# Comparative analysis of individualinvestor portfolios based on behavioral finance and efficient market theories

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## ABSTRACT

This quantitative study compared the effectiveness of two investment strategies with regards to return on investment (ROI). One investment strategy was based on behavioral finance theories of price momentum and was compared to an equally valued investment strategy based on the efficient market theory. Price momentum (rapid acceleration in asset price) was based on the behavioral theory of positive reinforcement. The behavioral finance theory strategy was represented by a momentum strategy based on crossing moving averages. The NIFTY 50 represented the efficient market theory. This researcher sought to identify if knowledge gained from recent studies in behavioral finance could be translated into a strategy that could enable the individual investor to fare better than the efficient market theory proxy of buying and holding the NIFTY 50. The study involved a quantitative quasi-experiment method utilizing an interrupted time series with nonequivalent no-treatment control group time series. Analysis of covariance with a single covariate (ANCOVA) was also employed. Data was taken from the Internet provider, Trade Station Brokerage. The stocks came from companies listed on the National Stock Exchange and BSE, which have mid-size and large capitalizations.

## 1. INTRODUCTION

After the U.S. stock market collapse of 1987, the extraordinary rise in prices of technology stocks, the subsequent decline of the market in 2000, and the financial crisis of 2008, several researchers shifted their support from the efficient market theory (the idea that an asset's price reflects all inforASIANPAINTion, thus investors have difficulty outperforming the market) to a behavioral finance theory Behavioral finance theorists study the quality and nature of financial choices made by individuals and investigate the subsequent economic results .Advocates of the behavioral finance theory argue that markets are not purely efficient because individuals making financial judgments are subject to emotions, such as fear and greed (Smith, 2008). Individuals are also subject to varying degrees of education and appetite for risk, and have different backgrounds that could render their behavior less than rational (Victoravich, 2010). Partially due to these events, investors have lost confidence in the professional investment industry, the professionals that represent securities, and the investment products they represent

## 2. STATEMENT OF THE PROBLEM

Price momentum (rapid acceleration in asset price) is based on the behavioral theory of positive reinforcement, whereby large increases in a stock's price draw in new investors and the inflow of new funds causes prices to rise further As investors buy more, this action reinforces behavior and the stock price climbs, thereby creating a positive feedback loop Negative feedback loops occur as more investors sell their stocks causing the price to collapse. Price momentum strategies were noticed in 16 European markets to be successful predictors of profits Evidence regarding Singapore, Malaysia, and Korea's futures markets indicated that price momentum strategies were able to predict

profitability .Additionally, such strategies were also demonstrated to be profitable in Canada .Despite the success of price momentum research, most published researchers examined foreign markets that may not be as efficient as U.S. markets because of their size and lack of transparency.

## 3. PURPOSE OF THE STUDY

The purpose of this quantitative quasi-experimental study was to compare the effectiveness of two different investment strategies with respect to return on investment (ROI). One investment strategy was based on behavioral finance theories of price momentum and compared to an equally valued investment strategy based on the efficient market theory. The goal of the research was to examine whether distinct investment strategies based on behavioral finance theory can produce greater profits than an investment strategy based on the efficient market theory. Specifically, the resulting ratio level data was used to compare the percentage change in the ROIs of the behavioral finance-based investment strategy with the percentage change in ROI of an investment strategy based on the NIFTY 50 index fund portfolio that served as a proxy for the efficient market theory. The portfolios were updated quarterly using data from Trade Station Securities, a large online brokerage firm and a member of the New York Stock Exchange, and then the data was entered into SPSS 21 for analysis .The ANCOVA with a single covariate was used to compare and examine a control group portfolio and experimental group portfolios (Cook & Campbell, 1979). In addition, an interrupted time series with a nonequivalent no-treatment control group time series study was used.

## 4.  NATURE OF THE STUDY

 The need exists to examine whether a strategy based on behavioral finance theory could aid individual investors better than a strategy based on the efficient market theory in U.S. markets. The nature of the study was to compare the effectiveness of two different investment strategies with respect to ROI. One investment strategy was based on behavioral finance theories of price momentum and compared to an equally valued investment strategy based on the efficient market theory. The goal of the research was to.

