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ISSN : 2348 - 5612 | Volume : 09 , Issue : 04 | October - December 2022

# Market Capitalization Anomaly: Evidence from the Indian Stock Market

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## Abstract

This research explores the daily effects of Market Capitalization anomalies from 2018 to 2022. Market capitalization, also known as "market cap", is the product of the current market price of one share and the total number of outstanding shares. The investment community uses market capitalization to determine the size of a company rather than relying on sales or total assets. The Market Capitalization effect is a phenomenon that has been studied by academics for a long time, even before the formulation of the CAPM. Various studies have attempted to determine whether it is accurate or a proxy for other factors. To investigate the Market Capitalization ratio anomaly in the Indian stock market, researchers divided the sample stocks into ten portfolios. The highest M/C stocks were included in Portfolio One, and the lowest M/C stocks were included in Portfolio Ten. For simplicity, each Portfolio contains almost 24 stocks. The Sharpe, Treynor, and Modigliani Risk-Adjusted Method ($M^2$) were used to evaluate various portfolios. The study results show that the portfolio return increased with the mid-capitalization portfolio. There is an inverse relationship between portfolio return and risk, meaning that higher risk is associated with lower returns. According to the Sharpe measure, capitalization M/C portfolios performed better than small-cap and large-cap M/C portfolios during the research period. The results obtained through the Treynor model are similar, as portfolio return increased with capitalization M/C portfolios in the stock market.

Conversely, large-cap and small-cap M/C portfolios did not perform well against market sensitivity. The Modigliani risk-adjusted performance shows that cap and small-cap M/C portfolios did not perform better than the benchmark (average market return) during the research period. The results clearly show that the mid-capitalization portfolio outperforms small capitalization, and large capitalization has the highest growth in wealth at the end of the study period.

Key Words: Market Capitalization, Treynor model, Modigliani risk-adjusted Model, Sharpe Model, Portfolio Risk

## Market Capitalization Anomaly: Evidence from the Indian Stock Market

Portfolio theory ensures that investors receive the required return on an investment. The investor estimates the investment's intrinsic value at the required rate of return and compares the estimated intrinsic value to the prevailing market price. The investor will not buy a security whose market price exceeds the estimated value because it will not gain the required rate of return; in contrast, if the estimated intrinsic value of the security exceeds the market price, the investor should buy the investment.

The following paper explores the use of market capitalization in constructing and evaluating portfolios, taking into account anomalies that affect the returns of certain companies. Specifically, studies found that companies with high closing prices and market capitalization tend to earn higher returns.

Companies with low opening prices and market capitalization tend to earn lower returns, assuming an efficient capital market. The market anomalies are patterns that deviate from what is expected and often result in abnormal returns. However, because some of these patterns are based on information in financial reports, they challenge the semi-strong Efficient Market Hypothesis (EMH) form and suggest that fundamental analysis can be helpful for individual investors.

This research explores the daily effects of Market Capitalization anomalies from 2018 to 2022. Empirical studies have consistently shown that the capital market is efficient and that information does not help generate abnormal returns. Market capitalization is the total value of a company's outstanding shares in the market, measured in rupees. It is commonly referred to as "market cap" and is calculated by multiplying the current market price of one share with the total number of shares outstanding. The investment community uses market capitalization to determine a company's size instead of sales or total asset figures. The Market Capitalization effect is an anomaly that academics have studied for a long time, even before Sharpe formulated the CAPM in 1964. Several studies have attempted to determine whether it is accurate or a proxy for other factors. Studies such as Nicholson (1960 & 1968), Basu (1975 & 1977), Ball (1978 & 1992), Jaffe, Keim & Westerfield (1989), Fuller, Huberts & Levinson (1993), Lakonishok, Schleifer & Vishny (1994), and Dreman (1998) have demonstrated its impact.

Hons and Tonks (2001) studied trading strategies, including the momentum effect in the Efficient Market Hypothesis in the US Stock market. They discovered that these momentum strategies existed in the stock market from 1977 to 1996. The study showed that investors could benefit from using momentum strategies. It is due to the positive autocorrelation in returns for a short period, and they can gain abnormal profits by buying past winners and selling past losers.

Frankfurter and McGoun (2001) argue that the term "anomaly" was initially used to refer to the direction of the Capital Asset Pricing Model (CAPM). However, it has now been renamed "Behavioral Factors," leading to the rejection of the Efficient Market Hypothesis (EMH) and CAPM. They argue that "anomaly" has become synonymous with "Behavioral factors," also commonly used in this context.

Barberis and Sheifer (2003) have classified investors into different investment styles. They argued that investors invest based on past performance, momentum effects, and herd behaviour. This can lead to a price bubble and asset prices' continuous rise or fall. Investors tend to follow the dominant investment style in the market, which can contribute to this trend.

Wouters (2006) classified investors into two groups based on market anomalies. The two groups are loyalists and revisionists, with rationalists belonging to the latter and behaviourists to the former group. Rationalists believe that financial markets are efficient and that abnormal returns are due to chance or common risk factors overlooked in initial stock returns analysis. Behaviourists, on the other hand, believe that not all market participants need to be rational. Instead, a small number of participants can drive the whole market.

Svetlana and Hossein (2008) concluded the study using the Sharpe Ratio to test the Efficient Market Hypothesis for different market capitalization and investment styles of mutual funds. The study covers 1994 -2007 and its two sub-periods (1994-1999) and (2000-2008); it indicated that small-cap funds provided the highest risk-adjusted return for the entire period. Growth funds have exhibited lower returns.

Khana (2015) examined the existence of calendar anomalies in the Efficient Market Hypothesis. The study found that stock market anomalies are patterns that often lead to abnormal returns. The information related to these anomalies is publicly available, which poses a challenge to the semi-strong form of the Efficient Market Hypothesis. This suggests that fundamental analysis can be of value to individual investors. The study provides empirical evidence of abnormal yield distribution. However, it is essential to note that these anomalies may persist or disappear at a particular time. The study focuses on the day-of-the-week and weekend effects on the stock returns of BSE Sensex in India.

Sundarvel and Velmurgan (2015) studied the stock market anomalies that appeared over time in various stock indices in India. They analyzed the anomalies of the day-of-the-week effect, weekend effect, Turn-month effect, and semi-strong form of the anomalies. These market anomalies challenge the semi-strong form of the market and include fundamental analysis.

Numerous researchers have observed the effect of market capitalization in India, the US, and worldwide, which is an undeniable fact. However, the discussion now concerns whether it is a natural effect or a Market Capitalization proxy for other factors.

## OBJECTIVE, SAMPLE AND DATABASE

This study aimed to investigate whether there were any anomalies in the market capitalization ratios in the Indian stock market. To achieve this objective, we analyzed the returns of 240 stocks. These stocks were divided into ten portfolios based on the size of their market capitalization ratios. There are ten portfolios, each consisting of an equal number of companies. Any odd number of companies left out is allocated equally to the portfolios on the extreme. The holding period for each Portfolio is one year, and annual returns have been calculated assuming an equal investment in each respective stock and then a buy-and-hold strategy. This process has been repeated for five consecutive years. The first Portfolio consisted of 24 stocks with the lowest market capitalization, followed by the next 24 stocks in the second Portfolio from September 2018 to September 2022. The sample stocks were listed on the. The data on daily market capitalization and stock prices from the Prowess-IQ corporate database on the Indian economy was maintained and compiled by the Center for Monitoring the Indian Economy (CMIE). Sample companies were selected on the following criteria: they were listed and continuously traded on the stock exchange during the study period, information on the necessary variables of the companies was available on the Prowess database, and the companies had a March-ending accounting year as per the reports filed on the official website of the Bombay Stock Exchange.

## TOOLS OF ANALYSIS

**Portfolio Return:** Portfolio return is the weighted average of individual security returns, *where weights* are the amount invested in each security.

