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Manifesting Overconfidence Bias and Disposition Effect in the Stock Market

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Abstract

The study investigates the influence of overconfidence bias and disposition effect among the investors in the Indian stock market by examining these biases' presence on individual stocks in the index. The study also aims to determine which of the two biases, overconfidence or disposition, dominates the market. Security-wide Vector Autoregression (VAR) model, impulse response function, and nonlinear analysis are used to inspect the presence of overconfidence bias and disposition effect in the market. The study's findings have shown both biases are present in the Indian market, with the former being predominant. Knowledge of the two effects in the market can be exploited by the investors to maximize their returns from the market. Simultaneously, administrators can take preventive measures before market turbulence goes beyond control, damaging the investors.

Keywords: Overconfidence Bias, Loss Aversion Bias, Disposition Effect, Vector Autoregression, and Impulse Response Function.

JEL classifications: G02, G11, G12.

1. Introduction

In an efficient and rational market, information can cause price change, but arbitrageurs' work quickly brings market values close to its fundamental values. In this scenario, no investor can make a windfall over and above the market prediction. However, in a real market, human behavioural biases of investors introduce

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irrationalities into the market. This leads to increased volatility and instability in the market. Previous studies in the Indian market have produced ample evidence of volatility signals in commodity and equity indices, generating speculative trading in the market (Mahalakshmi *et al.*, 2012; Thyagarajan *et al.*, 2015). Though many behavioural biases that influence the investors' investment decisions have been identified, overconfidence bias is considered one of the prominent biases that influence the stock markets.

Studies have shown that investors with overconfidence bias and loss aversion bias suffer loss or reduced profit compared to rational investors (Nofsinger, 2001; Pompian, 2006). Hence for a robust stock market, it is imperative to identify the influence of these two biases among the stocks traded in the constituent index, which represents the entire market in general.The present study aims to determine these two irrationalities in the Indian stock market and check which bias among these two dominates the Indian market. The study employs statistical tools like Vector Auto Regression (VAR), Impulse Response Function (IRF) to evaluate the two biases' presence and their impact on the Indian market. In addition to the Vector Autoregression, the study employs (Bai *et al.* 2018) model and nonlinear model for checking the robustness of the finding. Although these two biases have been studied in the Indian market before the present study,itis the most comprehensive one to date using daily data extending over ten years. Using the most advanced statistical tools, including the nonlinear models, are new to this area. In addition to this, Indian stock exchanges project a strong position at the Asian as well as a global stage because of the slowdown of the US economy, economic reforms in India during the same period in 1991 results in the emergent of the Indian stock market as it becomes a favorite hot spot of FII's (Foreign Institutional Investors) (Gupta, 2011; and Srivastava, 2016). Later during the period 2007-08 financial crisis where the global economies again went panic, Indian stock markets did not witness much effect. During the period 2012-13, 2013-14, and 2014-15 all witnessed an increase in FII investment (Ganesh *et al.* 2017). All this adds special characteristics to the Indian stock market, and during the period investors, the world overlooked the confidence level of investors in the market. Moreover in the study made by Ganesh *et al.* (2017) found that the Indian stock market is different from other foreign markets because most of the foreign markets witnessed the herding tendency of investors during the crisis period. Still, the Indian stock market was free from investors' herding tendency when the 2007-08 financial crisiswas examined. Investors may herd when they have some panic in mind or during uncertain times. All this calls for a special interest in worldwide investors, speculators, and other practitioners to look into the Indian market.

The paper is organized as follows: In section 2, the study's theoretical framework is discussed. In section 3, background and related papers are described. In section 4, the methodology is described, and in section 5, the study results are discussed, and section 6 gives the conclusion.

2. Theoretical Framework

Overconfidence bias may be defined as the excessive belief in one's intuitive reasoning, judgments, and cognitive abilities (Pompian, 2006). This false notion about one's ability drives investors with overconfidence bias to chase hot stocks with certainty. This results in the above said bias, whereby investors trade more frequently than average investors and ultimately end up with poorer returns (Nofsinger, 2001). Studies to identify overconfidence bias in a market look for a positive relationship between transaction volume and lagged returns. These investors even trade in the opposite direction of market movement based on the weight of the precision of private information they believe to possess (Daniel *et al.*, 1998 and Odean, 1998). They hence believe that they are better than others in choosing the best investment avenue and selecting the time to buy and sell off the assets to get a maximum return (Pompian, 2006). The volume of trading by overconfident investors is more than average trading (Glasser and Webber, 2007). However, the return from increased trading by overconfident investors is usually not more than that from average trading and is further reduced by the commensurate increase in the cost of trading (Barber and Odean, 2000). Overconfident investors' surprising behavior is that even when these investors' result in loss, instead of going for introspection, they go for an alternative stock to invest without doing any fundamental or technical analysis (Pompian, 2008).

Another group of investors has loss aversion bias; they are overcautious in deciding to buy or sell in the market. Investors suffering from loss aversion bias experience greater pain in a loss than pleasure from a gain of an equal amount. As they don't want to lose money, they hold on to losing stocks, assuming that those stocks' prices will increase shortly, whereas they sell the winning stocks too early to make a profit before the next price decline. In stock markets, this is manifested as the disposition effect (Shefrin and Statman, 1985; Pompian, 2006). By selling a winning stock too early, investors surrender the prospect of reaping higher profit in the event of future price escalation. Similarly, by holding on to losing stocks, they end up incurring heavy losses when the price falls further. Either way, the disposition effect can reduce the market returns for those investors with loss aversion bias.

Since the disposition effect also affects trading volume, the two biases are studied separately by studying overconfidence bias at the market level while studying the disposition effect at individual stock levels (Statman *et al.* 2006). The argument is that positive market returns drive overconfident investors to trade in most stocks, thus increasing market volume. Simultaneously, the disposition effect is more a localized effect acting on individual stocks and increasing trade volume on those stocks only. Siwar (2011) provides empirical support to this method of segregating these two biases when both biases are studied in conjunction.

The present study exploits this basic difference between the two biases by using appropriate models.

3. Background of the Study

The investors with Overconfidence Bias and Loss aversion bias commonly exist regarding any market investments across the world. Previous studies have established

both these biases in most markets, with the disposition effect being the most widely observed bias among individual investors (Barber and Odean, 1999). A study in US markets from January 1980 to December 2002 using the Odean (1998) model showed evidence of disposition effect among the US (Frazzini, 2006). A study in New York Stock Exchange for a much longer period from August 1962 to December 2002 using the Vector Autoregression (VAR) method has established both overconfidence bias and disposition effect in the market (Statman *et al.* 2006).

The disposition effect among the USA's individual investors was examined by Odean (1998) model on primary data. The study's findings showed a strong disposition effect among investors (Barber and Odean, 1999). Using a time series regression model on data from the French stock market from 1988 to 2004 indicated the strong presence of both overconfidence bias and disposition effect in France (Siwar, 2011).

Studies in Asian markets have also proved the existence of both biases in these markets. The overconfidence bias and disposition effect among investors in Shanghai and Shenzhen stock exchanges of the Chinese stock market from 1998 to 2002 have been considered. The study's findings produced enough evidence to prove both the overconfidence bias and disposition effect in the market. It was also found that the disposition effect is stronger than the overconfidence bias in these markets (Chen *et al.* 2007).

Studies conducted worldwide have brought out some of the salient features and latent dynamics of the two biases. According to the model developed by Gervais and Odean, a trader at the beginning of his career is not overconfident. When he initially meets with success, he becomes wealthier during trading, and his biased learning then makes him overconfident. As a result, his trading activity increases, and he begins to suffer losses or face reduced returns. He realizes his true potential and limitations with experience and whereby his overconfidence decreases (Gervais and Odean, 2001).

