

**Research Paper** 

# Anomalies Challenging EMH: A Review of Empirical Work

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## ABSTRACT

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In the recent years evidence which is contrary to the efficient market hypothesis has also surfaced in the finance literature, which is labelled as 'anomaly'. The documented anomalous price behaviour included apparent under reaction, apparent over reaction and puzzling variation of prices with day-of-the-week effect, size effect, dividend yield anomaly, earning yield anomaly etc. While some anomalies, such as those explained in relation to Dividend Yield, Market Capitalization, Price Earnings etc might be rightly said to be pointing at the inappropriateness of CAPM, the observance of Intra-Month, Weekend and Intraday 'seasonals' point out a general weakness of all asset pricing models or imperfections in the trading process itself. Many of these anomalies have also been described as fads or psychological effects or irrational bubbles by various researchers; though many others don't agree to these descriptions. According to them, Market Efficiency has, by and large, survived the challenge from the literature on experimental psychology and long-term return anomalies. They argue that these anomalies can be explained within the broader framework of efficiency, with some finetunings in the models and the data. Some of the key researches in this context are being briefly reviewed below.

#### KEYWORDS : efficient capital market, random walk hypothesis, anomaly, long term return, over-reaction and under-reaction, mean reversion

#### Introduction

In the recent years evidence which is contrary to the efficient market hypothesis has also surfaced in the finance literature, which is labelled as 'anomaly'. The documented anomalous price behaviour included apparent under reaction, apparent over reaction and puzzling variation of prices with day-of-the-week effect, size effect, dividend yield anomaly, earning yield anomaly etc. While some anomalies, such as those explained in relation to Dividend Yield, Market Capitalization, Price Earnings etc might be rightly said to be pointing at the inappropriateness of CAPM, the observance of Intra-Month, Weekend and Intra-day 'seasonals' point out a general weakness of all asset pricing models or imperfections in the trading process itself. Many of these anomalies have also been described as fads or psychological effects or irrational bubbles by various researchers; though many others don't agree to these descriptions. According to them, Market Efficiency has, by and large, survived the challenge from the literature on experimental psychology and long-term return anomalies. They argue that these anomalies can be explained within the broader framework of efficiency, with some fine-tunings in the models and the data. Some of the key researches in this context are being briefly reviewed below.

R.W. Banz (1981) was first to document the phenomenon of 'size-effect'. Studying "The Relationship between Return and Market Value of Common Stock' during 1931-75, he found that the statistical association between returns and size was negative and significant. The differences in the returns accruing to shares of the smallest and the largest firms were found to be quite handsome in the various stock markets. The inverse relationship between the company size and common stock return is now extensively documented in the finance literature. Various attempts have been made in explaining the size effect. Roll (1981) conjectured that large abnormal returns of small firms could be due to understatement of risk (or overstatement of risk-adjusted returns) because of infrequent trading of small firms. Christie and Hertzel (1981) argued that the size effect could be due to non-stationarity of beta. A firm whose common stock price has recently declined - i.e., a firm which is becoming 'small' has effectively experienced, other things remaining constant, an increase in debt-equity ratio and therefore a concomitant increase in the risk of its equity. Thus, historical estimates of beta that assume such risk as being constant over time shall amount to understating the risk and overstating the risk adjusted returns of stocks whose market capitalisation had just fallen. Chan (1983) made an adjustment for this bias, as a result of which the size effect was reduced to a magnitude whose economic significance was debatable. Brown, Kleidon and Marsh (1983) found that when averaged over all months, the size effect reverses itself for sustained period; in many periods there is a consistent premium for small size, in fewer other periods there is a discount.