**Portfolio Risk:** The risk of a portfolio is not solely determined by the standard deviation of each security.

The formula provided to create a spreadsheet for the computation of the Standard Deviation (risk) of the Portfolio comprises 24 securities:

$$\sigma_{\rho}^{2}=\omega_{1}^{2}\sigma_{1}^{2}+\omega_{2}^{2}\sigma_{2}^{2}+\omega_{3}^{2}\sigma_{3}^{2}+\omega_{4}^{2}\sigma_{4}^{2}+\omega_{5}^{2}\sigma_{5}^{2}+\omega_{6}^{2}\sigma_{6}^{2}+\omega_{7}^{2}\sigma_{7}^{2}+\omega_{8}^{2}\sigma_{8}^{2}+\omega_{9}^{2}\sigma_{9}^{2}+\omega_{10}^{2}\sigma_{10}^{2}$$

$$+\omega_{11}^{2}\sigma_{11}^{2}+\omega_{12}^{2}\sigma_{12}^{2}+\omega_{13}^{2}\sigma_{13}^{2}+\omega_{14}^{2}\sigma_{14}^{2}+\omega_{15}^{2}\sigma_{15}^{2}+\omega_{16}^{2}\sigma_{16}^{2}+\omega_{17}^{2}\sigma_{17}^{2}+\omega_{18}^{2}\sigma_{18}^{2}+\omega_{19}^{2}\sigma_{19}^{2}+\omega_{20}^{2}\sigma_{20}^{2}$$

$$+\omega_{21}^{2}\sigma_{21}^{2}+\omega_{22}^{2}\sigma_{22}^{2}+\omega_{23}^{2}\sigma_{23}^{2}+\omega_{24}^{2}\sigma_{24}^{2}+2\omega_{1}\omega_{2}\sigma_{1}\sigma_{2}\rho_{12}+2\omega_{1}\omega_{3}\sigma_{1}\sigma_{3}\rho_{13}$$

$$+2\omega_{1}\omega_{4}\sigma_{1}\sigma_{4}\rho_{42}+2\omega_{1}\omega_{5}\sigma_{1}\sigma_{5}\rho_{15}+2\omega_{1}\omega_{6}\sigma_{1}\sigma_{6}\rho_{16}+2\omega_{1}\omega_{7}\sigma_{1}\sigma_{7}\rho_{17}+2\omega_{1}\omega_{8}\sigma_{1}\sigma_{8}\rho_{18}$$

$$+2\omega_{1}\omega_{9}\sigma_{1}\sigma_{9}\rho_{19}+2\omega_{1}\omega_{10}\sigma_{1}\sigma_{10}\rho_{110}+2\omega_{1}\omega_{11}\sigma_{1}\sigma_{11}\rho_{111}+2\omega_{1}\omega_{12}\sigma_{1}\sigma_{12}\rho_{112}+2\omega_{1}\omega_{13}\sigma_{1}\sigma_{13}\rho_{113}$$

$$+2\omega_{1}\omega_{14}\sigma_{1}\sigma_{14}\rho_{114}+2\omega_{1}\omega_{15}\sigma_{1}\sigma_{15}\rho_{115}+2\omega_{1}\omega_{16}\sigma_{1}\sigma_{16}\rho_{116}+2\omega_{1}\omega_{17}\sigma_{1}\sigma_{17}\rho_{117}+2\omega_{1}\omega_{18}\sigma_{1}\sigma_{18}\rho_{118}$$

$$+2\omega_{1}\omega_{19}\sigma_{1}\sigma_{19}\rho_{119}+2\omega_{1}\omega_{20}\sigma_{1}\sigma_{20}\rho_{120}+2\omega_{1}\omega_{21}\sigma_{1}\sigma_{21}\rho_{121}+2\omega_{1}\omega_{22}\sigma_{1}\sigma_{22}\rho_{122}+2\omega_{1}\omega_{23}\sigma_{1}\sigma_{23}\rho_{123}$$

$$+2\omega_{1}\omega_{24}\sigma_{1}\sigma_{24}\rho_{124}+2\omega_{2}\omega_{3}\sigma_{2}\sigma_{3}\rho_{23}+2\omega_{2}\omega_{4}\sigma_{2}\sigma_{4}\rho_{24}+2\omega_{2}\omega_{5}\sigma_{2}\sigma_{5}\rho_{25}+2\omega_{2}\omega_{6}\sigma_{2}\sigma_{6}\rho_{26}$$

$$+2\omega_{2}\omega_{7}\sigma_{2}\sigma_{7}\rho_{27}+2\omega_{2}\omega_{8}\sigma_{2}\sigma_{8}\rho_{28}+2\omega_{2}\omega_{9}\sigma_{2}\sigma_{9}\rho_{29}+2\omega_{2}\omega_{10}\sigma_{2}\sigma_{10}\rho_{210}+2\omega_{2}\omega_{11}\sigma_{2}\sigma_{11}\rho_{211}$$

$$+2\omega_{2}\omega_{12}\sigma_{2}\sigma_{12}\rho_{212}+2\omega_{2}\omega_{13}\sigma_{2}\sigma_{13}\rho_{213}+2\omega_{2}\omega_{14}\sigma_{2}\sigma_{14}\rho_{214}+2\omega_{2}\omega_{15}\sigma_{2}\sigma_{15}\rho_{215}+2\omega_{2}\omega_{16}\sigma_{2}\sigma_{16}\rho_{216}$$

$$+2\omega_{2}\omega_{17}\sigma_{2}\sigma_{17}\rho_{217}+2\omega_{2}\omega_{18}\sigma_{2}\sigma_{18}\rho_{218}++2\omega_{2}\omega_{19}\sigma_{2}\sigma_{19}\rho_{219}+2\omega_{2}\omega_{20}\sigma_{2}\sigma_{20}\rho_{220}+2\omega_{2}\omega_{21}\sigma_{2}\sigma_{21}\rho_{221}$$

$$+2\omega_{2}\omega_{22}\sigma_{2}\sigma_{22}\rho_{222}+2\omega_{2}\omega_{23}\sigma_{2}\sigma_{23}\rho_{223}+2\omega_{2}\omega_{24}\sigma_{2}\sigma_{24}\rho_{224}+2\omega_{3}\omega_{4}\sigma_{3}\sigma_{4}\rho_{34}+2\omega_{3}\omega_{5}\sigma_{3}\sigma_{5}\rho_{35}$$

$$+2\omega_{3}\omega_{6}\sigma_{3}\sigma_{6}\rho_{36}+2\omega_{3}\omega_{7}\sigma_{3}\sigma_{7}\rho_{37}+2\omega_{3}\omega_{8}\sigma_{3}\sigma_{8}\rho_{38}+2\omega_{3}\omega_{9}\sigma_{3}\sigma_{9}\rho_{39}+2\omega_{3}\omega_{10}\sigma_{3}\sigma_{10}\rho_{310}$$

$$+2\omega_{3}\omega_{11}\sigma_{3}\sigma_{11}\rho_{311}+2\omega_{3}\omega_{12}\sigma_{3}\sigma_{12}\rho_{312}+2\omega_{3}\omega_{13}\sigma_{3}\sigma_{13}\rho_{313}+2\omega_{3}\omega_{14}\sigma_{3}\sigma_{14}\rho_{314}+2\omega_{3}\omega_{15}\sigma_{3}\sigma_{15}\rho_{315}$$

$$+2\omega_{3}\omega_{16}\sigma_{3}\sigma_{16}\rho_{316}+2\omega_{3}\omega_{17}\sigma_{3}\sigma_{17}\rho_{317}+2\omega_{3}\omega_{18}\sigma_{3}\sigma_{18}\rho_{318}+2\omega_{3}\omega_{19}\sigma_{3}\sigma_{19}\rho_{319}+2\omega_{3}\omega_{20}\sigma_{3}\sigma_{20}\rho_{320}$$