Like overconfidence bias, the disposition effect is also linked to trade experience. Market studies have shown that the loss of aversion also decreases (Feng and Seasholes, 2005; Seru *et al.* 2010). Unlike Overconfidence bias, Investors who suffer from the disposition effect will generally trade less (Kumar and Lim, 2008). A study in the US has shown that both overconfidence bias and disposition effect in the investors is reflected at its peak during uncertainty in the market and in stocks whose values are difficult to determine (Kumar, 2009). The level of disposition effect among the different income levels and occupations of investors in the USA has been examined. The empirical evidence supports the presence of disposition effect more in wealthier groups and professional groups (Dhar and Zhu, 2002). Investment patterns of a large number of investors of major Israeli brokerage houses were analyzed. The study's findings showed that though both professionals and amateur investors mostly influence disposition effect, disposition effect is stronger for amateur investors than professional investors (Shapira and Venezia, 2001).

Overconfidence bias and loss aversion bias among Indian stock market investors were examined through interviews with few individual investors in India. The study's

findings showed that Indian investors' investment decisions were influenced by both the biases (Sahi and Arora, 2012).

For easy analysis of previous studies on overconfidence bias and disposition effect worldwide is summarised in annexure-1. Previous studies worldwide on the overconfidence and disposition effect have shown that both these biases are present among investors in all the markets. Since these biases can make the market irrational, it is necessary to study these biases and its effect on the market. Studies have shown that the Indian market is not free from investors' herding (Ganesh *et al.*, 2016 and 2017). So it is likely that the Indian market is also affected by overconfidence bias and disposition effect.

Recent studies have shown that nonlinear techniques can be superior in bringing out the relationship between various financial variables. Chiang *et al.* (2010) shows strong bidirectional nonlinear Granger causality between trading volume and return volatility even while there was no linear causality between the two variables. The study suggests the usefulness of using lagged values of trading volume in nonlinear models to predict return volatility. Dhaoui and Bacha (2017) have used the nonlinear Auto Regressive Distributed Lag (NARDL) on the S&P 500 index to determine the overconfidence bias and optimism-pessimism indicators. Their study provides further confirmation of the nonlinear relationship between fundamental financial variables.

One of the most successful nonlinear Granger causality tests was developed by Hiemstra and Jones (1994). The test limited to bivariate series was later extended to a multivariate setting by Bai *et al.* (2010), which quickly found wide application in economics and finance (Fabozzi *et al.* 2012). Bai *et al.* (2018), more recently, have proposed a more consistent estimator of the probabilities for the multivariate nonlinear granger causality test with good results.

The present study also used nonlinear models to determine overconfidence bias and disposition (loss aversion) bias in the Indian market. The present study considers the investors' behavior during the past ten years (2005-2015) to determine the presence of overconfidence bias and disposition effect for each stock in the Nifty 50 index and determine which of the two biases predominates the Indian market. The present study uses the VAR model to estimate bias in the market during the study period. The study also finds out the approximate period of overconfidence bias and disposition effect present in each stock considered for the study.

4. Methodology

The investors' bias seems to have jolted the market observers and analysts in gauging global share prices. In the present study, the Nifty 50 index as a market and its constituent stocks during the period 1st April 2005 to 31st March 2015 were used to understand the Overconfidence bias and the disposition effect. Nifty 50 index and its constituent stocks were used for the study as it (Nifty 50 index) are considered as the barometer of the Indian economy. The constituent stocks in the index used for the study and their NSE symbols are given in annexure-2.

The daily data consisting of the closing price and volume traded in the index's market and its constituent stocks for the period have been downloaded from the official website of the National Stock Exchange (NSE). The study employs the Vector Autoregression (VAR) model to determine the overconfidence bias and disposition effect. VAR is an econometric model applied to capture the interdependencies among the multiple time series. Here, it is applied to capture the interdependencies between volume traded on each security and lag value of volume, the lag value of market return, and the lag value of stock return and idiosyncratic volatility. Impulse Response Function (IRF) is employed to test how long the overconfidence bias and disposition effect persist in the market. The study uses the logarithmic value of volume traded in each stock, return of each stock and market return as the dependent variable and idiosyncratic volatility of each stock along with lag values of each stock of volume traded. The market return of each stock is calculated with the help of the formula given below:

$$Return = ln\left(\frac{CurrentClosingPrice}{PreviousClosingPrice}\right) \quad (1)$$

Idiosyncratic volatility is the unsystematic risk computed by the regression residual's standard deviation between stock return and market return. VAR model is employed to find out the presence of overconfidence bias and disposition effect in the market.

$$LogT_t = \propto + \sum_{j=1}^{k} \beta_j \, LogT_{t-j} + \sum_{j=1}^{k} \gamma_j \, Ri_{t-j} + \sum_{j=1}^{k} \lambda_j \, Rm_{t-j} + \; vIvol_t + \; \varepsilon_{1t} \quad (2)$$

$$Ri_t = \propto' + \sum_{j=1}^{k} \beta'_j \, LogT_{t-j} + \sum_{j=1}^{k} \gamma'_j \, Ri_{t-j} + \sum_{j=1}^{k} \lambda'_j \, Rm_{t-j} + \; v'Ivol_t + \; \varepsilon_{2t} \quad (3)$$

$$Rm_t = \propto'' + \sum_{j=1}^{k} \beta''_j \, LogT_{t-j} + \sum_{j=1}^{k} \gamma''_j \, Ri_{t-j} + \sum_{j=1}^{k} \lambda''_j \, Rm_{t-j} + \; v''Ivol_t + \; \varepsilon_{3t} \quad (4)$$

Where: $LogT_t$: Log the value of volume traded of each security in time *t*, Ri_t: Daily return of security i, Rm_t: Daily market return, $Ivol_t$: Idiosyncratic volatility of stock i on day t, *k*: Number of lags, j: is the index of summation of the lags, t: Number of observations, ε: Error term

The positive value of γ_j with a 5% level of significance denotes the disposition effect's impact. The positive value of $\lambda_j$with a 5% level of significance denotes the impact of overconfidence bias. But before applying the above variables into the VAR model, the presence of unit root is checked by applying both the Augmented Dickey-Fuller (ADF) test and Philip Perron (PP) test and the number of lags to be used by lag length criteria based on Schwarz Information Criterion.

Recent research shows that nonlinear techniques are superior and robust compared to linear models (Chiang *et al.* 2010; Bingzhi, 2009; Vinod, 2017; Bai *et al.* 2018). Hence, to cross-check the VAR model results and examine the robustness of

the model, Bai *et al.* (2018) model and other multiple nonlinear models, developed by the authors, have been applied.

5. Results and Discussion

The variables used in the VAR model have to be stationary. So to check the presence of unit root in the series, both the Augmented Dickey-Fuller (ADF) test and Philip Perron (PP) test were calculated.

H_0: There is a unit root in the series.

The result of the unit root test is summarized in annexure-3 As P-values for all the model variables are less than 0.05, the null hypothesis was rejected at a 5% level of significance.

H_1: There is no unit root in the series.

All variables are stationary at levels, so the data can be fitted in a VAR model to determine the overconfidence bias and disposition effect in the stocks traded. But before running this VAR model, the number of optimum lags has to be determined. At a 5% level of significance, the Schwarz Information Criterion was employed to determine the number of optimum lags for the VAR variables model. The presence of overconfidence bias and disposition effect in the market was traced out by running 50 VAR equations as 50 stocks in the Nifty 50 index. The positive value of γ_j with a 5% level of significance indicates the disposition effect, and the positive value of λ_j with a 5% level of significance shows the overconfidence bias.

