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PERFORMANCE ANALYSIS OF SELECTED MUTUAL FUNDS USING DATA ENVELOPMENT ANALYSIS

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ABSTRACT A investment trust might be a trust that pools the overabundance money from scope of financial savers who share similar fiscal objective. The money so sourced is then put in fiscal market (capital market) instruments like. equity shares, debentures and elective capital market securities. The monetary benefit created by these appreciation are distributed by these trusts to its unit holders with respect to the amount of units invested by the saver.

The plans offered by these investment trust firms gave widespread options to the savers to invest. Using these sources, the study are conducted to understand the performance of these mutual funds using Sharpe Ratio, Treynor Ratio, Sortino Ratio, Beta and NAV. The study also used DEA to understand the performance using DEA – Constant Return to Scale method. The outcomes concluded based on the six inputs and two outputs, it is found the most efficient funds are Mirae Asset Hybrid Equity Fund, SBI Banking & Financial Services Fund, Kotak Small Cap Fund, Kotak India EQ Contra Fund, Aditya Birla Sun Life Equity Fund and Aditya Birla Sun Life Pure Value Fund.

Introduction.

Using DEA technique, investors can measure the efficiency of the mutual funds better than any other individual analysis. This method helps in determining the efficient and slack of performance of individual parameter taken for study. This study also helps Fund Managers to understand the parameters to be worked to make fund efficient in comparison to benchmark funds. The current efficiency can be measured by using two or more index variables. This could be sacrificed for a better long-term effectiveness. In all other method of analysis, we are able to consider only limited input and output, whereas DEA gives the leverage of analyzing multiple inputs and outputs. So, in this study, based on the six inputs and two outputs, it is found the most efficient funds are Mirae Asset Hybrid Equity Fund, SBI Banking & Financial Services Fund, Kotak Small Cap Fund, Kotak India EQ Contra Fund, Aditya Birla Sun Life Equity Fund and Aditya Birla Sun Life Pure Value Fund.

LITERATURE REVIEW

Murthi, Choi and Desai (1997) found strong evidence that mutual funds are approximately mean-variance efficient and that efficiency is not related to transaction costs. However, their study assumed a CRS frontier and therefore was unable to examine the issue of scale effects on the mutual funds.

McMullen and Strong (1998) postulated that an investor's choice of a mutual fund would be typically a function of recent performance, long-term performance, the associated risks of these returns and transaction costs. In particular, they considered 1, 3 and 5 years annualized returns as output variables and sales charge, expense ratio, minimum initial investment and standard deviation of return measured over three years as the input variables. on the other hand, analysed 135 common stock mutual funds using DEA. Their choice of the input-output variable set differed slightly from that of Murthi, Choi and Desai

Otten and Bams (2002), who investigate performance of mutual funds in France, Germany, Italy, the UK and the Netherlands and show that younger mutual funds achieve higher results than older mutual funds, stressing that while coefficients are negative in the case of all countries, only mutual funds in Germany and the UK have a significantly negative relationship between longevity and performance. It is important to note, however, that due to the lack of information on individual mutual fund characteristics in Italy, authors do not report results for this country.

Berk and Green (2004) investigate the relationship between mutual fund flows and performance and argue that higher inflows lead to lower performance because mutual fund managers increase expense ratios, or due to the fact that as mutual fund grows in size, diseconomies of scales, such as the need to add lower quality holdings, organizational inefficiencies or higher transaction cost, diminish superior performance.

Anand and Murugaiah (2007)evaluated the performance of 113 Indian mutual fund schemes having exposure of more than 90 percent of corpus to equity stocks of 25 fund houses, during four year period from April, 1999 to March, 2003. Authors showed that expected market risk and return have shown a close correlation with the fund returns.

Lin and Chen (2008) argue that risk measures used in DEA models should reflect fat tails and asymmetry in return distributions. They propose several DEA indices that employ as inputs value-at-risk (often abbreviated as VaR), which is a measure that "summarizes the worst loss over a target horizon that will not be exceeded with a given level of confidence" (Jorion, 2007), and conditional value-at-risk (often abbreviated as CVaR), which is defined as the conditional expectations of losses exceeding VaR (Rockafellar & Uryasev, 2000). Additional inputs used are standard deviation of mutual fund returns, half-variance of mutual fund returns, beta, the turnover ratio, the expense ratio, the redemption fee and loads. Outputs, on the other hand, include expected return and Jensen's alpha. It should be noted that in their analysis researchers consider 24 combinations of inputs and outputs. Academics conclude that the utilization of traditional performance indices may not be useful since certain DEA indices can be seen as the generalization of Treynor, Sharpe and reward-to-half-variance indices. Beta and costs, on the other hand, have a great effect on the performance appraisal. Results also show that VaR or CVaR should be used together with traditional risk measures. An interesting novelty of the research is the way the efficiency performance is analysed –several time periods are investigated and each mutual fund is treated as a different mutual fund in these periods.