## .5.  SIGNIFICANCE OF THE STUDY

  American individual investors have lost trillions in wealth and now mistrust traditional brokerages, their representatives, and their products . The individual investor's animal spirits or desire for risk has been damaged. Individuals acting alone with varying degrees of competence, lack strategies to ensure profitability (Chandra, 2009). Because individuals on their own lack strategies, an argument can be made that behavioral finance theory has the potential to create value for society and for individuals by aiding individuals with strategy development. The study showed how new developments in behavioral finance can be used to construct strategies that can aid the individual investor. Specifically, positive feedback, resulting from cognitive biases, can be visually interpreted from the use of the shorter period MAs crossing from the below longer period MAs on monthly stock price charts. The study is significant in that no fundamental analysis of the underlying company's financial data was used. The two experimental momentum portfolios were based on

CHAPTER II -   LITERATURE REVIEW

## 6. Overview

 Economist Keynes' (1964) statements regarding the nature of investing gave rise to the conceptual framework for market activity based, not on hard numbers, but on theories borrowed from psychology and sociology. Human decisions concerning the future of investments are based not on ASIANPAINTheASIANPAINTical expectations, but on the innate urge to activity, "our rational selves choosing between the alternatives as best we are able, calculating where we can, but often falling back for our motive on whim or sentiment or chance"

## 7. Research Methodology

 The goal of the research was to examine whether distinct investment strategies based on behavioral finance theory can produce greater profits than an investment strategy based on the efficient market theory. Specifically, the resulting ratio level data was used to compare the percentage change in the ROIs of the behavioral finance-based investment strategy with the percentage change in ROI of an investment strategy based on the NIFTY 50 index fund portfolio that served as a proxy for the efficient market theory. Up to 12 months may be the optimal length for a strategy to be effective.

The three major categories of research methods, (a) qualitative, (b) quantitative, and (c) mixed methods, have been used to investigate individual investment strategies . All three methods have also been employed successfully to examine the attributes of profitable individual investors . However, a qualitative study would be limited to only a small number of investors and a mixed methods approach may take longer to execute due to its multiple components By employing the quantitative approach, numbers allowed a precise analysis for this study.

The objective of time series analysis was to identify the nature of the phenomenon that was represented by a series of observations and to forecast or predict future values of the time series variables. These objectives required the patterns of observed data to be identified and described. In order to best illustrate visually the differences between

the portfolios, an interrupted time series with a nonequivalent no-treatment control group time series study was used (Cook & Campbell, 1979). The design is shown below:

    01 02 03 X 04 05 06 07 08 09   behavioral finance portfolio (1)
    01 02 03 04 05 06 07 08 09      efficient market portfolio
    01 02 03 X 04 05 06 07 08 09   behavioral finance portfolio

**Population**

The population for the momentum portfolio were chosen from NSE and BSE listed companies. There are 2,800 companies on the NSE. The BSE has 3821. These companies cover the spectrum of commerce including banks, manufacturing, technology; and products, such as ONGCs and food.

**8. Sample**

The momentum portfolios were comprised of stocks whose price trades between $10 and $200 and had market capitalizations of $1 billion. These stocks needed to meet the criteria of the covariate on the monthly chart in the 3 to 12 months preceding the purchase. The covariate was buying stocks, using monthly price charts, in which the line representing the 20 period MA has crossed, from the bottom of the chart upward, the line representing the 50 period MA. There were 10 companies in each of the two momentum portfolios. The sample size was limited for three reasons. The first was that the stocks had to meet the minimum capital requirements and trade volume. The second was that only approxiASIANPAINTely 20 stocks at any given time meet the covariate requirement and do not overlap significantly in industry classification. Third, this study was targeted at individual investors, who can only remember and track about 10 stocks at a time.

**9.  Results**

The stocks for the momentum strategy portfolio were selected and purchased on February 3, 2022. Whole shares were used with each of the 10 stocks having an approxiASIANPAINTe starting value of $50,000. The remainder was approxiASIANPAINTely $200 in cash.

The list of ticker symbols in he first portfolio, Basket 1, were AMT, ONGC, DIVISLAB, INFY, TECHM, ASIANPAINT, POWERGRID, TCS, BAJAJ-AUTO, and VFC (see Appendix). Basket 2 symbols were NWL, WMB, TWX, LOW, VIAB, MPEL, BX, M, UA, and HON (see Appendix). Each of the stocks met the criteria concerning the crossing MAs as well as the liquidity requirements. The $IDBI is the symbol for the NIFTY 50 index fund. $IDBI had an approxiASIANPAINTe starting value of $499,999 with approxiASIANPAINTely $1,000 in cash. An interrupted time series with a nonequivalent no-treatment control group time series study was used design is shown below where X represents the purchase of the 10 stocks, which met the criteria:

 01 02 03 X 04 05 06 07 08 09       behavioral finance portfolio (Basket 1)
 01 02 03 04 05 06 07 08 09          efficient market portfolio (NIFTY 50)
 01 02 03 X 04 05 06 07 08 09       behavioral finance portfolio (Basket 2)