Annexure-4 showed that out of the 50 companies, 44% of the index companies are influenced by overconfidence bias alone, whereas 4% are influenced by disposition effect alone. But 16% of the index companies are influenced by both overconfidence bias and disposition effect, whereas 36% of the index companies are neither influenced by overconfidence bias nor disposition effect.

To determine which bias is predominant in the Indian stock market, the frequency of overconfidence bias and disposition effect was inspected. The result given in Annexure-4 showed that 22 companies' trading was under the influence of overconfidence bias alone. Only two companies were under the influence of disposition effect alone. The results also show that trading of eight companies was under both biases, whereas trading in 18 companies was not influenced by either overconfidence or disposition effect. Thus out of the 50 companies, shares of 32 companies were traded under the influence of either overconfidence bias or disposition effect.

It is well known that overconfident investors contribute to excessive trading volume (Odean, 1999). This is a direct result of overconfident investors chasing hot stocks one after the other in the hope of reaping more than average returns. This explains why 30 out of 50 stocks in Nifty 50 show evidence of this 'hot chasing.' All these 30 stocks in NSE are viewed as plum stocks by Indian investors. The disposition effect is exhibited only by stocks that have suffered significant reversals during the period of study. Such major setbacks were witnessed only on two stocks, namely ONGC Ltd and Tech Mahindra Ltd.

ONGC is India's largest oil and gas exploration and production company. In terms of capitalization, it is the largest publicly-traded company and is listed in Fortune Global 500. Nevertheless, as the largest public sector undertaking company, it has been in the news often for mismanagement and many downturns. For instance, in 2013, ONGC saw a decline of 2.4% in its crude oil and 5.5% in natural gas production. Falling international oil prices also affect ONGC share prices. All these seem to have resulted in a disposition effect on ONGC with investors holding on to the stocks when prices drop, in the hope of price rise and when the price starts rising, selling them off fearing a price drop.

Tech Mahindra is the IT arm of the Mahindra Group and is a leading Indian multinational IT company. In the year 2009, a subsidiary of Tech Mahindra took over 'scandal-hit' Satyam Computer Services to become Mahindra Satyam that subsequently merged with Tech Mahindra in June 2013. From 2002 till 2009, Mahindra Satyam and Tech Mahindra had pending cases with the Income Tax Department for combined Tax default of INR 27 billion. All these had its toll on the company, with the company reporting a loss of INR 2.33 billion for the second quarter of 2010-2011. But by the first quarter of 2011-2012, Mahindra Satyam made a turnaround to post a net profit of INR 2252 million. Since then, the company has been doing well. But investors still seem to carry a hangover of 'fear of loss' manifested in its stock's disposition effect.

Annexure 4 shows 18 companies that neither displayed overconfidence bias nor disposition effect, though considered prime companies' stocks in India, only behind so-called 'hot stocks,' which showed overconfidence bias. This means that even when the market was not doing well, investors seem to have given top priority for the 22 companies' stocks that have exhibited overconfidence bias (Excessive Buying). The eight companies that have shown both biases had their vicissitudes during the ten-year period of study. Both biases on these stocks can indicate a roller coaster ride in the companies' performance. By the same argument, 18 companies showed neither the overconfidence bias nor disposition effect put up more or less consistent performance during the study period. Most of the time, their shares were never 'chased after' or never saw 'panic sell-offs.'

The impulse response function is employed to study the duration of the overconfidence bias and disposition effect for each stock. For overconfidence bias, the response of volume traded for each security to the shock of one standard deviation of market return is considered, whereas, for the impulse response function of disposition effect on each security, the response of volume traded for each security to the shock of one standard deviation of each security return is considered. The graphical presentation of each of the 50 stocks' impulse response function is evaluated and given in Annexure 5.

Examination of the 50 curves shows that on an average, overconfidence bias peaks at 2.97 days with an average increase in the volume of 4.69%. This percentage increase in trading volume is consistent with the findings of Statman *et al.* (2006). The peaking trading volume around the second day could be attributed to T+2 settlements. The curves typically go through some ups and downs after the peak, after

which, on an average from 4.87th day onwards, the volume falls steadily to touch around 0.1% by 20 days. More than normal trading frequency, which is attributed to overconfidence bias, persists in the market for around 27 days. The stock that exhibited the maximum level of overconfidence bias was Colgate Palmolive Limited, with a peak value of 9.6%. In contrast, Tata Tea Ltd stock exhibited overconfidence bias for the maximum number of days with 85 days. The Overconfidence of investors on these two stocks reflects the performance of these companies in India. Colgate Palmolive is a US-based multinational company spread over 200 countries, and India is the only country outside the US where the company is publicly listed. At the same time, Tata in India is synonymous with successful entrepreneurship.

The impulse response function result also shows that the disposition effect is maximum at around 1.7 days, with an average increase of 3.26%. The peak point around the second day is again attributed to the T+2 settlement. The disposition effect goes through a couple of ups and downs and then falls off from an average of 3.5th day to reach 0.1% by 14 days. The disposition effect persists in the market for around 20 days. The ups and downs and their periodicity is once again a result of T+2 days settlements prevailing in the market. The stock that exhibited the maximum level of disposition effect was Shipping Corporation of India Ltd with a peak value of 5.6%and the effect persisted for 20 days. Tech Mahindra Ltd stock exhibited a disposition effect for the maximum number of days with 70 days with a peak value of 3.2%.

The above discussion proves that overconfidence bias predominates the market because overconfidence bias influences more stocks than the disposition effect's influence. On average, overconfidence bias persists in the market for a longer period than the disposition effect. The peak point of the intensity of overconfidence bias is also more than the disposition effect. Thus Indian investors in the stock market are more influenced by their overconfidence bias in their decision making than disposition effect. But as discussed in methodology, recent researches have questioned the robustness of the linear models. The VAR model's robustness applied in the study is cross-examined by two nonlinear models; Bai *et al.* (2018) model and another nonlinear model have been applied. The results of the two models are given in annexure-6 and 7. Both models support the findings of the result of the VAR model applied in the study.

6. Conclusion

A vibrant market needs confident traders, but too much confidence can also be damaging because the overconfident investors overestimate the value of security and loss. Their overestimation of securities' value may even push away the value of securities from its fundamental values. Loss aversion bias in the investors acts as deterrence in free and rational trading, and consequently, the market loses its vital energy and life.