Karoui and Meier (2009), who study the performance of newly launched US equity mutual funds and document higher excess and abnormal returns as well as higher risk-adjusted performance if compared with older mutual funds. Interestingly, researchers also find that younger mutual funds exhibit higher unsystematic and total risk, are less diversified and invest in smaller and less liquid stocks.

Murcia (2011), who analyses the performance determinants in the Spanish mutual fund industry, and does not evidence any significant relationship between age and returns. At the same time, the researcher detects a negative relationship between longevity and performance when fixed income and balanced mutual funds are analysed.

Bhojraj, Jun Cho and Yehuda (2012), who examine the effect of regulatory changes on the relationship between mutual fund family size and performance. Researchers find that the positive effect of larger cumulative asset base on performance of individual mutual funds disappears after the adoption of new regulatory rules. Since the research also reveals that, after controlling for mutual fund size, managers of mutual funds from larger families have better stock-picking ability prior to the regulatory changes that limit selective information disclosure, the information advantage explanation of the analysed phenomenon seems to be the most appropriate.

INTRODUCTION – MUTUAL FUNDS

Mutual funds are one of the pillars of the modern financial system. Millions of investors worldwide decide to pursue investment goals using mutual funds. Among these investors are individuals and households as well as institutional investors, both financial and non-financial. One of the reasons mutual funds are so popular is that they act as transparent investment vehicles that invest in identifiable financial instruments that are regularly marked-to-market and could thus be perceived as an almost perfect link between savers and borrowers. India has a diversified financial sector undergoing rapid expansion, both in terms of strong growth of existing financial services firms and new entities entering the market. The sector comprises commercial banks, insurance companies, non-banking financial companies, co-operatives, pension funds, mutual funds and other smaller financial entities. Mutual funds remain the most popular investment vehicle among individual investors in India. Mutual funds have become an important constituent of the Indian financial system by channelizing investor savings to the capital market. By the very nature of their market operations that involve continuous buying, selling and holding various listed scrips or debt instruments, mutual funds significantly impact savings, investments and liquidity and, in turn, the overall status of financial markets.

The asset management industry in India is among the fastest growing in the world. As of November 2017, 42 asset management companies were operating in the country.

A mutual fund is an investment pooling entity which is professionally-managed by an asset management company (AMC). It brings together a group of investors and invests their money in stocks, bonds and other avenues. As a mutual fund investor, you are assigned mutual fund units which indicate your contribution in a particular scheme. You can purchase or redeem these units as needed at the fund's prevailing net asset value (NAV).

Usually, NAV of a mutual fund changes daily according to the underlying assets of the fund. Mutual funds are safe investment havens as they are compulsorily registered and operated within the SEBI regulations. The main benefit of investing through mutual fund is that you get access to professional fund management and diversified portfolios at a relatively small amount of investment.

The mutual fund industry has a long and cherished history. From 1963, when the first mutual fund structure was created by Government in the form of ''Unit Trust of India''; to 1987, when SBI Mutual Fund became the first non-UTI mutual fund in India; to 1993, when mutual funds came within the regulatory purview of SEBI; to the present day, the Indian mutual fund industry has, indeed, come a very long way. Remarkably, mutual funds, over these years, have established themselves as an important pillar of the Indian capital market.

Assets under Management(AUM) have increased more than 2 times over the last 5 years and has scaled up to reach almost Rs.23 trillion in July 2018. The customer base of mutual funds is also growing at a healthy rate with nearly 7.59 crore folios in July 2018,as against 5.99 crore folios in July 2017– an increase of around 27% over one year.

It is a major cause of concern that despite such tremendous growth, majority of market share of the industry remains concentrated with a few big players. The top 4 MFs account for almost 50 % of the industry AUM and the top 7 MFs account for around 70 % of the industry AUM. Concentration in the industry is evident not only in the AUM figures but also in the revenue and profit margins of the MFs. It is observed that the share of revenue of seven large AMCs is more than 60% of the total industry revenue. Profit margin of large MFs has also stood at a very healthy 40 -50 %.