An analysis of variance (ANOVA) was conducted to examine whether there was significant difference between the groups (DOW, Basket 1, and Basket 2) in terms of ROI percentage change after 1 year. The descriptive statistics for ROI based on the grouping variable is presented in Table 1. As observed in Table 1, the control group SENSEX 30 had mean percentage change of 12.16% (SD = 15.97%), while Basket 1 had mean percentage change of 54.06% (SD = 50.24%) and Basket 2 had a mean percentage change in ROI of 31.35% (SD = 21.66%). This shows that a higher gain is observed for Basket 1 and Basket 2 as opposed to SENSEX 30 index fund

**Table 1**
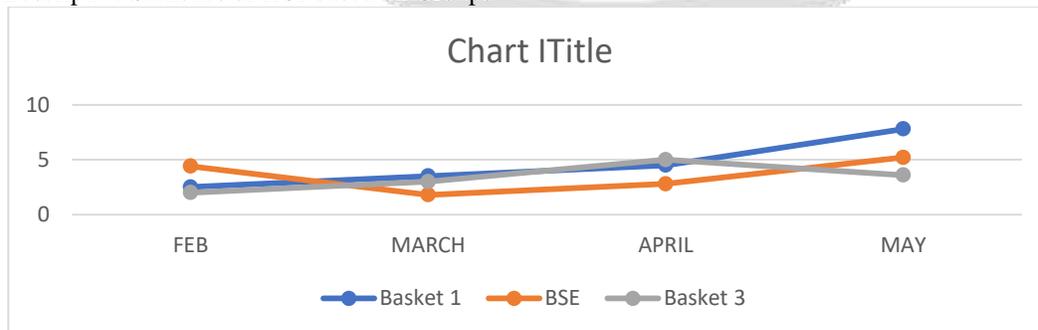 Descriptive Statistics of ROI based on Groups



Figure 1. Time-Series Chart of Stock Prices from Feb 2021 to Feb 2022

The individual symbol price appreciations for Basket 1 are as follows for the year February 3, 2012 to February 4, 2013:  gained 20%, ONGC gained 58.15%, DIVISLAB gained 179.6%, INFY gained 48.8%, TECHM gained 74%,

ASIANPAINT gained 21%, POWERGRID gained 77%, TCS gained 26.6%, BAJAJ-AUTO gained 31.7%, and VFC gained 10.6%. All stocks price appreciation exceeded the SENSEX 30 gain of 8.71%. In addition, the momentum portfolio also captured $13,677.36 in dividends, while only spending $140 in transaction costs. The first behavioral based portfolio resulted in a net ROI of 46.13%.portfolio resulted in a net ROI of 46.13%.

In Basket 2 the following are the individual symbols gains (not including dividends) from February 3, 2012 to February 4, 2013: BX gained 13.09%, HON gained 18.54%, LOW gained 43.52%, M gained 16,79%, MPEL gained 87.37%, NWL gained 26%, TWX gained 32.07%, UA 32.63%, VIAB gained 25.58%, and WMB 19.12%. Additionally, $16,433.04 accrued in dividends for the year, while only spending $140.00 in

| Group | Mean | Std. Deviation | N |
|---|---|---|---|
| Basket | .5406 | .50245 | 10 |
| SENSEX 30 | .1216 | .15975 | 30 |
| Basket 2 | .3135 | .21667 | 10 |
| Total | .2438 | .31340 | 50 |

transaction costs with an online broker. The second behavioral portfolio, Basket 2, had a net ROI of 34.72% compared with the SENSEX 30 ($INDU) at 8.7% and the first behavioral portfolio, Basket 1, of 46.13%.

**Table 2**

Test for Difference in Percentage Change in ROI based on Groups

| | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| Percent Change 2012 to 2013 | Between Groups | 1.202 | 2 | 0.601 | 7.826 | |
| | Within Groups | 3.611 | 47 | 0.077 | | |
| | Total | 4.813 | 49 | | | |
| Percent Change 2013 to 2014 | Between Groups | 0.151 | 2 | 0.076 | 0.92 | 0.406 |
| | Within Groups | 3.858 | 47 | 0.082 | | |
| | Total | 4.009 | 49 | | | |

The literature indicated that a time horizon of 1 year was as long as expected for a momentum strategy to work . Table 2 shows that the data between the groups was not as significant in the second year 2013 to 2014 as the first year 2012 to 2014. That would indicate that the momentum strategies might lose their effectiveness after 1 year. However, looking over a 2-year period (February 3, 2012 to February 3, 2014) the proxy for the efficient market theory (SENSEX 30 portfolio) had a net gain in ROI of 21.5%. Therefore, the original $500,000 increased to $607,733.86 for the SENSEX 30 over 2 years. The behavioral finance theory as exemplified in the Basket 1 momentum portfolio for the period February 2012 to February.