$$+2\omega_{3}\omega_{21}\sigma_{3}\sigma_{21}\rho_{321}+2\omega_{3}\omega_{22}\sigma_{3}\sigma_{22}\rho_{322}+2\omega_{3}\omega_{23}\sigma_{3}\sigma_{23}\rho_{323}+2\omega_{3}\omega_{24}\sigma_{3}\sigma_{24}\rho_{324}+2\omega_{4}\omega_{5}\sigma_{4}\sigma_{5}\rho_{45}$$

$$+2\omega_{4}\omega_{6}\sigma_{4}\sigma_{6}\rho_{46}+2\omega_{4}\omega_{7}\sigma_{4}\sigma_{7}\rho_{47}+2\omega_{4}\omega_{8}\sigma_{4}\sigma_{8}\rho_{48}+2\omega_{4}\omega_{9}\sigma_{4}\sigma_{9}\rho_{49}+2\omega_{4}\omega_{10}\sigma_{4}\sigma_{10}\rho_{410}$$

$$+2\omega_{4}\omega_{11}\sigma_{4}\sigma_{11}\rho_{411}+2\omega_{4}\omega_{12}\sigma_{4}\sigma_{12}\rho_{412}+2\omega_{4}\omega_{13}\sigma_{4}\sigma_{13}\rho_{413}+2\omega_{4}\omega_{14}\sigma_{4}\sigma_{14}\rho_{414}+2\omega_{4}\omega_{15}\sigma_{4}\sigma_{15}\rho_{415}$$

$$+2\omega_{4}\omega_{16}\sigma_{4}\sigma_{16}\rho_{416}+2\omega_{4}\omega_{17}\sigma_{4}\sigma_{17}\rho_{417}+2\omega_{4}\omega_{18}\sigma_{4}\sigma_{18}\rho_{418}+2\omega_{4}\omega_{19}\sigma_{4}\sigma_{19}\rho_{419}+2\omega_{4}\omega_{20}\sigma_{4}\sigma_{20}\rho_{420}$$

$$+2\omega_{4}\omega_{21}\sigma_{4}\sigma_{21}\rho_{421}+2\omega_{4}\omega_{22}\sigma_{4}\sigma_{22}\rho_{422}+2\omega_{4}\omega_{23}\sigma_{4}\sigma_{23}\rho_{423}+2\omega_{4}\omega_{24}\sigma_{4}\sigma_{24}\rho_{424}+2\omega_{5}\omega_{6}\sigma_{5}\sigma_{6}\rho_{56}$$

$$+2\omega_{5}\omega_{7}\sigma_{5}\sigma_{7}\rho_{57}+2\omega_{5}\omega_{8}\sigma_{5}\sigma_{8}\rho_{58}+2\omega_{5}\omega_{9}\sigma_{5}\sigma_{9}\rho_{59}+2\omega_{5}\omega_{10}\sigma_{5}\sigma_{10}\rho_{510}+2\omega_{5}\omega_{11}\sigma_{5}\sigma_{11}\rho_{511}$$

$$+2\omega_{5}\omega_{12}\sigma_{5}\sigma_{12}\rho_{512}+2\omega_{5}\omega_{13}\sigma_{5}\sigma_{13}\rho_{513}+2\omega_{5}\omega_{14}\sigma_{5}\sigma_{14}\rho_{514}+2\omega_{5}\omega_{15}\sigma_{5}\sigma_{15}\rho_{515}+2\omega_{5}\omega_{16}\sigma_{5}\sigma_{16}\rho_{516}$$