As the industry gears up to move to the next level of growth in terms of size, aspects of risk management and valuation become even more important. Valuation is extremely important for mutual funds. This is one area that is of fundamental importance as it has direct ramifications on the integrity of the industry as a whole. This is especially true for debt mutual funds. Debt Mutual Funds are also being used by non-retail investors mostly to park their short-term funds. Debt funds, therefore, have to be even more vigilant about the kind of risk they are taking and how these risks are being valued so as to ensure that the portfolio is adequately reflecting the maturity transposition and liquidity risk properly.

Mutual Funds are entrusted with the task of being the caretaker of investor's funds and they perform an important public utility function. Retail investors have around 51% share in terms of participation in equity oriented schemes. It follows that despite being profit-making entities, fund houses have strong public interest responsibilities incumbent upon them. It is, therefore, important to maintain the highest order of good governance and integrity.

DATA ENVELOPMENT ANALYSIS

Data Envelopment Analysis (DEA) is a very powerful service management and benchmarking technique originally developed by Chames, Cooper and Rhodes in 1978 to evaluate non-profit and public sector organizations. Thus , it's also known as CCR Model. DEA has since been proven to locate ways to improve service not visible with other techniques. Data envelopment analysis (DEA) is a technique used to compare the performances of several units. These units in the context of services can be various service organizations like banks, hospitals, schools etc. This technique is used in places where a relative performance of different units is to be compared and evaluated.

Data Envelopment Analysis (DEA) tries to find an individual measure of the efficiency and the corresponding input and output targets .The DEA technique defines an efficiency measure of a production unit by its position relative to the frontier of the best performance established mathematically by the ratio of the weighted sum of outputs to the weighted sum of inputs. Data Envelopment Analysis (DEA) tries to find an individual measure of the efficiency and the corresponding input and output targets The data envelopment analysis (DEA) method is a mathematical programming approach to evaluate the relative performance of options available. To fairly evaluate the performance variation of the same fund with different investment option for same time periods, we creatively treat them as different decision making units (DMUs).

Linear programming is the underlying methodology that makes DEA particularly powerful compared with alternative productivity management tools. DEA has been widely studied, used and analysed by academics that understand linear programming. Managers have not widely adopted DEA to improve organization performance, in part, because most DEA publications are in academic journals or books requiring the ability to understand linear programming and supporting mathematical notation.

DEA compares service units considering all resources used and services provided, and identifies the most efficient units or best practice units (branches, departments, individuals) and the inefficient units in which real efficiency improvements are possible. This is achieved by comparing the mix and volume of services provided and the resources used by each unit compared with those of all the other units. In short, DEA is a very powerful benchmarking technique. DEA calculates the amount and type of cost and resource savings that can be achieved by making each inefficient unit as efficient as the most efficient - best practice ~ units. Specific changes in the inefficient service units are identified, which management can implement to achieve potential savings located with DEA. These changes would make the efficient units performance approach the best practice unit performance. In addition, DEA estimates the amount of additional service an inefficient unit can provide without the need to use additional resources. Management receives information about performance of service units that can be used to help transfer system and managerial expertise from better-managed, relatively efficient units to the inefficient ones. This has resulted in improving the productivity of the inefficient units, reducing operating costs and increasing profitability.

DEA can be used to analyse the performance of several units to set a benchmark.

The analysis can be used to discover the inefficient operations or units even for the most profitable organizations.

DEA has an advantage over other analysis techniques as it can handle complex relation between multiple inputs and multiple outputs and the units are non-commeasurable.

DEA techniques are based on linear algebra and are related to linear programming concepts. The technique is similar to mathematical duality relations in linear programming.

EFFICIENCY CONCEPTS

Efficiency can be simply defined as the ratio of output to input. More output per unit of input reflects relatively greater efficiency. If the greatest possible output per unit of input is achieved, a state of absolute or optimum efficiency has been achieved and it is not possible to become more efficient without new technology or other changes in the production process. DEA compares each service unit with all other service units, and identifies those units that are operating inefficiently compared with other unit's actual operating results. It accomplishes this by locating the best practice or relatively efficient units, that are not less efficient than other units being evaluated. It also measures the magnitude of inefficiency of the inefficient units compared to the best practice units. The best practice units are relatively efficient and are identified by a DEA efficiency rating of = 1. The inefficient units are identified by an efficiency rating of less than 1. DEA will provide an efficiency rating that is generally denominated between zero and 1, which will interchangeably be referred to as an efficiency percentage between the range of zero and 100%. The upper limit is set as 1 or 100% to reflect the view that a unit cannot be more than 100% efficient.