| Source | Type III Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Corrected Model | 1.206a | 3 | 0.402 | 5.129 | 0.004 |
| Intercept | 1.197 | 1 | 1.197 | 15.271 | 0.000 |
| Buying Stock Price | 0.004 | 1 | 0.004 | 0.052 | 0.82 |
| Group | 1.206 | 2 | 0.603 | 7.693 | 0.001 |
| Error | 3.606 | 46 | 0.078 | | |
| Total | 7.784 | 50 | | | |
| Corrected Total | 4.813 | 49 | | | |

a R Squared = .251 (Adjusted R Squared = .202)

Table 3 shows the ANCOVA for 2012 to 2013 that support the alternative hypothesis having an F of 5.129 and a significance p-value of .004. The results were exceptionally robust for the February 2012 to 2013. Thus, for

consistency, a second round of testing was performed over a different period using different symbols for the two behavioral finance portfolios. The SENSEX 30 ($INDU), the efficient market portfolio rose from April 5, 2013 to April 7, 2014. The $INDU went from $14,565.25 to $16,245.87. To meet the requirements of the $500,000 portfolio, 34 shares were purchased with the remaining $4,781.5 in cash. The efficient market proxy achieved an ROI of 11.54%.

Descriptive statistics and an ANCOVA were performed as shown in Table 4. Additionally, ANCOVA was conducted to examine whether there is significant difference between the groups (DOW, Basket1, and Basket2) in terms of the percentage change in ROI after 1 year considering buying stocks as covariate. The descriptive statistics for ROI based on the grouping variable is presented in Table 4 and 5. As observed in Table 4, the control group SENSEX 30 has mean percentage change of .1655 while Basket 1 of .5163 has mean percentage change of and Basket 2 had a mean percentage change in ROI of .4081. This shows that a higher gain was observed for Basket 1 and Basket 2 as opposed to SENSEX 30 index fund, which also supports the alternative hypothesis.

**Table 4**
Descriptive Statistics for April 2021 to 2022

|  | Mean | Std. Deviation | N |
|---|---|---|---|
| Basket 1 | .5163 | .39028 | 10 |
| Basket 2 | .4081 | .36778 | 10 |
| SENSEX 30 | .1655 | .16012 | 30 |
| Total | .2842 | .30125 | 50 |

Moreover, as observed from Figures 2, although the stock prices of DOW, which started out higher, were still higher, the ROI had decreased for SENSEX stocks from the third quarter to the selling time. On the other hand, it can be observed that the stock prices for Baskets 1 and 2 had significantly increased over the quarters. Note that the overall prices of SENSEX stocks were higher than the other two portfolios, but the SENSEX

**Table 5**
ANCOVA Test for Difference in Percentage Change in ROI based on Groups

| Source | Type III Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Corrected Model | 1.254a | 3 | 0.418 | 6.02 | 0.002 |
| Intercept | 2.902 | 1 | 2.902 | 41.812 | 0.000 |
| Buy Stock | 0.139 | 1 | 0.139 | 1.997 | 0.164 |
| Group | 0.627 | 2 | 0.314 | 4.518 | 0.016 |
| Error | 3.193 | 46 | 0.069 |  |  |
| Total | 8.484 | 50 |  |  |  |
| Corrected Total | 4.447 | 49 |  |  |  |

a R Squared = .282 (Adjusted R Squared = .235)

**EVALUATION OF FINDINGS**

  The results of the research were not expected. Conventional wisdom, most text on investing, and many successful investors encourage a primarily fundamental or mixed approach of both technical and fundamental analysis of stocks . Very few suggest a completely technical approach to purchasing stocks .

The results of this study substantiates the hypothesis: There is a difference between the percentage change in ROI over 1 year of a behavioral finance based strategy (buying stocks, using monthly price charts, in which the line representing 20 period MA has crossed, from the bottom of the chart upward, the line representing 50 period MA) and an efficient market based strategy of buying and holding the SENSEX 30 index fund. In the first round of the study from February 2012 to February 2013, the second behavioral portfolio, Basket 2, had a net ROI of 34.72% compared with the SENSEX 30 ($INDU) at 8.7% and the first behavioral portfolio, Basket 1, of 46.13%. Extending the original round a second year the total for both years were. , the SENSEX 30 ($INDU) portfolio, had a net gain in

ROI of 21.5%. Therefore, the original $500,000 increased to $607,733.86 for the SENSEX 30 over 2 years. However, the original $500,000 invested in the momentum portfolio Basket 1 increased to $1,160,236.72 when adding in dividends and transaction costs. Additionally, the original $500,000 invested in the momentum portfolio Basket 2 doubled to just over $1,000,000 when adding in dividends and transaction costs. Thus, while the SENSEX 30 had gains of 21.5%, the behavioral finance portfolios, Basket 1 (gain 132%) and Basket 2 (101%), both doubled in 2 years.