$$+2\omega_5\omega_{17}\sigma_5\sigma_{17}\rho_{517} ++2\omega_5\omega_{18}\sigma_5\sigma_{18}\rho_{518} +2\omega_5\omega_{19}\sigma_5\sigma_{19}\rho_{519} +2\omega_5\omega_{20}\sigma_5\sigma_{20}\rho_{520} +2\omega_5\omega_{21}\sigma_5\sigma_{21}\rho_{521}$$
$$+2\omega_5\omega_{22}\sigma_5\sigma_{22}\rho_{522} +2\omega_5\omega_{23}\sigma_5\sigma_{23}\rho_{523} +2\omega_5\omega_{24}\sigma_5\sigma_{24}\rho_{524} +2\omega_6\omega_7\sigma_6\sigma_7\rho_{67} +2\omega_6\omega_8\sigma_6\sigma_8\rho_{68}$$
$$+2\omega_6\omega_9\sigma_6\sigma_9\rho_{69} +2\omega_6\omega_{10}\sigma_6\sigma_{10}\rho_{610} +2\omega_6\omega_{11}\sigma_6\sigma_{11}\rho_{611} +2\omega_6\omega_{12}\sigma_6\sigma_{12}\rho_{612} +2\omega_6\omega_{13}\sigma_6\sigma_{13}\rho_{613}$$
$$+2\omega_6\omega_{14}\sigma_6\sigma_{14}\rho_{614} +2\omega_6\omega_{15}\sigma_6\sigma_{15}\rho_{615} +2\omega_6\omega_{16}\sigma_6\sigma_{16}\rho_{616} +2\omega_6\omega_{17}\sigma_6\sigma_{17}\rho_{617} +2\omega_6\omega_{18}\sigma_6\sigma_{18}\rho_{618}$$
$$+2\omega_6\omega_{19}\sigma_6\sigma_{19}\rho_{619} +2\omega_6\omega_{20}\sigma_6\sigma_{20}\rho_{620} +2\omega_6\omega_{21}\sigma_6\sigma_{21}\rho_{621} +2\omega_6\omega_{22}\sigma_6\sigma_{22}\rho_{622} +2\omega_6\omega_{23}\sigma_6\sigma_{23}\rho_{623}$$
$$+2\omega_6\omega_{24}\sigma_6\sigma_{24}\rho_{624} +2\omega_7\omega_8\sigma_7\sigma_8\rho_{78} +2\omega_7\omega_9\sigma_7\sigma_9\rho_{79} +2\omega_7\omega_{10}\sigma_7\sigma_{10}\rho_{710} +2\omega_7\omega_{11}\sigma_7\sigma_{11}\rho_{711}$$
$$+2\omega_7\omega_{12}\sigma_7\sigma_{12}\rho_{712} +2\omega_7\omega_{13}\sigma_7\sigma_{13}\rho_{713} +2\omega_7\omega_{14}\sigma_7\sigma_{14}\rho_{714} +2\omega_7\omega_{15}\sigma_7\sigma_{15}\rho_{715} +2\omega_7\omega_{16}\sigma_7\sigma_{16}\rho_{716}$$
$$+2\omega_7\omega_{17}\sigma_7\sigma_{17}\rho_{717} +2\omega_7\omega_{18}\sigma_7\sigma_{18}\rho_{718} +2\omega_7\omega_{19}\sigma_7\sigma_{19}\rho_{719} +2\omega_7\omega_{20}\sigma_7\sigma_{20}\rho_{720} +2\omega_7\omega_{21}\sigma_7\sigma_{21}\rho_{721}$$
$$+2\omega_7\omega_{22}\sigma_7\sigma_{22}\rho_{722} +2\omega_7\omega_{23}\sigma_7\sigma_{23}\rho_{723} +2\omega_7\omega_{24}\sigma_7\sigma_{24}\rho_{724} +2\omega_8\omega_9\sigma_8\sigma_9\rho_{89} +2\omega_8\omega_{10}\sigma_8\sigma_{10}\rho_{810}$$
$$+2\omega_8\omega_{11}\sigma_8\sigma_{11}\rho_{811} +2\omega_8\omega_{12}\sigma_8\sigma_{12}\rho_{812} +2\omega_8\omega_{13}\sigma_8\sigma_{13}\rho_{813} +2\omega_8\omega_{14}\sigma_8\sigma_{14}\rho_{814} +2\omega_8\omega_{15}\sigma_8\sigma_{15}\rho_{815}$$
$$+2\omega_8\omega_{16}\sigma_8\sigma_{16}\rho_{816} +2\omega_8\omega_{17}\sigma_8\sigma_{17}\rho_{817} +2\omega_8\omega_{18}\sigma_8\sigma_{18}\rho_{818} +2\omega_8\omega_{19}\sigma_8\sigma_{19}\rho_{819} +2\omega_8\omega_{20}\sigma_8\sigma_{20}\rho_{820}$$
$$+2\omega_8\omega_{21}\sigma_8\sigma_{21}\rho_{821} +2\omega_8\omega_{22}\sigma_8\sigma_{22}\rho_{822} +2\omega_8\omega_{23}\sigma_8\sigma_{23}\rho_{823} +2\omega_8\omega_{24}\sigma_8\sigma_{24}\rho_{824} +2\omega_9\omega_{10}\sigma_9\sigma_{10}\rho_{910}$$
$$+2\omega_9\omega_{11}\sigma_9\sigma_{11}\rho_{911} +2\omega_9\omega_{12}\sigma_9\sigma_{12}\rho_{912} +2\omega_9\omega_{13}\sigma_9\sigma_{13}\rho_{913} +2\omega_9\omega_{14}\sigma_9\sigma_{14}\rho_{914} +2\omega_9\omega_{15}\sigma_9\sigma_{15}\rho_{915}$$
$$+2\omega_9\omega_{16}\sigma_9\sigma_{16}\rho_{916} +2\omega_9\omega_{17}\sigma_9\sigma_{17}\rho_{917} +2\omega_9\omega_{18}\sigma_9\sigma_{18}\rho_{918} +2\omega_9\omega_{19}\sigma_9\sigma_{19}\rho_{919} +2\omega_9\omega_{20}\sigma_9\sigma_{20}\rho_{920}$$
$$+2\omega_9\omega_{21}\sigma_9\sigma_{21}\rho_{921} +2\omega_9\omega_{22}\sigma_9\sigma_{22}\rho_{922} +2\omega_9\omega_{23}\sigma_9\sigma_{23}\rho_{923} +2\omega_9\omega_{24}\sigma_9\sigma_{24}\rho_{924} +2\omega_{10}\omega_{11}\sigma_{10}\sigma_{11}\rho_{1011}$$
$$+2\omega_{10}\omega_{12}\sigma_{10}\sigma_{12}\rho_{1012} +2\omega_{10}\omega_{13}\sigma_{10}\sigma_{13}\rho_{1011} +2\omega_{10}\omega_{14}\sigma_{10}\sigma_{14}\rho_{1014} +2\omega_{10}\omega_{15}\sigma_{10}\sigma_{15}\rho_{1015} +2\omega_{10}\omega_{16}\sigma_{10}\sigma_{16}\rho_{1016}$$
$$+2\omega_{10}\omega_{17}\sigma_{10}\sigma_{17}\rho_{1017} +2\omega_{10}\omega_{18}\sigma_{10}\sigma_{18}\rho_{1018} +2\omega_{10}\omega_{19}\sigma_{10}\sigma_{19}\rho_{1019} +2\omega_{10}\omega_{20}\sigma_{10}\sigma_{20}\rho_{1020} +2\omega_{10}\omega_{21}\sigma_{10}\sigma_{21}\rho_{1021}$$
$$+2\omega_{10}\omega_{22}\sigma_{10}\sigma_{22}\rho_{1022} +2\omega_{10}\omega_{23}\sigma_{10}\sigma_{23}\rho_{1023} +2\omega_{10}\omega_{24}\sigma_{10}\sigma_{24}\rho_{1024} +2\omega_{11}\omega_{12}\sigma_{11}\sigma_{12}\rho_{1112} +2\omega_{11}\omega_{13}\sigma_{11}\sigma_{13}\rho_{1113}$$
$$+2\omega_{11}\omega_{14}\sigma_{11}\sigma_{14}\rho_{1114} +2\omega_{11}\omega_{15}\sigma_{11}\sigma_{15}\rho_{1115} +2\omega_{11}\omega_{16}\sigma_{11}\sigma_{16}\rho_{1116} +2\omega_{11}\omega_{17}\sigma_{11}\sigma_{17}\rho_{1117} +2\omega_{11}\omega_{18}\sigma_{11}\sigma_{18}\rho_{1118}$$
$$+2\omega_{11}\omega_{19}\sigma_{11}\sigma_{19}\rho_{1119} +2\omega_{11}\omega_{20}\sigma_{11}\sigma_{20}\rho_{1120} +2\omega_{11}\omega_{21}\sigma_{11}\sigma_{21}\rho_{1121} +2\omega_{11}\omega_{22}\sigma_{11}\sigma_{22}\rho_{1122} +2\omega_{11}\omega_{23}\sigma_{11}\sigma_{23}\rho_{1123}$$
$$+2\omega_{11}\omega_{24}\sigma_{11}\sigma_{24}\rho_{1124} +2\omega_{12}\omega_{13}\sigma_{12}\sigma_{13}\rho_{1213} +2\omega_{12}\omega_{14}\sigma_{12}\sigma_{14}\rho_{1214} +2\omega_{12}\omega_{15}\sigma_{12}\sigma_{15}\rho_{1215} +2\omega_{12}\omega_{16}\sigma_{12}\sigma_{16}\rho_{1216}$$
$$+2\omega_{12}\omega_{17}\sigma_{12}\sigma_{17}\rho_{1217} +2\omega_{12}\omega_{18}\sigma_{12}\sigma_{18}\rho_{1218} +2\omega_{12}\omega_{19}\sigma_{12}\sigma_{19}\rho_{1219} +2\omega_{12}\omega_{20}\sigma_{12}\sigma_{20}\rho_{1220} +2\omega_{12}\omega_{21}\sigma_{12}\sigma_{21}\rho_{1221}$$
$$+2\omega_{12}\omega_{22}\sigma_{12}\sigma_{22}\rho_{1222} +2\omega_{12}\omega_{23}\sigma_{12}\sigma_{23}\rho_{1223} +2\omega_{12}\omega_{24}\sigma_{12}\sigma_{24}\rho_{1224} +2\omega_{13}\omega_{14}\sigma_{13}\sigma_{14}\rho_{1314} +2\omega_{13}\omega_{15}\sigma_{13}\sigma_{15}\rho_{1315}$$
$$+2\omega_{13}\omega_{16}\sigma_{13}\sigma_{16}\rho_{1316} +2\omega_{13}\omega_{17}\sigma_{13}\sigma_{17}\rho_{1317} +2\omega_{13}\omega_{18}\sigma_{13}\sigma_{18}\rho_{1318} +2\omega_{13}\omega_{19}\sigma_{13}\sigma_{19}\rho_{1319} +2\omega_{13}\omega_{20}\sigma_{13}\sigma_{20}\rho_{1320}$$
$$+2\omega_{13}\omega_{21}\sigma_{13}\sigma_{21}\rho_{1321} +2\omega_{13}\omega_{22}\sigma_{13}\sigma_{22}\rho_{1322} +2\omega_{13}\omega_{23}\sigma_{13}\sigma_{23}\rho_{1323} +2\omega_{13}\omega_{24}\sigma_{13}\sigma_{24}\rho_{1324} +2\omega_{14}\omega_{15}\sigma_{14}\sigma_{15}\rho_{1415}$$
$$+2\omega_{14}\omega_{16}\sigma_{14}\sigma_{16}\rho_{1416} +2\omega_{14}\omega_{17}\sigma_{14}\sigma_{17}\rho_{1417} +2\omega_{14}\omega_{18}\sigma_{14}\sigma_{18}\rho_{1418} +2\omega_{14}\omega_{19}\sigma_{14}\sigma_{19}\rho_{1419} +2\omega_{14}\omega_{20}\sigma_{14}\sigma_{20}\rho_{1420}$$
$$+2\omega_{14}\omega_{21}\sigma_{14}\sigma_{21}\rho_{1421} +2\omega_{14}\omega_{22}\sigma_{14}\sigma_{22}\rho_{1422} +2\omega_{14}\omega_{23}\sigma_{14}\sigma_{23}\rho_{1423} +2\omega_{14}\omega_{24}\sigma_{14}\sigma_{24}\rho_{1424} +2\omega_{15}\omega_{16}\sigma_{15}\sigma_{16}\rho_{1516}$$
$$+2\omega_{15}\omega_{17}\sigma_{15}\sigma_{17}\rho_{1517} +2\omega_{15}\omega_{18}\sigma_{15}\sigma_{18}\rho_{1518} +2\omega_{15}\omega_{19}\sigma_{15}\sigma_{19}\rho_{1519} +2\omega_{15}\omega_{20}\sigma_{15}\sigma_{20}\rho_{1520} +2\omega_{15}\omega_{21}\sigma_{15}\sigma_{21}\rho_{1521}$$
$$+2\omega_{15}\omega_{22}\sigma_{15}\sigma_{22}\rho_{1522} +2\omega_{15}\omega_{23}\sigma_{15}\sigma_{23}\rho_{1523} +2\omega_{15}\omega_{24}\sigma_{15}\sigma_{24}\rho_{1524} +2\omega_{16}\omega_{17}\sigma_{16}\sigma_{17}\rho_{1617} +2\omega_{16}\omega_{18}\sigma_{16}\sigma_{18}\rho_{1618}$$
$$+2\omega_{16}\omega_{19}\sigma_{16}\sigma_{19}\rho_{1619} +2\omega_{16}\omega_{20}\sigma_{16}\sigma_{20}\rho_{1620} +2\omega_{16}\omega_{21}\sigma_{16}\sigma_{21}\rho_{1621} +2\omega_{16}\omega_{22}\sigma_{16}\sigma_{22}\rho_{1622} +2\omega_{16}\omega_{23}\sigma_{16}\sigma_{23}\rho_{1623}$$
$$+2\omega_{16}\omega_{24}\sigma_{16}\sigma_{24}\rho_{1624}$$
$$+2\omega_{17}\omega_{18}\sigma_{17}\sigma_{18}\rho_{1718} +2\omega_{17}\omega_{19}\sigma_{17}\sigma_{19}\rho_{1719} +2\omega_{17}\omega_{20}\sigma_{17}\sigma_{20}\rho_{1720} +2\omega_{17}\omega_{21}\sigma_{17}\sigma_{21}\rho_{1721} +2\omega_{17}\omega_{22}\sigma_{17}\sigma_{22}\rho_{1722}$$
$$+2\omega_{17}\omega_{23}\sigma_{17}\sigma_{23}\rho_{1723} +2\omega_{17}\omega_{24}\sigma_{17}\sigma_{24}\rho_{1724} +2\omega_{18}\omega_{19}\sigma_{18}\sigma_{19}\rho_{1819} +2\omega_{18}\omega_{20}\sigma_{18}\sigma_{20}\rho_{1820} +2\omega_{18}\omega_{21}\sigma_{18}\sigma_{21}\rho_{1821}$$
$$+2\omega_{18}\omega_{22}\sigma_{18}\sigma_{22}\rho_{1822} +2\omega_{18}\omega_{23}\sigma_{18}\sigma_{23}\rho_{1823} +2\omega_{18}\omega_{24}\sigma_{18}\sigma_{24}\rho_{1824} +2\omega_{19}\omega_{20}\sigma_{19}\sigma_{20}\rho_{1920} +2\omega_{19}\omega_{21}\sigma_{19}\sigma_{21}\rho_{1921}$$
$$+2\omega_{19}\omega_{22}\sigma_{19}\sigma_{22}\rho_{1922} +2\omega_{19}\omega_{23}\sigma_{19}\sigma_{23}\rho_{1923} +2\omega_{19}\omega_{24}\sigma_{19}\sigma_{24}\rho_{1924} +2\omega_{20}\omega_{21}\sigma_{20}\sigma_{21}\rho_{2021} +2\omega_{20}\omega_{22}\sigma_{20}\sigma_{22}\rho_{2022}$$
$$+2\omega_{20}\omega_{23}\sigma_{20}\sigma_{23}\rho_{2023} +2\omega_{20}\omega_{24}\sigma_{20}\sigma_{24}\rho_{2024} +2\omega_{21}\omega_{22}\sigma_{21}\sigma_{22}\rho_{2122} +2\omega_{21}\omega_{23}\sigma_{21}\sigma_{23}\rho_{2123} +2\omega_{21}\omega_{24}\sigma_{21}\sigma_{24}\rho_{2124}$$
$$+2\omega_{22}\omega_{23}\sigma_{22}\sigma_{23}\rho_{2223} +2\omega_{22}\omega_{24}\sigma_{22}\sigma_{24}\rho_{2224} +2\omega_{23}\omega_{24}\sigma_{23}\sigma_{24}\rho_{2324}$$