Previous studies showed both the market's biases with disposition effect influencing the investors more (Feng and Seasholes, 2001; Frazzini, 2006; Chen *et al.* 2007; and Kumar and Lim, 2008). Moreover, most previous studies compared

overconfidence and disposition anomaly between both males and females (Barber and Odean, 1999); wealthy and less wealthy investors (Gervais and Odean), professional and amateur investors (Shapira and Venezia). The exception to those studies is by Statman *et al.* (2006), which opined that both biases persist in the US market with overconfidence bias predominates the disposition effect. However, the present study investigated the presence of overconfidence bias and disposition effect, and the result showed the presence of both biases in individual stocks with the former's predominance. This difference in the results could be attributed to the Indian stock market (Gupta, 2011; Srivastava, 2016; and Ganesh *et al.* 2017). The study also employed two nonlinear models to cross verify the finding, which is unique to this study.So in a scenario where there is a price rise, both overconfident and loss aversion investors resorts to increased selling. The consequent increase in the stock availability either reverses the price rise or holds back sharp increases in stock price. Therefore, both biases work together to arrest the price rise in the upmarket and prevent investors from realizing a price rise's full advantage. When prices drop in the down market, investors with disposition effect will hold on to their stocks while overconfident investors will continue to trade. Thus there is an asymmetry in trade in two phases of the market, with the rise being more in the upmarket. In the down market, the increase in trade and consequent availability of stocks will cause prices to drop, though too much lower extent, since the disposition effect will reduce the availability of stocks and hold back the steep drop in stock prices. Thus, the disposition effect acts as a cushion from steeper and more damaging market crashes. The present finding shows the disposition effect to be less dominant, implying that India's market crashes could be much more severe than most other markets. The presence of a significant level of overconfidence bias in the Indian stock market results in hectic trading and irrationality. The present study can help the investors and market regulators recognize the stocks with stable performance and those that are turbulent and risky. This can help investors make better investment decisions, while regulators and policymakers may more effectively govern the market. The present study only looks into the overconfidence bias and disposition effect for each stock in the Nifty 50 index and how long the effect persists in the market. It will be interesting to study the level of overconfidence bias and disposition effect among different industrial sectors by applying a similar methodology.

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Appendix

Appendix 1- Describes the Purpose and Findings of the Study Along with the Novelty in Their Study

This table gives an outline of the previous studies focused on overconfidence bias and disposition effect or loss aversion bias by highlighting the country or market focused in the study, whether it is primary or secondary data, model applied, the focus of the study, and their findings along with the novelty of each study.

No	Author	Year	Country /Market	Data Used	Period or Sample Size	Model Used	Focused on	Major Findings	The novelty in the paper
1	Barber and Odean	1999	USA (New York Stock Exchange)	Secondary Data	1987-1993	Odean (1998)	Both overconfidence bias and loss aversion bias	Influence of both biases are present in the investors	The study compared the difference in the level of confidence among male and female investors and find out that male investors are generally more overconfident than female investors has proved.
2	Frazzini	2006	USA (New York Stock Exchange)	Secondary Data	January 1980 to December 2002	Odean (1998)	Disposition effect	Found disposition effect is present among investors.	Studying the disposition effect of investors in the mutual fund category is an original study.
3	Statman *et al.*	2006	USA (New York Stock Exchange)	Secondary Data	August 1962 to December 2002	VAR model and Impulse response function	Both overconfidence bias and loss aversion bias	Both biases persist in the market, and both biases are more pronounced in small-cap stocks than mid cap and large-cap stocks. The study also find out that overconfidence bias predominates the market than disposition effect.	A comparison between the presence of overconfidence bias and loss aversion bias among small-cap, mid-cap, and large-cap stocks has been made.

4	Siwar	2011	France	Secondary Data	June 2002 to March 2004	VAR model	Both overconfidence bias and loss aversion bias	Both biases persist in the market	The study also finds out that bad news has more impact on volatility than good news.
5	Chen *et al.*	2007	China Shanghai and Shenzhen stock exchanges	Secondary Data	20th May 1998 to 30th September 2002	Odean (1998) and Odean (1999) model	Both overconfidence bias and loss aversion bias	Both biases persist in the market, and the disposition effect is stronger than overconfidence bias in the market.	The study explored the influence of overconfidence and loss aversion bias in the Chinese stock market by covering China's two most important stock exchanges.
6	Gervais and Odean	2001	USA	Theoretical Paper	Not Applicable	Gervais and Odean (2001)	Focused on developing a new model for finding overconfidence	When he initially meets with success, he becomes wealthier during trading, and his biased learning then makes him overconfident. As a result, his trading activity increases, and he begins to suffer losses or face reduced returns. With experience, he realizes his true potential and his limitations and whereby his overconfidence decreases	Find out a new model to find out overconfidence bias.

7	Feng and Seassholes	2001	China	Secondary Data	As on or after 1st January 1999	Odean (1998)	Focused on the disposition effect	The disposition effect is present in the market. The study also finds out that the disposition effect is linked to trade experience, and with an increase of trade experience, loss aversion will also decrease.	The study finds out that the disposition effect is linked with trading experience, but its influence cannot be eliminated.
8	Seru *et al.*	2010	Finland	Secondary Data	1995 to 2003	Odean (1998)	Focused on the disposition effect	The disposition effect is present in the market, and it will reduce as investors become more experienced.	A comparative study between the experience of investors by classifying experienced and less experienced investors.
9	Kumar and Lim	2008	USA	Secondary Data	1991 to 1996	Odean (1998)	Focused on the disposition effect	The disposition effect is present in the market, and the effect is more susceptible to change in losses than a change in gain	A comparative study between the difference in investment behavior during the selected period, making a gain, and incurring loss has been done.
10	Kumar	2009	USA	Secondary Data	1991 to 1996	Odean (1998)	Both the overconfidence bias and disposition effect	Both overconfidence bias and disposition effect present in the market, but both effects are maximum when the market becomes uncertain.	A comparative study between the different investment confidence of investors during the certainty and uncertainty of the market

11	Dhar and Zhu	2002	USA	Secondary Data	1991 to 1996	Odean(1998)	Focused on the disposition effect	The disposition effect is present in the market, and find out that disposition effect is stronger for wealthier and professional investors.	A comparative study between wealthy and non-wealthy investors that was not done before has covered in this study.
12	Shapira and Venezia	2001	Israel (Tel Aviv Stock Exchange)	Secondary Data	January 1961 to December 1973	Schlarbaum, Lease, and Lewellen (1978a. 1978b)	Focused on the disposition effect	The disposition effect influences both professionals and amateur investors, but professional investors are less influenced.	A comparison with professionals and amateur investors which was not done before
13	Sahi and Arora	2012	India	Primary Data	377 investors	Not Applicable	Focused on both overconfidence bias and disposition effect	Both overconfidence bias and disposition effect present in the market	A study on primary data looking into the perception or attitude of investors

Appendix 2 - List of the 50 Constituent Stocks in Nifty 50 Index

SL.NO	NAME OF THE COMPANY	NSE SYMBOL
1	ABB India Ltd.	ABB
2	ACC Ltd.	ACC
3	Ambuja Cements Ltd.	AMBUJACEM
4	Bajaj Auto Ltd	BAJAJ-AUTO
5	Bharat Heavy Electricals Ltd.	BHEL
6	Bharat Petroleum Corporation Ltd.	BPCL
7	Bharti Airtel Ltd.	BHARTIARTL
8	Cipla Ltd.	CIPLA
9	Colgate Palmolive (I) Ltd	COLPAL
10	Dabur India Ltd.	DABUR
11	Dr. Reddy's Laboratories Ltd.	DRREDDY
12	GAIL (India) Ltd.	GAIL
13	Glaxosmithkline Pharmaceuticals Ltd.	GLAXO
14	Grasim Industries Ltd.	GRASIM
15	HCL Technologies Ltd.	HCLTECH
16	HDFC Bank Ltd.	HDFCBANK
17	Hero MotoCorp Ltd.	HEROMOTOCO
18	Hindalco Industries Ltd.	HINDALCO
19	Hindustan Petroleum Corporation Ltd.	HINDPETRO
20	Hindustan Unilever Ltd.	HINDUNILVR
21	Housing Development Finance Corporation Ltd.	HDFC
22	I T C Ltd.	ITC
23	ICICI Bank Ltd.	ICICIBANK
24	Infosys Ltd.	INFY
25	Larsen & Toubro Ltd.	LT
26	Mahanagar Telephone Nigam Ltd.	MTNL
27	Mahindra & Mahindra Ltd.	M&M
28	Maruti Suzuki India Ltd.	MARUTI
29	National Aluminium Co. Ltd.	NATIONALUM
30	NTPC Ltd	NTPC
31	Oil & Natural Gas Corporation Ltd.	ONGC
32	Oriental Bank of Commerce	ORIENTBANK
33	Punjab National Bank	PNB
34	Ranbaxy Laboratories Ltd.	RANBAXY
35	Reliance Industries Ltd.	RELIANCE
36	Reliance Infrastructure Ltd.	RELINFRA
37	Shipping Corporation of India Ltd.	SCI
38	State Bank of India	SBIN
39	Steel Authority of India Ltd.	SAIL
40	Sun Pharmaceutical Industries Ltd.	SUNPHARMA
41	Tata Chemicals Ltd.	TATACHEM
42	Tata Communications Ltd.	TATACOMM
43	Tata Consultancy Services Ltd.	TCS
44	Tata Motors Ltd.	TATAMOTORS
45	Tata Power Co. Ltd.	TATAPOWER
46	Tata Steel Ltd.	TATASTEEL
47	Tata Tea Limited	TATAGLOBAL
48	Tech Mahindra Ltd	TECHM
49	Wipro Ltd.	WIPRO
50	Zee Entertainment Enterprises Ltd.	ZEEL