Reinganum (1981) found that approximately 50% of the return difference between small and large firm stocks found by was concentrated in January. He further reported that 50 percent of the January effect was concentrated in the first five trading days of the year. This turn-of-the-year return behaviour was also found by Roll (1983) who notes that small firms have abnormally large returns on the last trading day in December. Cooke and Rozeff (1984) document that P/E, P/B and price effects too are more pronounced in January. Keim (1982) found that the size effect is concentrated in January. The January effect is stated to be caused by year-end-tax induced trading, which depresses stock prices temporarily at the end of the fiscal year. Once selling pressure abates, prices rebound to their normal level. The rebound is what is considered as the turn-of-the-year effect. Popularly called as Tax Loss Selling Hypothesis (TLS), the hypothesis maintains that tax laws influence investors' portfolio decisions by encouraging the sale of securities that have experienced recent price declines so that short-term capital loss can be offset against taxable income. TLS argument relies on the assumption that investors wait until the tax-year-end to sell their common stock losers. The heavy selling pressure during this period supposedly depresses the price of shares. After the tax-year-end, the selling pressure disappears and prices rebound to their equilibrium levels. Therefore, TLS predicts abnormal returns in the months immediately following the tax-year-end. The study by De Bondt and Thaler (1985) provided some support for the tax-loss selling hypothesis. (over/under reaction & later reversal linked to "month of the year" effect.) However, TLS is seen primarily in terms of the explanation for small firm effect, for small firm stocks are more likely candidates for tax-loss selling since these stocks typically have higher variances of price changes, and therefore, larger probabilities of large price declines

Ariel (1987) examined the intra-month seasonals and showed that for the period 1963 to 1981 the average returns for US common stocks, using CRSP index returns as proxy for the returns, are positive only for the last day of the month and for days during the first half of the month; during the latter half of the month, returns are indistinguishable from zero. He concluded that during his sample period all of the market's cumulative advance occurred around the first half of the months, the second half contributed nothing to the cumulative increase. Research on "week-end effects" has shown that average stock returns tend to be higher on Fridays and negative on Mondays. Cross documented this as early as in 1973 and French in 1980. Keim and Stambaugh (1984) found consistently negative Monday returns for Standard and Poor's (S&P) Composite Index, for stocks traded on NYSE, AMEX and also for stocks traded on OTC. The 'week-end' effect can even be decomposed into the 'intra-day' stock return patterns. A striking difference was found by Lawrence Harris (1988) between Monday and other week days in the first 45 minutes of trading. The mean return in this interval for the NYSE portfolio was negative on Monday (-0.13 percent) while on other days it was positive (0.09, 0.14, 0.12 and 0.10 per cent respectively). In general too, there is an anomalous tendency for large returns to occur at the beginning

and at the end of the trading day. Whole of the beginning-of-day returns accrue over several transactions, the large positive end-ofday returns accrue only on the last transaction of the day. Ray Ball (1989) attributed these 'seasonals' to the absence of consideration of supply factors in financial asset pricing theory. He argued that all modern financial models address to the implications of pure exchange only, i.e. supply is assumed to be determined exogenously. He felt that when supply factors are considered, these anomalies won't be found startling: In a competitive world market returns should equal the marginal efficiency of investment (MEI). Though there is no theory of how the MEI varies over time, casual observation does suggest that MEI on weekends is lower than on week days. Mondays are said to have higher work absenteeism than other weekdays, with possibly lower MEI. Nights presumably are less productive than days. All this illustrates the feasibility of any seasonal pattern in the absence of consideration of supply parameters of asset pricing.

Warner De Bondt and Richard Thaler (1985) propounded one of the most important long-term return anomalies' theories. They suggested that, most people tend to "overreact" to unexpected and dramatic news events. Over-reaction is a relative term in comparison of some correct reaction and Bayes' rule prescribes correct reaction to new information. They concentrated on an empirical test of the over-reaction hypothesis. Specifically, two hypotheses were suggested: (a) Extreme movements in stock prices will be followed by subsequent price movements in the opposite direction; (b) The more extreme the initial price movement, the greater will be the subsequent adjustment. Both hypotheses would imply a violation of weak-form of market efficiency. So their goal was to test whether the over-reaction hypothesis is predictive. Monthly return data for New York Stock Exchange (NYSE) common stocks, as compiled by the Centre for Research in Security Prices (CRSP) of the University of Chicago, were used for the period between January 1926 and December 1982. An equally weighted arithmetic average rate of return on all CRSP listed securities served as the market index. They focused on stocks that had experienced either extreme capital gains or extreme losses over periods up to five years. In other words "Winner" (W) and "loser" portfolios (L) were formed, conditional upon past success returns. For every stock j, the market-adjusted excess returns residuals were calculated i.e.  $\mu_{it} = R_{it} - R_{mt}$ . For any period t, the same constant market returns  $R_{mt}$  were subtracted from all  $R_{jt}$ 's. Then they calculated cumulative excess returns for the entire period. The cumulative excess returns were ranked from low to high and portfolios were formed. Firms in the top 35 stocks were assigned to the winner portfolio "W", and firms in the bottom 35 stocks to the loser portfolio L. Thus, the portfolios were formed conditional upon excess return behaviour prior to t=0, (formation date) and same procedure was adopted for period subsequent to t=0. They then computed the cumulative average residual returns for all securities in the portfolio prior and subsequent to t=0 and compared these values. Results consistent with the over-reaction hypothesis, evidence against weak-form market efficiency was found. Portfolios of prior "loses" were found to out perform prior "winners". Thirty-six months after portfolio formation, the losing stocks had earned about 25% more than the winners, even though the latter were significantly more risky.