Portfolio beta has been calculated as the weighted average of betas of individual securities, weights being the amount invested in each security, which has been assumed to be equal for the research.

The Systematic risk or beta can be measured using the following statistical formula:

$$\beta_i = \frac{\operatorname{cov}(im)}{\sigma m^2} = \frac{\rho_{im}}{\sigma m^2} * \sigma_i * \sigma_m = \frac{\rho_{im}}{\sigma_m} * \sigma_i \text{ s}$$

Where,

$cov_{im}$ = covariance between security and market returns

$\sigma_m^2$ = market variance

$\rho_{im}$= correlation between security and market returns

$\sigma_i$ = security standard deviation

$\sigma_m$ = market standard deviation

Sharpe Measure: In addition to this, a comparison based on risk-adjusted returns has also been attempted. William Sharpe has given a summary measure of portfolio performance. This measure adjusts portfolio performance for total risk.

Sharpe's performance index gives one number determined by the risk and return of the mutual fund portfolio or other investments. This index is compared against a riskless rate of return. The Sharpe portfolio performance index (S) is stated as

$$S_i = \frac{R_i - RFR}{SD_i}$$

Where,

$S_i$ =Sharpe portfolio performance (Sharpe's index) measure for Portfolio *i*.

$R_i$ =The average rate of return for Portfolio *i* for the period.

*RFR* = The risk-free rate of return for the period.

$SD_i$ =Standard deviation (risk) or rate of return for Portfolio *i* during the period. (It is also written as $\sigma$).

**Treynor's Measure:** Treynor's portfolio performance measures the risk premium of the Portfolio and relates it to the amount of systematic risk of the Portfolio (β). It shows how the price of a security responds to market forces and is given by

$$\frac{R_i}{\beta_i} - R_f$$

Where,

$R_i$ = expected return on security on Portfolio i

$R_f$ = return on a risk-less security

$\beta_i$ = beta of Portfolio I for the period't'.

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ISSN : 2348 - 5612 | Volume : 09 , Issue : 04 | October - December 2022

**Modigliani Risk-Adjusted Return ($M^2$) Measure:** M squared intercepts an incremental return over a market index of a hypothetical portfolio. $M^2$measure, also known as the Modigliani risk-adjusted performance measure, is a risk-adjusted performance measure. It is closely related to the Sharpe Ratio. Moreover, the $M^2$ measure continuously holds its meaning in negative returns, while the Sharpe ratio is hard to intercept.