Source: NSE Website

Appendix 3- Result of Unit Root Test

This table shows the result of the unit root test on the variables considered for the study. The unit root test was conducted by using both ADF and PP tests. Their t-statistics result and level of significance on each variable are also shown. The variables considered for the study are volume, stock return, market return, and idiosyncratic volatility.

NSE SYMBOL	Volume		Stock Return		Market Return		Idiosyncratic Volatility	
	ADF t-stats	PP test- t-stats	ADF t-stats	PP test- t-stats	ADF t-stats	PP test- t-stats	ADF t-stats	PP test- t-stats
ABB	-5.029**	-26.111**	-48.981**	-48.975**	-46.857**	-46.774**	-19.722**	-28.002**
ACC	-5.852**	-42.327**	-46.966**	-46.968**	-46.857**	-46.774**	-18.280**	-39.143**
AMBUJACEM	-7.81**	-44.936**	-51.731**	-51.727**	-46.857**	-46.774**	-11.676**	-40.253**
BAJAJ-AUTO	-7.322**	-41.064**	-45.198**	-45.155**	-46.857**	-46.774**	-22.413**	-29.737**
BHEL	-2.939*	-14.762**	-45.105	-44.910**	-46.857**	-46.774**	-34.067**	-38.872**
BPCL	-6.087**	-39.787**	-48.516**	-48.530**	-46.857**	-46.774**	-12.879**	-38.281**
BHARTIARTL	-4.548**	-29.065**	-38.088**	-50.841**	-46.857**	-46.774**	-36.167**	-39.478**
CIPLA	-7.962**	-41.257**	-49.825**	-50.040**	-46.857**	-46.774**	-34.471**	-35.931**
COLPAL	-6.620**	-43.522**	-49.269**	-49.440**	-46.857**	-46.774**	-34.762**	-36.040**
DABUR	-13.441**	-41.791**	-52.767**	-55.164**	-46.857**	-46.774**	-46.849**	-46.779**
DRREDDY	-13.601**	-42.053	-50.247**	-50.250**	-46.857**	-46.774**	-34.155**	-38.980**
GAIL	-6.708**	-46.076**	-38.522**	-53.534**	-46.857**	-46.774**	-18.695**	-40.083**
GLAXO	-8.776**	-47.676**	-46.861**	-46.782**	-46.857**	-46.774**	-23.320**	-28.804**
GRASIM	-7.105**	-41.219**	-48.871**	-49.900	-46.857**	-46.774**	-16.435**	-38.666
HCLTECH	-8.031**	-45.959**	-49.478**	-49.846**	-46.857**	-46.774**	-9.631**	-46.871**
HDFCBANK	-4.183**	-30.603**	-36.652**	-47.158**	-46.857**	-46.774**	-17.826**	-43.152**
HEROMOTOCO	-9.759**	-44.913**	-31.969**	-49.142**	-46.857**	-46.774**	-36.216**	-38.872**
HINDALCO	-4.930**	-17.683**	-46.807**	-46.792**	-46.857**	-46.774**	-19.512**	-40.743**
HINDPETRO	-6.607**	-39.564**	-48.954**	-48.965**	-46.857**	-46.774**	-21.871**	-39.263**
HINDUNILVR	-12.296**	-41.948**	-49.816**	-50.256**	-46.857**	-46.774**	-34.143**	-37.414**
HDFC	-3.543**	-30.310**	-25.973**	-48.525**	-46.857**	-46.774**	-15.837**	-45.144**
ITC	-6.482**	-30.523**	-51.782**	-52.212**	-46.857**	-46.774**	-34.440**	-37.355**
ICICIBANK	-4.034**	-23.528**	-44.802**	-44.552**	-46.857**	-46.774**	-8.858**	-46.979**
INFY	-4.304**	-23.528**	-44.803**	-44.552**	-46.857**	-46.774**	-8.858**	-46.979**
LT	-15.476**	-38.706**	-38.534**	-49.877**	-46.857**	-46.774**	-33.711**	-36.034**
MTNL	-4.366**	-26.453**	-35.294**	-44.424**	-46.857**	-46.774**	-36.405	-40.430**
M&M	-7.306**	-30.714**	-48.189**	-48.480**	-46.857**	-46.774**	-14.983**	-36.558**
MARUTI	-6.338**	-44.030**	-44.893**	-44.656**	-46.857**	-46.774**	-14.650**	-43.127**
NATIONALUM	-6.640**	-37.083**	-47.594**	-47.545**	-46.857**	-46.774**	-35.220	-38.213**
NTPC	-6.161**	-29.174**	-46.445**	-46.501**	-46.857**	-46.774**	-14.308**	-41.974**
ONGC	-4.439**	-37.231**	-48.669**	-48.731**	-46.857**	-46.774**	-23.121**	-38.896**
ORIENTBANK	-6.342**	-36.507**	-46.255**	-46.255**	-46.857**	-46.774**	-22.738**	-37.961**
PNB	-3.395**	-31.514**	-47.146**	-47.137**	-46.857**	-46.774**	-18.565**	-38.228**
RANBAXY	-8.081**	-34.105**	-48.859**	-48.979**	-46.857**	-46.774**	-21.685**	-33.045**
RELIANCE	-11.518**	-43.180**	-47.374**	-47.355**	-46.857**	-46.774**	-35.502**	-39.480**
RELINFRA	-5.979**	-21.320**	-48.092**	-48.084**	-46.857**	-46.774**	-21.408**	-40.777**
SCI	-6.915**	-32.904**	-47.09**	-47.111**	-46.857**	-46.774**	-22.697**	-36.225**
SBIN	-4.542**	-31.972**	-45.090**	-44.902**	-46.857**	-46.774**	-35.574**	-39.713**
SAIL	-5.187**	-30.621**	-47.347**	-47.286**	-46.857**	-46.774**	-17.142**	-40.136**
SUNPHARMA	-4.034**	-23.528**	-51.191**	-51.679**	-46.857**	-46.774**	-32.995**	-36.633**
TATACHEM	-10.413**	-40.053**	-45.630**	-45.641**	-46.857**	-46.774**	-18.449**	-39.068**
TATACOMM	-5.143**	-26.546**	-47.837**	-47.821**	-46.857**	-46.774**	-32.691**	-35.206**
TCS	-9.291**	-41.808**	-32.139**	-49.764**	-46.857**	-46.774**	-32.139**	-49.764**
TATAMOTORS	-3.696**	-22.503**	-45.139**	-44.968**	-46.857**	-46.774**	-19.120**	-40.709**
TATAPOWER	-3.383**	-17.112**	-36.993**	-48.881**	-46.857**	-46.774**	-16.000**	-40.278**
TATASTEEL	-5.785**	-35.344**	-46.260**	-46.535**	-46.857**	-46.774**	-10.565**	-45.628**
TATAGLOBAL	-3.326*	-15.072**	-47.704**	-47.662**	-46.857**	-46.774**	-22.147**	-39.366**
TECHM	-3.562**	-14.186**	-14.046**	-44.368**	-46.857**	-46.774**	-8.023**	-26.198**
WIPRO	-12.081**	-43.538**	-51.188**	-51.231**	-46.857**	-46.774**	-11.718**	-41.307**
ZEEL	-12.806**	-42.314**	-49.212**	-49.402**	-46.857**	-46.774**	-18.896**	-35.931**