Lawrence H. Summers (1986) guestioned the power of common tests of market efficiency. The central message of the huge literature on market efficiency was the supreme difficulty of earning abnormal returns making use only of publicly available information. This paper had not disputed this conclusion. Rather, it had taken issue with the corollary implication of the efficient market view that market price represented rational assessment of fundamental values. It suggested caution in treating stock prices or changes therein as rational reflections of fundamental values. The study suggested that certain types of inefficiency in market valuations were not likely to be detected using standard methods. This point is important for both corporate financial policy and for event study research. This means the evidence found in many studies that the hypothesis of efficiency couldn't be rejected should not lead us to conclude that market prices represent rational assessments of fundamentals valuations. Rather, we must face the fact that most of our tests had relatively little power against certain types of market inefficiency.

to see if market valuations involved inflation illusion or were moved by fads as some experts suggested. The study also suggested that valuation errors, if present, would be difficult to detect by looking at observed returns. However, both theoretical and empirical considerations suggested the likelihood that market valuations differ frequently and substantially from fundamental values. Indirect empirical evidence suggested the importance of valuation errors. This analysis suggested that a more catholic approach should be taken to explaining the behaviour of speculative prices. The inefficiency entertained was one in which the deviation of the price from the rational market fundamental was persistent and potentially large. This deviation was similar to a speculative bubble, which could induce "excess" volatility and negative autocorrelation in returns. The major contribution of this paper lies in the observation that, while the pricing error can contribute substantially to the variance of returns, the negative autocorrelation can be too small to detect inefficiency using common techniques. Thus, he argued that most tests of market efficiency have had little power to reject market efficiency against this alternative version of inefficiency.

Eugene F. Fama and Kenneth R. French (1988b) examined the issue of 'Dividend Yields and Expected Stock returns'. This followed the anomaly evidence demonstrated by Rozeff (1984) and Shiller (1984) that dividend yields (D/P) can forecast short horizon stock returns. Similar arguments were also advanced by Campbell and Shiller (1988) who found that the E/P ratios have reliable forecast power, which also increases with the return horizon i.e, as the period increases, the forecast power also increases. Fama and French noted that though there was much evidence that stock returns were predictable, the predictable component of returns is a small fraction (usually less than 3%) of the return variance. Even where the existing researches had suggested strong predictability they could not reject the hypothesis that stock prices are random walks. Fama and French confirmed the existing evidence that the predictable (expected) component of returns is a small fraction of short-horizon return variances. Regressions of returns on yields typically explain less than 5% of monthly or quarterly variances. They further offered evidence that the forecast power of the dividend yields (D/P) increases with the return horizon. The explanation offered is two fold: firstly that the high autocorrelation causes the variance of expected return to grow faster than the return horizon; and secondly the cumulative price effect of the expected return shock and the associated opposite price shock is roughly zero. This happens because the growth of variance of the unexpected returns with the return horizon is attenuated by a discount-rate effect. Thus the shocks to the expected return generate opposite shocks to the current prices. As a result it was concluded that, on an average, the future price increases implied by the higher expected returns are just offset by the decline in the current prices and time-varying expected returns generate only mean reverting or temporary component of prices.