Modigliani risk-adjusted return is defined as follows:

Let $D_t$ be the Portfolio's excess return (i.e., above the risk–free rate ) for some time t.

$$D_t = Rp_t – Rf_t$$

$Rp_t$ is the portfolio return for the period t

$Rf_t$ is the risk–free rate for a time period t

Sharpe Ratio S is:

$$S = \frac{D}{\sigma_D}$$

D is the average of all excess returns over some period and $\sigma_D$ is the Standard deviation of those excess returns.

And finally:

$$M^2 = S_x \sigma_\beta + R_f$$

Where S is the Sharpe Ratio, $\sigma_\beta$ it is the standard deviation of the excess for some benchmark portfolio against which you are comparing the Portfolio in question, and $R_f$ it is the average risk–free rate for the period in question.

$$M^2 = D * \frac{\sigma_\beta}{\sigma_D} + R_f$$

$$M^2 \text{ alpha} = S * \sigma_\beta$$

$$M^2 \text{ alpha} = D * \frac{\sigma_\beta}{\sigma_D}$$

An efficient market is one in which the current return of a security reflects all available information and is considered the fair value. The market price is considered fair because the market has already traded at that price. As new information becomes available, the market adjusts the security's return up or down to assimilate the information. This means that the return instantly responds to the release of new information. The current study examines the accuracy of return adjustment in response to the release of earning information and tests the return ratio hypothesis. Over four years, portfolio returns have been compiled for 10 M/C portfolios.

**Table 1: Average Market Capitalisation Ratio for Various Portfolios**

| Portfolios | 2017-18 | 2018-19 | 2019-20 | 2020-21 | 2021-22 | Average |
|---|---|---|---|---|---|---|

| | | | | | | |
|---|---|---|---|---|---|---|
| **MC₁** | -1.866 | 7.608 | 18.167 | 23.446 | -13.658 | 6.739 |
| **MC₂** | -3.537 | 0.914 | 23.058 | 29.835 | -20.522 | 5.584 |
| **MC₃** | -1.871 | -1.036 | 0.969 | 49.543 | -15.356 | 6.450 |
| **MC₄** | 7.720 | 0.079 | 14.238 | 43.140 | 1.197 | 13.275 |
| **MC₅** | 7.989 | 1.490 | 26.305 | 57.558 | -8.557 | 16.957 |
| **MC₆** | 5.373 | -4.673 | 20.461 | 54.042 | -16.567 | 11.727 |
| **MC₇** | -20.495 | -28.657 | 21.947 | 54.917 | -4.958 | 4.551 |
| **MC₈** | -13.900 | -3.354 | 18.420 | 50.749 | -29.931 | 4.397 |
| **MC₉** | -40.287 | -9.050 | 25.840 | 48.307 | 5.483 | 6.058 |
| **MC₁₀** | -16.849 | -26.145 | 26.830 | 73.856 | 7.429 | 13.024 |
| **Overall Average** | **-7.772** | **-6.282** | **19.624** | **48.539** | **-9.544** | **8.876** |

Table 1 shows the MC ratio of various portfolios during the study period. MC5 had the highest MC ratio, while MC8 had the lowest. The average MC ratio for the last four years was 6.73% to 13.024% for different portfolios. During 2017-18 to 2021-2022, the year-wise average portfolio MC ratios were 7.772 per cent, -6.282 per cent, 19.624 per cent, 48.539 per cent, and -9.544 per cent. All portfolios from MC1 to MC10 performed well in MC in 2019-20 and 2020-21.

**Portfolio Return Analysis**

Table 2 depicts the average returns of all portfolios for the entire period. It is clear from the table that all of the portfolios had positive mean returns except the MC3 portfolio during the study period. The Indian stock market witnessed a bullish run during 2017-18 and 2021-22.

**Table 2 Average Annual Return for various Portfolios**

The Indian economy showed rising trends due to government stability, healthy economic policies and

| Portfolios | 2017-18 | 2018-19 | 2019-20 | 2020-21 | 2021-22 | Average |
|---|---|---|---|---|---|---|
| **MC₁** | -2.180 | 7.572 | 15.786 | 23.323 | -14.422 | **6.016** |
| **MC₂** | -3.723 | -1.633 | 22.157 | 29.805 | -20.615 | **5.198** |
| **MC₃** | -1.991 | -2.759 | -1.822 | -2.727 | -4.836 | **-2.827** |
| **MC₄** | 5.847 | 0.164 | 14.396 | 41.515 | -0.198 | **12.345** |
| **MC₅** | 5.960 | -0.177 | 24.121 | 51.714 | -10.284 | **14.267** |
| **MC₆** | -8.806 | -0.959 | 20.368 | 52.576 | -16.951 | **9.245** |
| **MC₇** | -19.971 | -29.974 | 21.361 | 54.400 | -4.990 | **4.165** |
| **MC₈** | -16.685 | -5.235 | 16.441 | 47.675 | -15.970 | **5.245** |
| **MC₉** | -44.671 | -9.653 | 25.237 | 44.920 | 3.924 | **3.951** |
| **MC₁₀** | -20.293 | -25.620 | 1.605 | 60.829 | 6.279 | **4.560** |
| **Overall Average** | **-10.651** | **-6.827** | **15.965** | **40.403** | **-7.806** | **6.217** |

an encouraging environment for FIIs and FDI. On average, during the entire study period, MC5 earned the highest average return of 14.267 per cent, followed by the returns in MC4, MC6, MC1, MC8, MC2, MC10, MC7 and MC9 with average returns of 12.345 per cent, 9.245 per cent, 6.016 per cent, 5.245 per cent, 5.198 per cent, 4.560 per cent, 4.165 per cent, and 3.951 per cent respectively.

The average return for the MC3 portfolio is the lowest at -2.827 (presently negative portfolio return ratio) per cent. Notably, the above phenomenon holds irrespective of the years under study except 2017-18, 2018-19 and 2021-22, which shows a vice-versa position. Hence, there are anomalies in the Portfolio return ratio. This shows the market anomaly: the highest M/C ratio MC5 return is 14.267 per cent more than the mean return of the lowest M/C ratio MC3 -2.827 per cent. The year-wise average portfolio return ratios are found -10.651,-6.827, 15.965, 40.403 and -7.806 during 2017-18, 2018-19, 2019-20, 2020-21 and 2015-2016, respectively. All Portfolios from MC1 to MC10 perform well in 2019-20 and 2020-21.

**Portfolio Risk Analysis**

To make the study more comprehensive, we have added a dimension to compute portfolio risk using the method of portfolio diversification for more than two securities. In this case, deviation is measured by portfolio risk. The calculated risk for various portfolios is shown in Table 3.

**Table 3 Portfolio Risk from 2017-18 to 2021-22**

| Portfolios | 2017-18 | 2018-19 | 2019-20 | 2020-21 | 2021-22 | Average | Per cent |
|---|---|---|---|---|---|---|---|
| **$MC_1$** | 0.0147 | 0.0122 | 0.0158 | 0.0140 | 0.0183 | **0.0150** | **1.500** |
| **$MC_2$** | 0.0173 | 0.0148 | 0.0160 | 0.0142 | 0.0185 | **0.01616** | **1.616** |
| **$MC_3$** | 0.0175 | 0.0129 | 0.0167 | 0.0166 | 0.0206 | **0.01686** | **1.686** |
| **$MC_4$** | 0.0138 | 0.0116 | 0.0129 | 0.0154 | 0.0179 | **0.01432** | **1.432** |
| **$MC_5$** | 0.0159 | 0.0126 | 0.0127 | 0.0155 | 0.0166 | **0.01466** | **1.466** |
| **$MC_6$** | 0.0159 | 0.0141 | 0.0143 | 0.0182 | 0.0180 | **0.01610** | **1.610** |
| **$MC_7$** | 0.0164 | 0.0129 | 0.0155 | 0.0189 | 0.0176 | **0.01626** | **1.626** |
| **$MC_8$** | 0.0156 | 0.0111 | 0.0135 | 0.0180 | 0.0210 | **0.01584** | **1.584** |
| **$MC_9$** | 0.0182 | 0.0157 | 0.0162 | 0.0185 | 0.0220 | **0.01812** | **1.812** |
| **$MC_{10}$** | 0.0418 | 0.0493 | 0.0349 | 0.0434 | 0.0251 | **0.0389** | **3.890** |