Objectives of the study
• To identify various inputs and outputs variables influencing the performance of mutual funds.
• To measure the efficiency of the selected funds.
• To evaluate the performance variation of the select Mutual Funds under different economies of scale.

DATA ANALYSIS AND DISCUSSION
INPUTS FOR DEA:
Standard deviation : Standard deviation is a statistical measurement that sheds light on historical volatility. Standard deviation is applied to the annual rate of return of an investment to measure the investment's volatility. Standard deviation is also known as historical volatility and is used by investors as a gauge for the amount of expected volatility.

β (BETA): A measure of the volatility, or systematic risk, of a security or a portfolio in comparison to the market as a whole.

Total assets : The assets represents the mutual fund scheme holds for a particular period of time.

Sharpe Ratio : The Sharpe ratio is calculated by subtracting the risk free rate from the Expected return and divided by standard deviation of the portfolio.

Sortino Ratio: The Sortino ratio, determined as the amount of mutual fund's excess return, relative to the minimum acceptable return (often abbreviated as MAR), which is also called the hurdle rate, divided by the downside deviation of mutual fund returns (which means that when calculating standard deviation only mutual fund returns lower than MAR are taken into account). It measures the risk-adjusted returns of a given scheme.

Expense Ratio: The expense ratio, also known as the management expense ratio (MER), measures how much of a fund's assets are used for administrative and other operating expenses. An expense ratio is determined by dividing a fund's operating expenses by the average value of its assets under management (AUM). Operating expenses reduce the fund's assets, thereby reducing the return to investors.

OUTPUT OF DEA:
NAV: The net asset value (NAV) represents the net value of an entity, and is calculated as the total value of the entity's assets minus the total value of its liabilities.

Turnover : Portfolio turnover is a measure of how frequently assets within a fund are bought and sold by the managers. Portfolio turnover is calculated by taking either the total amount of new securities purchased or the amount of securities sold (whichever is less) over a particular period, divided by the total net asset value (NAV) of the fund.

Input and Output variables for the Selected Mutual Funds
Table 1

Fund Name	SD(I)	Sharpe (I)	expense ratio (I)	Sorti no (I)	Assets Value (I)	Beta (I)	NAV (O)	Turn Over (O)
Aditya Birla Sun Life Small Cap Fund Growth	18.14	0.59	1.27	0.98	2,327	0.76	35.11 94	37
Aditya Birla Sun Life Pure Value Fund - Growth	18.8	0.48	1.2	0.89	4,258	0.86	54.19 04	193

Aditya Birla Sun Life Equity Fund - Growth	14.2	0.76	1.21	1.16	10,307	0.98	703.17	58
Kotak India EQ Contra Fund	12.44	0.91	1.76	1.48	565	0.7	52.137	36
Kotak Small Cap Fund	16.44	0.55	1.4	0.86	824	0.75	71.515	68
Kotak Emerging Equity Scheme	15.28	0.7	1.26	1.02	3,453	0.87	37.04	91
Kotak Standard Multicap Fund	13.16	0.81	1.17	1.33	21,927	0.93	33.584	47
Kotak Equity Opportunities Fund	13.68	0.64	1.02	1.05	2,569	0.91	113.525	12
Mirae Asset Emerging Bluechip Fund	16.19	0.67	1.73	0.94	6,120	0.99	49.001	78
Mirae Asset India Opportunities Fund	14.71	0.58	1.32	0.84	9,049	0.98	48.451	44
Aditya Birla Sun Life Tax Relief'96 Fund	13.21	0.75	1.11	0.72	7,020	0.89	31.12	1
DSP Mid Cap Fund	18.55	0.41	1.46	0.57	5,816	0.93	50.928	36
DSP Small Cap Fund	20.49	0.19	1.86	0.25	5,506	0.86	53.458	20
SBI Magnum Multicap Fund	15.06	0.46	1.35	0.62	6,176	0.98	46.3126	35
SBI Small Cap Fund	20.56	0.63	1.47	0.94	1,067	0.82	51.9575	83
SBI Banking & Financial Services Fund	18.97	0.7	1.47	0.97	603	0.91	15.4015	150
Mirae Asset Hybrid Equity Fund	11.04	0.5	2.2	0.75	1,345	0.94	13.422	218
Nifty Fifty	12.21	1.01	0.13	0.61	15293.32	0.89	44.96	89