Source: Computed Data Note:*: 5% Level of Significance**: 1% Level of Significance

Appendix 4-Classification of Stocks Under the Influence of Bias - Vector Autoregression Model

This table classifies the 50 stocks listed in the Nifty 50 index into four clusters with the Vector Autoregression (VAR) model's help. The four cluster groups are stocks under the influence of overconfidence bias alone, disposition effect alone, both biases, and no effect. The table also explains how many stocks are under each bias's influence and their proportion out of 50 stocks.

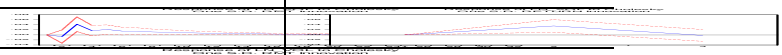
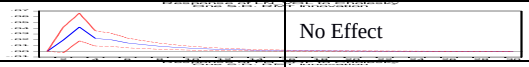
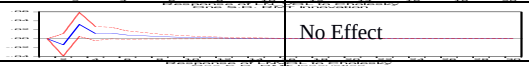
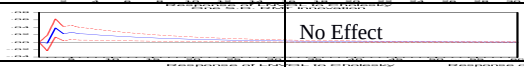
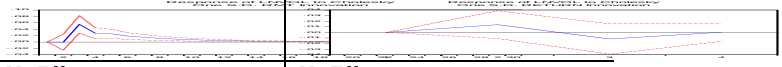
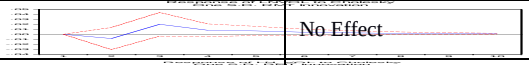
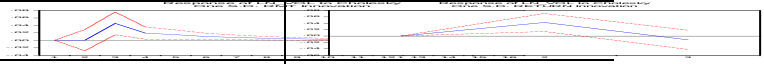
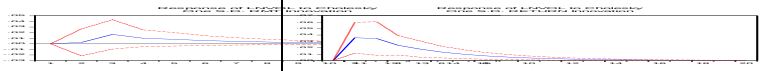
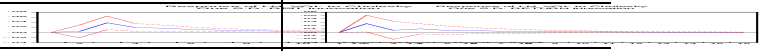
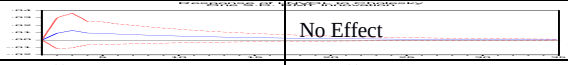
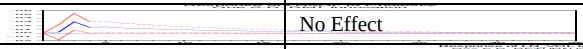
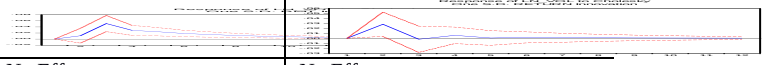
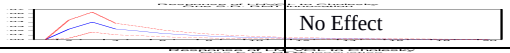
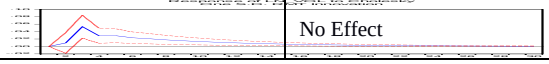
Name of the Bias	NSE SYMBOL	Disposition Effect				Overconfidence				Total	% Share of Nifty	Bias %
		1st lag		2nd lag		1st lag		2nd lag				
		coeff	t-stats	coeff	t-stats	coeff	t-stats	coeff	t-stats			
Overconfidence Bias Alone	ACC	-0.703	-1.079	-1.074	-1.656	1.553	1.745	**2.708**	**3.054****	22	44	64
	AMBUJACEM	-0.041	-1.676	-0.017	-0.690	0.774	0.814	**3.285**	**3.464****			
	BAJAJ-AUTO	0.423	0.357	-0.112	0.785	-0.938	0.281	**2.562**	**0.003****			
	BHEL	-0.001	-1.682	-0.016	-0.974	-0.231	-0.259	**3.436**	**3.865****			
	CIPLA	0.294	0.443	-0.631	-0.951	-0.618	-0.763	**1.749**	**2.166***			
	COLPAL	0.044	1.770	-0.016	-0.626	1.792	1.652	**5.784**	**5.360****			
	ICICI BANK	-1.119	-1.830	-0.518	-0.846	1.009	10.769	**3.649**	**4,031****			
	LT	-0.838	-1.347	-0.001	-0.616	0.240	0.250	**2.922**	**3.056***			
	MTNL	-0.055	-1.596	-0.003	-0.768	**1.867**	**2.258****	**2.284**	**2.761***			
	NATIONALUM	0.315	0.536	-0.003	-0.123	0.695	0.674	**3.543**	**3.446***			
	ORIENTBANK	-0.709	-1.393	-0.032	-1.303	**2.681**	**2.875***	**2.407**	**2.570****			
	PNB	-0.033	-0.800	-0.460	-0.796	1.401	1.568	**3.068**	**3.434***			
	RELINFRA	0.109	1.745	-0.294	-0.703	**3.346**	**3.760***	**3.346**	**3.760***			
	SBIN	-0.057	-1.935	-0.986	-1.853	1.314	1.623	**2.734**	**3.394***			
	SAIL	-0.124	-0.273	-0.046	-1.635	1.617	1.858	**3.365**	**3.877***			
	TATACHEM	0.666	0.335	0.040	1.118	1.013	1.0178	**4.138**	**4.154***			
	TATACOMM	-0.038	-1.513	-0.046	-1.853	**4.588**	**4.391***	**4.645**	**4.495***			
	TATAMOTORS	-0.037	-0.078	-0.002	-1.736	0.682	0.800	**2.561**	**3.001***			
	TATAPOWER	-0.594	-1.269	-0.661	-1.407	0.595	8.904*	3.734	4.503*			
	TATASTEEL	0.003	2.497	-0.054	-0.127	**1.684**	**2.118***	**2.440**	**3.081***			
	TATAGLOBAL	-0.026	-1.008	-0.017	-0.993	**2.969**	**2.889***	**4.866**	**4.770***			
	ZEEL.	0.490	0.932	-0.920	-1.764	-0.144	-0.156	**1.948**	**2.110****			
Disposition Effect Alone	ONGC	**1.89**	**2.859****	-0.852	-1.296	-0.029	-1.085	0.003	0.914	2	4	
	TECHM	0.599	0.694	**1.847**	**2.137***	0.359	1.160	0.272	0.902			
Both Bias	ABB	**1.233**	**2.837***	-0.913	-2.499	-0.464	-0.504	**2.695**	**2.987****	8	16	
	BPCL	0.5892	1.031	**1.799**	**3.181****	-0.038	-0.043	**3.871**	**4.448****			
	DABUR	**2.292**	**3.280****	-1.255	-1.806	**2.501**	**19.447****	**4.064**	**3.740****			
	GRASIM	**1.611**	**2.240****	0.412	0.575	1.029	1.064	**1.461**	**18.152***			
	HINDPETRO	-0.003	-0.702	**0.145**	**4.120***	0.248	0.284	**2.510**	**2.876***			
	M&M	0.741	1.477	**1.490**	**3.023***	0.824	0.889	**3.348**	**3.630***			
	RANBAXY	**1.109**	**2.667***	0.507	1.271	0.475	0.590	**1.898**	**2.372****			
	SCI	**1.341**	**2.153****	-1.468	-2.459	**2.491**	**2.438****	**4.933**	**4.859***			
No Effect	BHARTIARTL	-0.515	-0.855	-0.130	0.144	0.023	0.881	1.514	1.676	18	36	36