The portfolios MC10 and MC9 have the highest risk as calculated by standard deviation. This means that the degree of risk borne by MC10 and MC9 is higher than that of the M/C ratio portfolio (MC1, MC2, MC3, MC4, MC5, MC6, MC7, and MC8). An abnormal risk trend is observed as we move from Portfolio 1 to 2, 3, and so on to the 9$^{th}$ and 10$^{th}$ portfolios. Portfolio MC10 has the highest standard deviation of 3.89 per cent, followed by MC9 with a standard deviation of 1.812 per cent %. They are followed by MC3, MC7, MC2, MC6, MC8, MC1, MC4, and MC5 with standard deviations of 1.686 per cent, 1.626 per cent, 1.616 per cent, 1.610 per cent, 1.584 per cent, 1.500 per cent, 1.466 per cent, and 1.432 per cent respectively. The minimum standard deviation is of portfolio MC4 (i.e. 1.432 per cent). A yearly analysis of the degree of risk of various portfolios shows that in most years, the portfolios MC4 and MC5 have experienced higher variability in their returns.

A close examination of portfolio risk shows that, on average, all the portfolios have experienced an extraordinarily high fluctuation in their mean return during the study period. For example, MC4 and MC5 have an average return of 12.345 per cent and 14.267 per cent, respectively, whereas portfolio risk is 1.432 per cent and 1.466 per cent, respectively. This means there is an average return distribution; it is expected that approximately in 68 per cent of cases, the return of MC4 would fall between 13.78 per cent and 10.91 per cent. Approximately 32 per cent of the result would be even beyond these values.

Conversely, MC10 has the highest risk ratio of 3.890 per cent, with an average return ratio of 4.560 per cent. This means there is a normal distribution of return; it would be expected that in approximately 99 per cent of cases, the return of MC10 would fall between ranges of 16.23 per cent to -7.11 per cent. Approximately one per cent of the result would be even beyond these values. The basic principle of finance, i.e., the higher the risk, the higher the return, is evident as all those portfolios that have performed better in return have simultaneously experienced a higher degree of risk. A close analysis of risk and return in individual years and aggregate makes it clear that the higher return earned by Portfolio MC10 is induced by higher variability in their return distribution. A small-cap M/C ratio portfolio MC10, which has earned a lower return, on average, has experienced a higher degree of risk over some time. It can be undoubtedly concluded that the anomaly of the Indian stock market is that mid-cap M/C portfolios earn superior returns with the lowest degree of risk. Conversely, investing in a low M/C ratio stock or Portfolio can undoubtedly earn superior returns. However, these returns would come at the expense of a higher risk associated with investment in these stocks.

### Beta, Sharpe and Treynor Model

It is possible to compare the performance of different M/C ratio-based portfolios and rank them using performance indexes such as Sharpe and Treynor. The Sharpe performance ratio provides a single value to rank the performance of various portfolios. It measures the Portfolio's risk premium, which is the excess return per unit of risk (standard deviation) relative to the total amount of risk in a portfolio.

**Table 4 Sharpe Ratio for Various Portfolios**

| Portfolios | 2017-18 | 2018-19 | 2019-20 | 2020-21 | 2021-22 | Average |
|---|---|---|---|---|---|---|
| **$MC_1$** | -7.134 | -0.390 | 4.538 | 10.619 | -11.916 | **-0.8564** |
| **$MC_2$** | -6.960 | -6.538 | 8.473 | 15.048 | -15.199 | **-1.035** |
| **$MC_3$** | -5.885 | -8.404 | -6.269 | -6.760 | -5.970 | **-6.657** |
| **$MC_4$** | -1.770 | -6.808 | 4.450 | 21.453 | -4.265 | **2.612** |
| **$MC_5$** | -1.511 | -6.529 | 12.214 | 27.919 | -10.652 | **4.288** |
| **$MC_6$** | -11.441 | -6.090 | 8.209 | 24.241 | -13.543 | **0.275** |
| **$MC_7$** | -17.109 | -29.972 | 8.310 | 24.629 | -7.074 | **-4.243** |
| **$MC_8$** | -18.017 | -12.307 | 5.672 | 22.632 | -11.570 | **-2.718** |
| **$MC_9$** | -29.265 | -11.647 | 10.219 | 19.675 | -1.597 | **-0.596** |
| **$MC_{10}$** | -6.834 | -6.833 | -2.013 | 12.061 | -0.460 | **-0.816** |

The calculated values of the Sharpe ratio for different portfolios are presented in Table 4. A higher value of the ratio indicates better fund performance. According to the table, MC5 has the highest ratio value of 4.288 and is ranked first. MC4 is a close second with a value of 2.612, and MC6 also shows positive performance coefficients. Portfolios MC1, MC2, MC3, MC7, MC8, MC9, and MC10 have negative Sharpe Ratios

**Table 5 Average Beta for Various Portfolios**

| Portfolios | 2017-18 | 2018-19 | 2019-20 | 2020-21 | 2021-22 | Average |
|---|---|---|---|---|---|---|
| **$MC_1$** | 0.684 | 0.749 | 0.823 | 0.861 | 0.982 | **0.820** |
| **$MC_2$** | 0.701 | 0.778 | 0.732 | 0.859 | 0.970 | **0.808** |
| **$MC_3$** | 0.698 | 0.664 | 0.693 | 0.900 | 1.056 | **0.802** |
| **$MC_4$** | 0.557 | 0.539 | 0.422 | 0.763 | 0.868 | **0.634** |
| **$MC_5$** | 0.652 | 0.657 | 0.529 | 0.783 | 0.885 | **0.701** |
| **$MC_6$** | 0.562 | 0.665 | 0.558 | 0.883 | 0.964 | **0.727** |
| **$MC_7$** | 0.656 | 0.676 | 0.606 | 0.970 | 0.968 | **0.775** |

| | | | | | | |
|---|---|---|---|---|---|---|
| **$MC_8$** | 0.614 | 0.619 | 0.576 | 0.926 | 1.090 | **0.765** |
| **$MC_9$** | 0.768 | 0.781 | 0.621 | 1.015 | 1.105 | **0.858** |
| **$MC_{10}$** | 0.419 | 0.303 | 0.452 | 1.086 | 1.418 | **0.735** |

The beta measure of risk assumes a diversified portfolio where only systematic risk is relevant. Since the beta of the market portfolio is always 1.00, the beta of other portfolios is presented in Table 5. Portfolio MC9 has the highest average beta value of 0.858 throughout the study period, followed by Portfolio MC1 and Portfolio MC2 with values of 0.820 and 0.808, respectively. Beta value describes a portfolio's sensitivity to the market ratio (SENSEX) and how much it responds to the market. Risk-taking investors prefer portfolios with high beta values, as they give better returns. However, Tables 5 and 2 show that a portfolio with a high beta value will give the worst return, while a low beta value will give a better return. This is evident from MC9, which has a higher beta value and a lower average return value.