James M. Poterba and Lawrence H. Summers (1988) investigated transitory components in stock prices. Using data from the United States and 17 other countries they showed that, statistically, tests had little power to detect persistent deviations between market prices and fundamental values. That is there may be significant departures from fundamentals, yet the statistical tests may not capture them and from test result statistics it may appear that prices are random. They also investigated whether prices were indeed mean reverting, by using variance-ratio tests and regression analysis. They analyzed monthly returns on both the value-weighted and equal-weighted NYSE indices from the CRSP database for the period 1926-1985. The study considered excess returns, with the risk-free rate measured as the treasury bill yield, as well as real returns measured using the Consumer Price Index (CPI) inflation rate. Though mean reversion was more pronounced for the equal-weighted than for the value-weighted returns, but the variance ratios at long horizons were well below unity for both, raising question marks over EMH. Their results also suggested that stock returns show positive serial correlation over short periods and negative correlation over longer intervals. The conclusions emerging from this data were corroborated by data from other nations and time periods. Although individual data sets did not consistently permit rejection of the random-walk hypothesis at high significance levels, the various data sets together strengthened the case against its validity.

These were exactly the sort of errors in valuation one would expect

I.M. Pande and Ramesh Bhat (1988) wanted to assess the extent to which the users and prepares of accounting information in India were aware of the efficient market hypothesis (EMH) and accepted the empirical findings on EMH in the Indian context. In spite of some empirical evidence in favour of the capital market efficiency in weak form and mildly in favour of semi-strong form, the experts as well as the capital markets participants in India allege that the market is excessively speculative and inefficient. This study used the methodology developed by Mayer-Somes and sent questionnaires to (1) the chief financial executives; (2) academicians; (3) Chartered Accountants; and (4) cross-section of investors and brokers. The first three groups fell in the category of accounting information preparers and the last group belonged to the user category. Fifteen per cent of investors exhibited no understanding of EMH in any of its forms. 55 per cent of investors understood the EMH in all three of its forms. The results also indicated that the respondents who understood EMH did not necessarily accept it in reality. Majority of the respondents in each category thought that the fundamental and technical analysis could be used to out-perform the market. Index comparison was considered to be less useful than the technical and fundamental analysis. On the various information sources, 82 per cent of the Chartered Accountants and Company respondents considered the audited financial statements to be useful, 76 per cent of company respondents considered other publicly available information to be useful. 87 per cent of the accounting academicians thought inside information to be useful in out-performing the market. Thus there was suggestive evidence that anomalies and inefficiencies prevailed in the market as per the belief of key players.

Narasimhan Jagadeesh and Sheridan Titman (1993) presented an alternative to the view suggested by De Bondt and Thaler (1985) that stock prices overreact to information, leading to success of contrarian strategies which bought past losers and sold past winners. This study argued that trading strategies which buy stocks that have performed well in the past and sell stocks that have performed poorly in the past, viz relative strength strategies, could also generate significant positive returns. This study investigated the efficiency of the stock market by examining the profitability of a number of trading strategies. The strategies they considered would select stocks based on their returns over the past 1, 2, 3 and 4 guarters. They also considered holding periods that varied from 1 to 4 guarters. This gave a total of 16 strategies. In addition, they examined a second set of 16 strategies that would skip a week between the portfolio formation period and the holding period. To increase the power of their tests, the strategies they examined included portfolios with overlapping holding periods. The period of the study was 1965 to 1989, of NYSE and AMEX stocks. The profits of the above strategies were calculated for both a series of buy and hold portfolios and a series of portfolios that were rebalanced monthly to maintain equal weights. Trading strategies that bought past winners and sold past losers realised significantly abnormal returns over the period of study. The strategy they examined in most detail, which would select stocks based on their past 6-month returns and would hold them for 6 months, realised a compounded excess return of 12.01% per year on average. The evidence was, thus, consistent with delayed price reaction to firm-specific information, rather than overreaction as DeBondt and Thaler had suggested. The long term performances of past winners and losers revealed that half of their excess returns in the year following the portfolio formation date dissipated within the following 2 years. The returns of the stocks in the winners and losers portfolios around their earnings announcements in the 36 months following the formation period were also examined and a similar pattern was found. Specifically, stocks in the winner portfolio realised significantly higher returns than the stocks in the losers' portfolios few months following the formation date. However, the announcement date returns in the 8 to 20 months following the formation date were significantly higher for the stocks in the losers' portfolio than for the stocks in the winner portfolios. The evidence of initial positive and later negative relative strength returns suggested that common interpretations of return reversals as evidence of over-reaction and return persistence (i.e. past winners achieving positive returns in future) as evidence of under-reaction were probably overly simplistic. A more sophisticated model of investor behaviour is needed to explain the observed pattern of returns. It is possible that the market under-reacts to information about the short-term prospects of firms but over-reacts to information about their long-term prospects.