Source: Mutual Fund Fact Sheet

The above table signifies the inputs and outputs values of the selected mutual fund schemes for the study period .The expenses ratio of the fund for all the schemes ranged from 0.13 to 2.2. The beta values are ranged from 0.7 to 0.99. The total assets values ranged from 565 to 21927. Standard Deviation ranges between 11.04 to 20.56. The Sharpe ratio of the select fund schemes are 0.19 to 1.01. The Sortino values of the funds ranges from 0.25 to 1.48. Funds with higher sortino ratio will be better investment option because it captures better, the downside volatility of a scheme.

DEA RESULTS OF THE SELECT MUTUAL FUND SCHEMES

Constant Return to Scale
Table: 1

DMU Name	Constant Return to Scale
Aditya Birla Sun Life Small Cap Fund Growth-Direct Plan	0.29867
Aditya Birla Sun Life Pure Value Fund - Growth-Direct Plan	1.00000
Aditya Birla Sun Life Equity Fund - Growth-Direct Plan	1.00000
Kotak India EQ Contra Fund - Direct Plan - Growth	1.00000
Kotak Small Cap Fund - Direct Plan - Growth	1.00000
Kotak Emerging Equity Scheme- Direct Plan - Growth	0.53581
Kotak Standard Multicap Fund - Direct Plan - Growth	0.32061
Kotak Equity Opportunities Fund - Direct Plan - Growth	0.61800
Mirae Asset Emerging Bluechip Fund - Direct Plan - Growth	0.38889
Mirae Asset India Opportunities Fund - Direct Plan - Growth	0.28323
Aditya Birla Sun Life Tax Relief'96 Fund- Growth-Direct Plan	0.07130
DSP Mid Cap Fund - Direct Plan - Growth	0.33461
DSP Small Cap Fund - Direct Plan - Growth	0.56203
SBI Magnum Multicap Fund - Direct Plan - Growth	0.29199
SBI Small Cap Fund Direct Growth	0.77840
SBI Banking & Financial Services Fund - Direct Plan-Growth	1.00000
Mirae Asset Hybrid Equity Fund	1.00000
Nifty Fifty	0.72718

The above table signifies the efficiency scores of the selected Mutual Fund schemes for the study period. The efficiency score of one are said as mutual funds performing efficiently whereas the efficiency score less than one as inefficient. In this study, six mutual funds are performing efficiently while taken into consideration of all the considered inputs.

Constant returns to scale measures the efficiency fund when it changes their inputs or resources, with the results being exactly the same change in outputs or production. In other words, if a fund increases their inputs or resources, they will see a proportional increase in production or outputs. In the selected mutual funds only six are effective - Mirae Asset Hybrid Equity Fund, SBI Banking & Financial Services Fund, Kotak Small Cap Fund, Kotak India EQ Contra Fund, Aditya Birla Sun Life Equity Fund and Aditya Birla Sun Life Pure Value Fund. Rest of the fund's efficiencies ranges from 0.07 – 0.77.

Efficiency Ranks
Table: 2

DMU Name	Rank
Aditya Birla Sun Life Pure Value Fund - Growth-Direct Plan	1
Aditya Birla Sun Life Equity Fund - Growth-Direct Plan	1
Kotak India EQ Contra Fund - Direct Plan - Growth	1
Kotak Small Cap Fund - Direct Plan – Growth	1
SBI Banking & Financial Services Fund - Direct Plan-Growth	1
Mirae Asset Hybrid Equity Fund	1
SBI Small Cap Fund Direct Growth	7
Nifty Fifty	8
Kotak Equity Opportunities Fund - Direct Plan - Growth	9
DSP Small Cap Fund - Direct Plan – Growth	10
Kotak Emerging Equity Scheme- Direct Plan - Growth	11
Mirae Asset Emerging Bluechip Fund - Direct Plan - Growth	12
DSP Mid Cap Fund - Direct Plan – Growth	13
Kotak Standard Multicap Fund - Direct Plan - Growth	14
Aditya Birla Sun Life Small Cap Fund Growth-Direct Plan	15
SBI Magnum Multicap Fund - Direct Plan - Growth	16
Mirae Asset India Opportunities Fund - Direct Plan - Growth	17
Aditya Birla Sun Life Tax Relief'96 Fund- Growth-Direct Plan	18