**Table 6 Treynor Ratio for Various Portfolios**

| Portfolios | 2017-18 | 2018-19 | 2019-20 | 2020-21 | 2021-22 | Average |
|---|---|---|---|---|---|---|
| **$MC_1$** | -0.153 | -0.006 | 0.087 | 0.173 | -0.222 | **-0.0245** |
| **$MC_2$** | -0.172 | -0.124 | 0.185 | 0.248 | -0.289 | **-0.030** |
| **$MC_3$** | -0.147 | -0.163 | -0.151 | -0.124 | -0.116 | **-0.140** |
| **$MC_4$** | -0.042 | -0.146 | 0.137 | 0.433 | -0.088 | **0.059** |
| **$MC_5$** | -0.036 | -0.125 | 0.293 | 0.553 | -0.200 | **0.097** |
| **$MC_6$** | -0.304 | -0.135 | 0.210 | 0.499 | -0.253 | **0.003** |
| **$MC_7$** | -0.431 | -0.562 | 0.210 | 0.473 | -0.128 | **-0.088** |
| **$MC_8$** | -0.407 | -0.215 | 0.135 | 0.423 | -0.215 | **-0.055** |
| **$MC_9$** | -0.689 | -0.227 | 0.267 | 0.359 | -0.032 | **-0.428** |
| **$MC_{10}$** | -0.683 | -1.111 | -0.156 | 0.482 | -0.008 | **-0.295** |

The Treynor ratio is a measure used to rank the performance of a portfolio based on the excess return earned by the Portfolio per unit of systematic risk (beta). In Table 6, it is shown that, on average, over the four-year study period, portfolios MC5, MC4, and MC6 have performed better with a ratio value of 0.097, 0.059, and 0.003, respectively. The Portfolio with the highest return ratio, MC9, had a ratio value of -0.428, making it the worst performer in Table 6. Among all the portfolios, MC5 ranked first, followed by MC4 in second place, and MC6 in third place.

**Table 7 Modigliani Risk-Adjusted Performance for Various Portfolios**

| Portfolios | 2017-18 | 2018-19 | 2019-20 | 2020-21 | 2021-22 | Average |
|---|---|---|---|---|---|---|
| **$MC_1$** | -2.209 | 0.020 | 4.223 | 3.680 | -3.130 | **0.517** |
| **$MC_2$** | -2.153 | -0.927 | 7.811 | 5.180 | -4.013 | **1.180** |
| **$MC_3$** | -1.808 | -1.215 | -5.629 | -2.204 | -1.531 | **-2.477** |
| **$MC_4$** | -0.486 | -0.969 | 4.143 | 7.349 | -1.073 | **1.793** |
| **$MC_5$** | -0.403 | -0.926 | 11.221 | 9.538 | -2.790 | **3.328** |
| **$MC_6$** | -3.593 | -0.858 | 7.570 | 8.293 | -3.567 | **1.569** |
| **$MC_7$** | -5.415 | -4.540 | 7.663 | 8.424 | -1.828 | **0.861** |
| **$MC_8$** | -5.706 | -1.817 | 5.258 | 7.748 | -3.037 | **0.489** |
| **$MC_9$** | -9.321 | -1.715 | 9.403 | 6.747 | -0.355 | **0.952** |
| **$MC_{10}$** | -2.113 | -0.973 | -1.749 | 4.169 | -0.049 | **-0.143** |

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ISSN : 2348 - 5612 | Volume : 09 , Issue : 04 | October - December 2022

The Treynor ratio shares similarities with the Sharpe ratio. The difference between the two metrics is that the Treynor ratio utilizes beta, or market risk, to measure volatility instead of total risk (standard deviation). The Sharpe ratio is complex to interpret when it is negative. Further, it takes work to directly compare the Sharpe ratios of several investments. For example, what does it mean if one investment has a Sharpe ratio of 0.50 and another has a Sharpe ratio of −0.50? How much worse was the second Portfolio than the first? The Treynor ratio does not include any added value gained from active portfolio management. It is simply a ranking criterion. A list of portfolios ranked based on the Treynor ratio is valid only when considered sub-portfolios of a more extensive, fully diversified portfolio. Otherwise, portfolios with varying total risk but identical systematic risk will be ranked or rated precisely the same. Another weakness of the Treynor ratio is its backward-looking nature. Investments will almost inevitably perform differently in the future than they did in the past. For example, a stock carrying a beta of two will not typically be twice as volatile as the market indefinitely. A portfolio cannot be expected to generate 12 per cent returns over the next decade because it has generated 12 per cent over the last ten years. These downsides apply to all risk-adjusted return measures.

$M^2$ has the enormous advantage of being in units of percentage return, which is instantly interpretable by virtually all investors. Table 7 indicates that, on average, MC5, MC4, and MC6 have performed better over the four years of the study period, with a ratio value of 3.328 and 1.569. Compared to a high return ratio-based portfolio MC3 with a ratio value -2.477, the lowest is in Table 7. Portfolio MC5 ranked first, MC4 ranked second, and MC6 ranked third. These results show that MC5, MC4, and MC6 portfolios have high M-squared ratios. Portfolio MC5 gives a higher return in comparison to the market return. MC4 closely follows it with a value of 1.793 and MC6 with a value of 1.569, which also shows positive performance coefficients. To make the results more understandable and meaningful, it has been assumed that Rs. 10,000 was initially invested in April 2017 in all ten portfolios with a holding period of one year. At the end of the period, wealth is reinvested in revised portfolios annually until March 2022, the end of the study period. Table 8 shows the result of investing in different portfolios.

**Table 8 Results of Investing Rs. 10,000 in Different Return Ratio-Based Portfolios**

| Portfolios | $MC_1$ | $MC_2$ | $MC_3$ | $MC_4$ | $MC_5$ | $MC_6$ | $MC_7$ | $MC_8$ | $MC_9$ | $MC_{10}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| **Initial Investment** | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 |
| **Wealth Index** | 12858 | 11921 | 8662 | 17129 | 17870 | 13776 | 9977 | 11408 | 9429 | 10296 |
| **Portfolio Value** | 12858 | 11921 | 8662 | 17129 | 17870 | 13776 | 9977 | 11408 | 9429 | 10296 |
| **Rank** | **4** | **5** | **10** | **2** | **1** | **3** | **8** | **6** | **9** | **7** |

It is observed that an initial investment of Rs. 10,000, when invested and reinvested annually in MC5 and MC4, would have grown to Rs. 17,870 and Rs. 17,129, respectively. This indicates a growth of approximately 1.7 million in the principal sums invested. As per Table 8, it is evident that a Midcap M/C ratio-based portfolio MC5 has the highest growth in wealth of Rs. 17,870 as compared to a Large-cap M/C ratio-based portfolio MC3, which has a negative growth of Rs. 8662. However, transaction and information costs have yet to be factored in thus far in the stock market operation.

The study was conducted on 240 randomly selected stocks from the Bombay Stock Exchange Limited to examine the portfolio return ratio anomaly in the Indian stock market. The sample stocks were divided into 10 portfolios based on their market capitalization, with almost 24 stocks in each Portfolio.

The analysis involved computing various measures such as average market capitalization, average annual return, and standard deviation as a measure of portfolio risk, beta as a measure of systematic risk, Sharpe ratio, Treynor ratio, and Modigliani risk-adjusted performance. The study findings suggest that investing in Midcap M/C ratio stocks can help maximize an investor's return. However, it is essential to note that these results are based on historical data, and the future might follow a different pattern. The study also indicates an inverse relationship between portfolio return and portfolio risk. In other words, higher-risk portfolios tend to yield lower returns. The Sharpe measure shows that the risk premium is higher in a portfolio of Midcap M/C ratio stocks, implying that these stocks are better than large-cap and small-cap ratio stocks.

Similarly, the Treynor model shows that the Portfolio return increases with Midcap M/C portfolios in the stock market, while large-cap and small-cap M/C portfolios perform poorly against market sensitivity. Finally, the Modigliani risk-adjusted performance method shows that the Midcap M/C portfolios have performed better than the benchmark (average market return) after adjusting for market risk. Conversely, large-cap and small-cap M/C portfolios have not performed better than the benchmark during the research period.

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