A second round of tests was conducted to rule out the possibility of luck. The SENSEX 30 ($INDU), the efficient market portfolio rose from April 5, 2013 to April 7, 2014. The $INDU went from $14,565.25 to $16,245.87. To meet the requirements of the $500,000 portfolio, 34 shares were purchased with the remaining $4,781.5 in cash. An ROI of 11.54% was achieved by the SENSEX 30. The first April 2013 to April 2014, momentum portfolio, Basket 1, had an ROI, which includes dividends and transaction cost, of 52.9% for the year. The second momentum portfolio, Basket 2 had an ROI, which includes dividends and transaction cost of 42.1% for the year (see Appendix for charts).

## SUMMARY

The results of the analyses showed a large difference between the percentage change in ROI over 1 year of a behavioral finance based strategy and an efficient market based strategy of buying and holding the SENSEX 30 index fund. In the first portfolio comparison from February 2012 to 2013, the results indicated that there is a significant difference based on the data gathered. The SENSEX 30 showed a mean percentage change of 16.55%, while Basket 1 had 51.63% and Basket 2 had 40.81% mean percentage change in ROI. A further analysis of the data determined that among stocks that gained, the second behavioral portfolio, Basket 2, had a net ROI of 34.72% compared with the efficient market theory portfolio, SENSEX 30 at 8.7% ,and the first behavioral portfolio, Basket 1 of 46.13%. The February 2012 study was extended out and a year was added to see if the momentum had slowed. The SENSEX 30 ROI was up 21.5% and both momentum baskets had doubled between February 2012 and 2014. The behavioral finance portfolios, Basket 1 gained 132%, and Basket 2 gained 101%.

The April 2013 to April 2014 also garnered robust statistics. All momentum portfolios tracked by time series analysis significantly outperformed the buy and hold efficient market proxy. The ROI for the efficient market, the DOW, was up 11.54%. The ROI for the momentum portfolio Basket 1 was up 52.9% and the ROI for the momentum portfolio Basket 2 was up 42.1%.

The results of both rounds of ANCOVA analysis indicated that not all groups were the same over the 1-year period. The analysis showed that the group variable significantly differentiates the percentage change in ROI after 1 year of investment ($F = 5.129$, $p = .004$; $F = 4.518$, $p = .016$). These ANCOVA's indicated that a significant difference in the change in ROI for stocks based on the classifications existed. However, the ANCOVA could not prove significance beyond 1 year. In conclusion, knowledge of behavioral finance could allow investors to form profitable strategies and should be encouraged in business schools and among individual investors.

## CONCLUSION

This research indicates support of the argument that behavioral finance theory has the potential to create value for society and for individuals by aiding individuals with strategy development. This study was an extension of the research into behavioral finance by forming what has been learned about investor behavior into a strategy for portfolio selection that the individual investor might profit from. The study showed how new developments in behavioral finance, which incorporate psychological and sociological factors, such as confirASIANPAINTion bias, anchoring bias, herding, positive feedback, and confidence, can be used to construct strategies that can aid the individual investor. The resulting momentum price strategy used for this study was utilized to resolve the research question: To what extent, if any, is there a difference between the percentage change in ROI over 1 year of a behavioral finance based strategy (buying stocks, using monthly price charts, in which the line representing 20 period MA has crossed, from the bottom of the chart upward, the line representing 50 period MA) and an efficient market based strategy of buying and holding the SENSEX 30 index fund? The researcher failed to reject the affirASIANPAINTive hypothesis through the use of modeling portfolios and testing them against the buy and hold efficient market proxy. The resulting ANCOVA data was statistically significant over the 1 year period for both rounds of tests. The momentum portfolios based on behavioral finance began to decline in statistical significance after 1 year. However, all experimental behavioral finance momentum portfolios tracked by time series analysis significantly outperformed the buy and hold efficient market proxy control portfolio. This study is significant because the momentum strategy tested did not rely on accounting or financial data but rather upon the recognition of patterns in price action that represent psychological and sociological factors such as herding, anchoring bias, and positive feedback.

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