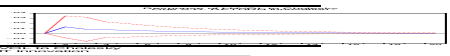
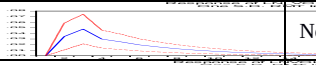
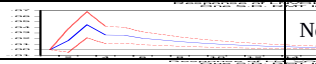
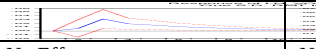
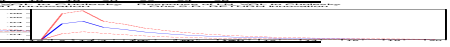
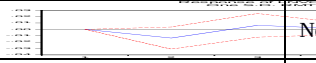
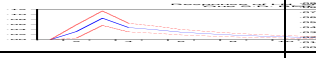
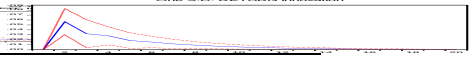
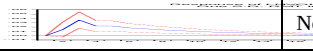
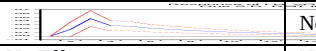
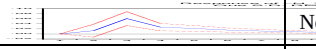
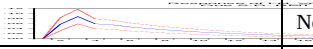
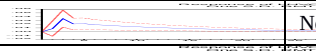
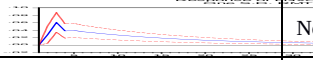
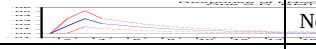
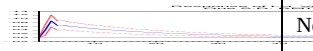
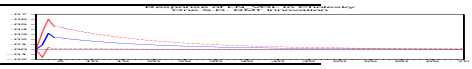
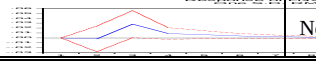
	DRREDDY	-0.537	-0.768	-0.338	-0.485	1.044	1.244	1.092	1.303			
	GAIL	-0.013	-0.020	-0.680	-1.062	0.113	0.127	1.281	1.434			
	GLAXO	-1.326	-1.108	-1.439	-1.203	0.605	0.482	1.913	1.523			
	HCLTECH	-0.120	-0.197	-0.120	-0.200	0.035	0.035	1.266	1.273			
	HDFCBANK	-0.823	-1.056	-1.896	-2.441	0.359	0.346	0.823	0.795			
	HEROMOTOCO	0.709	1.042	-0.032	-1.425	-0.783	-0.892	1.268	1.443			
	HINDALCO	0.001	1.080	-0.001	-1.124	0.018	1.246	0.003	0.179			
	HINDUNILVR	-0.265	-0.389	-0.034	-1.508	0.990	1.189	1.134	1.372			
	HDFC	-0.809	-0.756	-1.359	-1.889	0.018	0.419	1.039	0.939			
	I T C	-0.040	-1.670	-0.667	-0.965	-0.097	-0.116	0.035	0.946			
	LT	-0.044	-1.658	0.491	0.659	0.071	1.944	0.521	0.512			
	INFY	-0.143	-0.245	-0.344	0.596	-0.011	-0.604	0.337	0.444			
	MARUTI	-0.203	-0.354	0.899	-1.580	0927	1.044	1.069	1.201			
	RELIANCE	0.386	0.591	-108	-0.164	-0.147	-1.577	1.285	1.379			
	SUNPHARMA	0.043	0.0617	-0.989	-1.400	-0.901	-1.007	1.468	1.646			
	TCS	-1.016	-1.660	-0.212	-0.348	-0.719	-0.852	1.224	1.453			
	WIPRO	0.258	0.429	0.338	0.567	-0.462	-0.539	0.421	0.493			
Total										50	100%	100%

Source: Computed Data. Note: *: 5% Level of Significance **:1 % Level of Significance.

Appendix 5- Graphical Presentation of Impulse Response Function

This table illustrates the graphs of the impulse response function for each stock. The impulse response function indicates how long the effect persists in the market if bias exists.

Sl. No	NSE SYMBOL	Overconfidence Effect	Disposition Effect
1	ABB		
2	ACC		No Effect
3	AMBUJACEM		No Effect
4	BAJAJ-AUTO		No Effect
5	BHEL		No Effect
6	BPCL		
7	BHARTIARTL	No Effect	No Effect
8	CIPLA		No Effect
9	COLPAL		No Effect
10	DABUR		
11	DRREDDY	No Effect	No Effect
12	GAIL	No Effect	No Effect
13	GLAXO	No Effect	No Effect
14	GRASIM		
15	HCLTECH	No Effect	No Effect
16	HDFCBANK	No Effect	No Effect
17	HEROMOTOCO	No Effect	No Effect
18	HINDALCO	No Effect	No Effect
19	HINDPETRO		
20	HINDUNILVR	No Effect	No Effect
21	HDFC	No Effect	No Effect
22	ITC	No Effect	No Effect
23	ICICIBANK		No Effect
24	INFY	No Effect	No Effect
25	LT	No Effect	No Effect
26	MTNL		No Effect
27	M&M		
28	MARUTI	No Effect	No Effect
29	NATIONALUM		No Effect
30	NTPC		No Effect

31	ONGC	No Effect	
32	ORIENTBANK		No Effect
33	PNB		No Effect
34	RANBAXY		
35	RELIANCE	No Effect	No Effect
36	RELINFRA		No Effect
37	SCI		
38	SBIN		No Effect
39	SAIL		No Effect
40	SUNPHARMA	No Effect	No Effect
41	TATACHEM		No Effect
42	TATACOMM		No Effect
43	TCS	No Effect	No Effect
44	TATAMOTORS		No Effect
45	TATAPOWER		No Effect
46	TATASTEEL		No Effect
47	TATAGLOBAL		No Effect
48	TECHM	No Effect	
49	WIPRO	No Effect	No Effect
50	ZEEL		No Effect

Source: Computed Data.

Annexure 6 - Classification of Stocks Under the Influence of Bias According to Non-Linear Method 1 (BAI *et al.* 2018**)**

This table classifies the 50 stocks listed in the Nifty 50 index into four clusters with the nonlinear method developed by Bai *et al.* 2018. The four cluster groups are stocks under the influence of overconfidence bias alone, disposition effect alone, both biases, and no effect. The table also explains how many stocks are under each bias's influence and their proportion out of 50 stocks.

