on stocks of similar risk.

- Mitchell and Stafford (1997) show that SEO's have strong stock returns prior to issue.

- Bhandari (1988) finds a positive relationship between return and leverage.

- Litzenberger and Ramaswamy (1979) find that a significant positive relationship exists between the dividend yield and stock returns over their period 1936-77. Sorenson and Williams (1983) also find similar results.

- Michaely, Thaler and Womack (1995) find firms that initiate dividends have positive abnormal stock returns while firms omitting dividends have negative abnormal return.

- Rosenberg, Ried and Lanstien (1985) and Stattman (1980) provide evidence of a positive relationship between prices and book to market equity. This implies that shares with low Price to book value experience higher subsequent growth than shares with high price to book ratios.

- Studies by Desai and Jain (1997) and Ikenberry, D. Rankine, G. Stice E. (1996) conclude that positive abnormal returns of about 7 per cent are recorded on securities that have had stock splits.

- Lakonishok and Vermaelen (1990) find positive abnormal returns for companies that tender for their stock.

Annex-3: Behavioural Explanations Exuberance in US Stock Markets

Shiller, R. (2000): Irrational Exuberance

- The arrival of the internet and the economic revival; the reversal of the economy combined with the market sentiment about the impact of the internet on businesses.

- Decline of foreign rivals and their systems; Break-up of Russia, failure of the communists system, the economic crash of Japan, the opening up of China leading to increased confidence in US markets.

- Increase in Materialistic Values; increasing views of people equating success and happiness to money has led them to move to relatively high risk avenues of investing in stock markets rather than low yield fixed income instruments.

- Cut in the capital gains tax; the recent cut and the expectation of further reductions cause investors to hold on the their realised gains for longer and not sell.

- Increase in media reporting of financial news; media now closely follows financial events leading to greater information and increased awareness of consumers causing more interest in stock markets.

- Increase in the optimism of analysts forecasts; Over the years analysts views about company performance have become more optimistic due to potential conflict of interest issues such as the same company not providing other forms of business or new information to the researcher subsequent to a poor review.

- Increase in defined contribution pension plans; due to increases in defined contribution plans investors have had to make more active investment decision rather than leaving it to their employers. this increased interest has caused them to take a more active role in the stock markets.

- Growth of mutual funds; subsequent to the failure of investment schemes in the crash of 1929 and their revival under the trusted name of "utual" investors have a lot more confidence in them, leading to increased interest in the market.

- Decrease in inflation; has the effect of making people believe that these are "good times" leading them to be more bullish than would be.

- Increase in trading volumes and declining transactions costs; with a large proportion of the public investing and innovations like internet trading is making trading both convenient and cheap leading to increase volumes.

- Increased opportunities and volume of gambling; with the legalisation of gambling and the development of schemes promoting such activities, investors feel encouraged to take on games of chance including investments in the financial markets.

Annex-4: Two Classes of Anomalies Literature

Overreaction	
Authors	**Anomaly Reported**
DeBondt & Thaler (1985)	Winner v/s. Loser Portfolios
Lakonishok, Shleifer, & Vishny, (1994)	Glamour v/s. Value
Ritter (1991) Loughran & Ritter (1995)	Initial Public Offerings
Loughran & Ritter (1995) Spiess & Affleck-Graves (1995) Mitchell & Stafford (1997)	Seasoned Public Offerings
Dharan & Ikenberry (1995)	New Index Listings

Underreaction	
Authors	**Anomaly Reported**
Ball & Brown (1968) Bernard & Thomas (1990)	Stock Prices and Earnings
Jagdeesh & Titman (1993) Cusatis, Miles & Woodridge (1993)	Momentum Effect Divestiture
Desai & Jain (1997)	Stock Splits

Annex-5 : Behavioural Finance – A Practitioners Viewpoint

Excerpts from Article titled "Behavioural Finance – Institutions are human too" written in Neuberger Berman Management Inc. Research Review.

"... people base their decisions on their perceptions—whether these come from anecdotal evidence, their own experience, or "rules of thumb." Individual perceptions are often flawed, because of something called the "framing effect." In other words, the way in which a choice is framed influences the individual's decision-making. Financial matters are not so different. An enlightening study in 1996 showed that people allocate their defined contribution plans between stocks and bonds depending largely on which historical information they see.

..One might expect institutional investors—highly trained professionals, often working in groups—to be more rational than individuals. To put it bluntly, they're supposed to be the "smart money." Think again. Shefrin and Statman noted in an article in a 1984 issue of the Journal of Financial Economics ...examines a number of behavioural factors to explain the preference for dividends-for instance, the importance of self-control, ... Investors fear that once they begin selling stock to finance consumption, they will continue to sell stock until they have depleted their capital. They hope that limiting their spending to the dividend stream will help them maintain self-control.

Both growth and value investors can use behavioural finance to their benefit. Neuberger Berman's Rick White, ... says. "People tend to chronically overpay for glamour and excitement and at the same time they tend to chronically underpay for prosaic businesses over longer periods of time." ....White sees behavioural finance as fundamental to value investing, but growth investors also use behavioural finance to their advantage. Numerous academic studies have shown the impact of human behaviour on the formation of prices for growth stocks.

"Overall, our evidence suggests a price formation process in which the market systematically under-reacts to recent news and overreacts to longer-term (older) news," write Cornell University professors Bhaskaran Swaminathan and Charles M.C. Using such behavioural under reaction to positive news.

Behavioural finance does not purport to explain why value stocks, growth stocks, or any other category outperform others during a given period. Behavioural observations also hold some potentially valuable lessons

for how defined contribution plan sponsors can structure those plans and educate their participants. Of course, the vast majority of pension sponsors profess to be "prudent" investors, following rational, soundly thought-out strategies to achieve the highest possible returns for the least risk. Traditional economists have long argued that market psychology is largely irrelevant, because investors are "rational maximisers" who aim to maximise something-probably profits-and rationally pursue that objective.

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