T.P. Madhusoodanan (1995) tested the over-reaction hypothesis, using the winner-loser effect suggested by De Bondt and Thaler for the first time in India. According to the study, the strategy of purchasing loser shares and short selling winner shares would be able to generate an excellent arbitrage return in the Indian case. He used weekly data on average stock prices, which were adjusted for bonus and right issues. The data pertained to the share prices of 186 companies, which covered the period from April 1989 to March 1995. The rate of return was calculated from this data. The returns were calculated as the continuously compounded ones. From the return series, the excess returns over the market were calculated. Market return was calculated from the RBI weekly index of share price for all industries. After calculating weekly excess returns over a 52 weeks period, cumulative excess return (CER) was estimated. Those CERs were then ranked from high to low and portfolios were formed. Shares ranked as top 10 formed a winner portfolio and shares ranked as bottom 10 formed a loser portfolio. The process was repeated for the five years viz. 1989-90, 1990-91, 1991-92, 1992-93 and 1993-94. In addition to the RBI index, he took the BSE Sensex and BSE National to check whether any significant differences existed. The performance of these winner and loser portfolios was tested in the next year. In order to account for risk, an equation was used which simultaneously estimated beta (a measure of risk) and the abnormal return.

He found that the returns in Indian stock market also showed winner-loser effect and hence supported the over-reaction hypothesis. However, when the market witnessed an artificial boom, the strategy of over-reaction had not received the punishment it deserved, while during the recession period as well as normal periods, over-reaction based strategy did pay well. On the basis of this analysis, it can be said that the current winner alone should not lure investors, because the current losers may have the potential of giving better returns in the next period. Therefore, fundamentals were more important than impressive over-reaction. If the investors resist from overreacting and take decisions based on the fundamentals it will also be conducive for injecting efficiency in the market, so essential for maintaining good investment climate.

The study by Barberis, Shleifer and Vishny (BSV) (1996) was motivated by evidence from cognitive psychology of two judgement biases: (a) the representative's bias: people give too much weight to recent patterns in the data and too little to the properties of the population that generates the data: (b) conservatism. In the model of stock prices, proposed by BSV to capture the two judgement biases, earnings were a random walk, but investors falsely perceived that there were two possible earning regimes. In regime A, which investors assume is more likely, a stock's price under-reacts to a change in earnings because investors mistakenly think the change is likely to be temporary. When later earnings do not confirm this expectation (i.e. when earnings don't turn out to be temporary), stock prices show a delayed response to earlier earnings. In regime B, which investors think is less likely, a run of earning changes of the same sign leads investors to perceive that a firm's earnings are trending. Once investors are convinced that the trending regime B holds, they incorrectly extrapolate the trend and the stock price over-reacts. Because earnings are a random walk the over-reaction is exposed by future earnings, leading to reversal of long-term returns. Regime A in the BSV model was motivated by the evidence of short term momentum in stock returns and the evidence of delayed short term response of stock prices to earnings announcements. Regime B was meant to explain the long-term return reversals of De Bondt and Thaler (1985). The prediction of regime B was reversal of long-term abnormal returns. Specifically, persistent long-term pre-event returns were evidence of market over-reaction, which should eventually be corrected, in postevent returns. In short, not surprisingly, the BSV model did well on the anomalies it was designed to explain. Viewed as a whole, the long-term return literature seems more consistent with the market efficiency prediction that long-term return continuation and long-term return reversal are equally likely chance results.