Name of the Bias	NSE Symbol	Disposition Effect		Overconfidence Bias		Total	% Share of Nifty 50	Bias %
		Coeff	t-stats	Coeff	t-stats			
Overconfidence Bias alone	ACC	-0.023	-1.167	0.054	2.749***	22	44	64
	AMBUJACEM	-0.060	-3.017	0.065	3.278***			
	BAJAJ-AUTO	-0.046	-2.888	0.041	2.262**			
	BHEL	-0.033	-2.588	0.034	2.673***			
	CIPLA	-0.048	-2.488	0.054	2.767***			
	COLPAL	-0.059	-3.244	0.094	5.223***			
	ICICI BANK	-0.018	-0.920	0.053	2.741***			
	LT	-0.040	-2.134	0.037	1.976**			
	MTNL	-0.106	-6.344	0.051	3.041***			
	NATIONALUM	-0.076	-4.948	-0.037	2.428**			
	ORIENTBANK	-0.038	-2.076	0.059	3.211***			
	PNB	-0.031	-1.702	0.055	2.982***			
	RELINFRA	-0.044	-2.712	0.046	2.785***			
	SBIN	-0.035	-1.714	0.058	2.829***			
	SAIL	-0.066	-3.500	0.069	3.655***			
	TATACHEM	-0.093	-4.630	0.064	3.179***			
	TATACOMM	-0.038	-2.450	0.065	4.201***			
	TATAMOTORS	-0.017	-1.116	0.033	2.206***			
	TATAPOWER	-0.042	-3.199	0.051	3.853***			
	TATASTEEL	-0.013	-0.615	0.064	2.912***			
	TATAGLOBAL	-0.026	-2.333	0.046	4.192***			
	ZEEL.	-0.013	-0.626	0.070	3.439***			
Disposition Effect alone	ONGC	0.078	3.993***	-0.073	-3.757	2	4	
	TECHM	0.003	3.322***	-0.015	-1.545			
Both Bias	ABB	0.135	8.199***	0.038	2.734***	8	16	
	BPCL	0.0731	4.141***	0.058	3.609***			
	DABUR	0.109	5.709***	0.037	2.114***			
	GRASIM	0.0791	3.829***	0.040	2.419**			
	HINDPETRO	0.090	5.155***	0.045	2.847***			
	M&M	0.015	2.585***	0.107	6.162***			

	RANBAXY	0.084	4.971***	0.055	3.597***			
	SCI	0.140	7.778***	0.076	5.160***			
No Effect	BHARTIARTL	-0.047	-2.807	-0.020	-1.189	18	36	36
	DRREDDY	-0.003	0.968	-0.005	-0.243			
	GAIL	-0.010	0.982	-0.020	-0.929			
	GLAXO	-0.040	-2.144	-0.016	-0.854			
	HCLTECH	-0.007	-1.064	-0.035	-1.638			
	HDFCBANK	0.015	-2.681	-0.023	-1.792			
	HEROMOTOCO	0.032	1.602	-0.005	0.250			
	HINDALCO	-0.041	-2.859	-0.038	-2.670			
	HINDUNILVR	-0.010	-0.442	-0.010	-1.399			
	HDFC	-0.008	-1.612	-0.034	-1.876			
	I T C	-0.008	-1.239	-0.028	-1.675			
	LT	0.001	0.241	-0.040	-2.173			
	INFY	0.000	0.027	-0.063	-2.977			
	MARUTI	-0.015	0.773	-0.004	0.202			
	RELIANCE	0.030	1.030	0.019	1.060			
	SUNPHARMA	-0.023	-1.843	-0.033	-2.595			
	TCS	-0.011	-1.649	-0.049	-2.352			
	WIPRO	-0.047	-2.057	-0.039	-1.705			
Total						50	100%	100%

Source: Computed Data. Note:*: 10% Level of Significance, **: 5% Level of Significance, ***: 1% Level of Significance.

Appendix 7 - Classification of Stocks Under the Influence of Bias According to Non-Linear Method 2 (Model Developed by the Authors).

This table classifies the 50 stocks listed in the Nifty 50 index into four clusters with another nonlinear model's help. The four cluster groups are stocks under the influence of overconfidence bias alone, disposition effect alone, both biases, and no effect. The table also explains how many stocks are under each bias's influence and their proportion out of 50 stocks.

Name of the Bias	NSE Symbol	Disposition Effect		Overconfidence Bias		Total	% Share of Nifty 50	Bias %
		Coeff	t-stats	Coeff	t-stats			
Overconfidence Bias	ACC	-0.043	-2.188	0.026	4.983***	22	44	64
	AMBUJACEM	-0.024	-1.222	0.032	5.639***			
	BAJAJ-AUTO	-0.052	-1.864	0.067	3.577***			
	BHEL	-0.079	-6.587	0.051	11.672***			

	CIPLA	-0.093	-5.182	0.096	5.317***			
	COLPAL	-0.012	-1.760	0.044	2.478***			
	ICICI BANK	-0.002	-0.348	0.056	2.713***			
	LT	-0.059	-3.233	0.026	4.682***			
	MTNL	-0.012	-0.729	0.035	2.196**			
	NATIONALUM	-0.032	-2.132	0.025	5.759***			
	ORIENTBANK	-0.039	-2.172	0.055	3.058***			
	PNB	-0.023	-2.660	0.048	2.727***			
	RELINFRA	-0.040	-2.517	0.0490	3.096***			
	SBIN	-0.069	-3.456	0.071	3.576***			
	SAIL	-0.034	-1.826	0.061	3.320***			
	TATACHEM	-0.009	-1.175	0.015	2.779***			
	TATACOMM	-0.023	-3.787	0.086	5.662***			
	TATAMOTORS	-0.013	-0.844	0.025	6.422***			
	TATAPOWER	-0.016	-3.661	0.041	3.267***			
	TATASTEEL	-0.056	-2.683	0.068	3.223***			
	TATAGLOBAL	-0.025	-5.169	0.047	4.265***			
	ZEEL.	-0.007	-1.334	0.014	2.532**			
Disposition Effect	ONGC	0.086	10.331***	-0.066	-3.520	2	4	
	TECHM	0.111	8.122***	-0.057	-5.977			
Both Bias	ABB	0.135	8.200***	0.038	2.734***	8	16	
	BPCL	0.625	3.845***	0.013	2.550***			
	DABUR	0.036	1.939***	0.013	2.242***			
	GRASIM	0.083	3.801***	0.187	10.5111***			
	HINDPETRO	0.044	2.355**	0.028	4.975***			
	M&M	0.082	3.936***	0.086	4.136***			
	RANBAXY	0.012	6.802***	0.022	5.073***			
	SCI	0.219	13.187***	0.117	7.172***			
No Effect	BHARTIARTL	-002	-0.097	-0.006	-0.960	18	36	36
	DRREDDY	0.018	0.908	-0.003	-0.149			
	GAIL	-0.002	-0.202	-0.012	-1.795			
	GLAXO	-0.002	-0.078	-0.006	-1.078			
	HCLTECH	-0.027	-1.289	-0.018	-3.080			
	HDFCBANK	-0.019	-1.066	-0.001	-0.167			
	HEROMOTOCO	-0.027	-3.204	-0.031	-1.522			
	HINDALCO	-0.017	-2.728	0.011	0.750			
	HINDUNILVR	-0.014	-0.687	-0.028	-4.937			
	HDFC	-0.019	-1.066	0.020	1.131			
	I T C	0.005	0.737	-0.012	-2.507			
	LT	0.014	1.149	-0.025	-4.57			
	INFY	-0.030	-1.436	-0.030	-5.729			
	MARUTI	-0.032	-1.718	-0.014	-0.759			
	RELIANCE	-0.015	0.530	-0.051	-5.480			
	SUNPHARMA	-0.008	-0.635	0.014	1.153			
	TCS	0.028	1.398	-0.041	-1.989			
	WIPRO	0.013	0.545	-0.005	-0.724			

Total					50	100%	100%

Source: Computed Data. Note:*: 10% Level of Significance, **: 5% Level of Significance, ***: 1% Level of Significance.