**Daniel, Hirshleifer and Subrahmanyam (DHS) (1997)** adopted different behavioural foundations than the BSV model. In DHS there were informed and uninformed investors. The uninformed ones were

not subject to judgement biases. But stock prices were determined by the informed investors, and they were subject to two biases, 'over-confidence' and 'biased self-attribution'. Over confidence led them to exaggerate the precision of their private information about a stock's value. Biased self-attribution caused them to down-weight pubic information about value, especially when the public information contradicted their private information. Over-reaction to private information and under-reaction to public information tended to produce short-term continuation of stock returns, but long-term reversals. Thus, though based on different behavioural premises, the DHS predictions were close to those of BSV, and the DHS model shared the empirical successes and failures of the BSV model. DHS made a special prediction about what they call selective events. These were events that occurred to take advantage of the mis-pricing of a firm's stock. For example, managers announce a new stock issue when a firm's stock price is too high, or they repurchase shares when the stock price is too low. These public signals produce an immediate price reaction that absorbs some of the mis-pricing. But in the DHS model, the announcement period price response was incomplete because informed investors overweighed their prior beliefs about the stock's value. (The conservatism bias of the BSV model would produce a similar result). Eventually, the mis-pricing was fully absorbed as further public information would confirm the information implied by the event announcement. The general prediction for selective events was thus momentum; stock returns after an event announcement will tend to have the same sign as the announcement period return.

The problem is that all models for expected returns are incomplete descriptions of the systematic patterns in average returns during any sample period. As a result tests of efficiency are always contaminated by a bad-model problem. The bad-model problem is less serious in event studies that focus on short return windows. But the problem grows with the return horizon. Thus it would appear that Anomalies are chance results; apparent over-reaction to information is about as common as under-reaction, and post-event continuation of pre-event abnormal returns is about as frequent as post event reversal. Most importantly, consistent with the market efficiency prediction, those apparent anomalies can be due to methodology, most long-term return anomalies tend to disappear with reasonable changes in technique.

T.P. Madhusoodanan (1998) analysed the mean reverting tendencies of share prices in the Indian stock market. He argued that the investors tend to overreact to information about the company and market, and hence stock prices will revert back in the future. He tested it under the null hypothesis of homoscedasticity as well as hetroscedasticity. He used the technique of variance ratios to test the mean reversion behaviour. The study was carried out using aggregate level of market indices and disaggregated level of individual companies. The weekly data on 120 stocks traded on the Bombay Stock Exchange (BSE) and two market indices, BSE sensitive index of 30 stocks and BSE National Index of 100 stocks were taken for the analysis. The data pertained to the period from January 1987 to December 1995. The results showed that there were a number of auto-correlations significant at different lags, and most of them at higher lags were negative. This indicated the possibility of long-term mean reversion in the Indian Stock Market. The variance ratio tests suggested that at the aggregate level of BSE sensitive and national indices, the random walk hypothesis cannot be accepted, and the movements appeared to be persistent. From the analysis, it could be argued that hetroscedasticity did not seem to be playing an important role in the Indian stock market. At the disaggregated level of individual stocks, all of them except one showed significant auto-correlations, positive at lower lags and negative at higher lags. The variance ratios were significantly different from one (1) for a vast majority of the cases. Only 16 out of 120 stocks showed random behaviour. The persistent behaviour shown by the market indices was shown by a majority of the individual stock also.

Till date researchers have been trying to defy the RWH and discovering new anomalies.

So far whatever anomalies have been discovered could be divided into two broad categories viz. Asset Pricing Anomalies and Behavioural Finance Anomalies. Further, asset pricing anomalies include size effect, PE effect, dividend/ earning announcement effect, book to market equity effect, momentum effect, reversal effect, stock split effect, short term price drift, merger effect, neglected firm effect, liquidity effect and so on. Behavioural finance anomalies include volatility, predictability, equity premium puzzle, winners curse, calendar effect( January effect, turn of the month effect, weekend effect, turn of the year effect etc).

Thus, it is seen that the market efficiency issue is yet to be definitely settled and there exists a controversy in the finance literature as to whether or not the major stock markets of the world are 'efficient' in pricing the securities that are traded there. This controversy manifests itself not only in the classical confrontation between the stock market practitioners and the stock market theorists, but also in the research findings that have unearthed evidence both for and against efficiency.

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