Source: DEA Solver Results

The above table shows the efficiency ranking as per the Constant Rate to Scale (CRS). The mutual funds which ranked as 1 are the most efficient funds. Only Mirae Asset Hybrid Equity Fund, SBI Banking & Financial Services Fund, Kotak Small Cap Fund, Kotak India EQ Contra Fund, Aditya Birla Sun Life Equity Fund and Aditya Birla Sun Life Pure Value Fund are the most efficient funds in the selected eighteen samples.

Weight Co-efficient Lambda () of the Reference Benchmarking

Source: DEA Solver Results

If in all optimal solutions of the selected mutual funds, 1, it means that the DMU is in the IRS State. If the 1 , then that DMU is in the state of DRS and if the =1, it is said to be in the state of CRS. In the above selected mutual funds, Mirae Asset Hybrid Equity Fund, SBI Banking & Financial Services Fund, Kotak Small Cap Fund, Kotak India EQ Contra Fund, Aditya Birla Sun Life Equity Fund and Aditya Birla Sun Life Pure Value Fund are in the CRS state. Rest of the funds Returns to Scale is in increasing state.

DEA Slack Variables

The efficiency of the inputs and outputs can be easily understand from the slack variables. If the slack is nonzero , then it shows the weak efficiency of the variable. The performance of the DMU is said to be efficient only when the CRS is equal to one and the slack results are zero. The performance of DMU is weakly efficient if and only if both CRS =1 and slack variables 0. Slacks represent the leftover portions of inefficiencies; after proportional reductions in inputs or increases in outputs, if a DMU cannot reach the efficiency target, slacks are needed to push the DMU to the target. They represent the potential improvements in the input and the output variables for the inefficient units in the data set when compared with their peer efficient ultimate benchmark targets. For an inefficient DMU, its direction of improvement is to reduce the input or to increase the output. Therefore, the slack improvement value of the input is denoted by a negative number and the slack improvement value of the output is denoted by a positive number.

If the slack variables of all inputs are not equal to zero, then there are still scope for improvement. So the solution obtained for those DMUs are not the optimal solutions.

Slack Data of the Selected Mutual Funds

Source: DEA Solver Results

If the efficiency value is equal to 1, and if all the slack variables are zero simultaneously, it will be a strong efficiency. In the analysis results of the above selected mutual funds, the efficiency values of six DMUs are 1 and all slack variables of inputs and outputs of these six DMUs are 0,showing all the six DMUs are strongly efficient. The strongly efficient funds in this study are Mirae Asset Hybrid Equity Fund, SBI Banking &

Financial Services Fund, Kotak Small Cap Fund, Kotak India EQ Contra Fund, Aditya Birla Sun Life Equity Fund and Aditya Birla Sun Life Pure Value Fund.

Efficient Input & Output Target to get Maximum Efficiency

Source: DEA Solver Results

The above table speaks about the input and the output target to get the maximum efficiency. The projection value of the inefficient DMU in the selected list of mutual funds represents its improved target value. Determination of strong or weak efficiency is depends on the target value of selected inputs and outputs. Target value will be the sum of improvement value + the original value .The standard deviation target ranges from 0.60-18.97. The Sharpe ratio target ranges from 0.03-0.91. The expense ratio target ranges from 0.05- 2.20. Targeted Sortino ratio ranges from 0.05-1.48. The targeted Beta value lies in between 0.03-0.98.

The efficient targeted output for NAV ranges from 13.42-703.17. The targeted turnover lies from 2.56 to 218.

FINDINGS

In this research I found how well the mutual funds are performing in the period of study. The performance of the mutual funds vary depends on the index selection.

- Mirae Asset Hybrid Equity Fund is the most efficient fund when we take standard deviation into consideration. The standard deviation of the most efficient fund is 11.04%.

- Based on the study using Beta, four funds - Mirae Asset Emerging Blue-Chip Fund (0.99), Mirae Asset India Opportunities (0.98), Aditya Birla Sun Life Equity Fund (0.98) and SBI Magnum Multi cap Fund (0.98) are efficient with less volatility.

- Nifty Fifty Fund is the best fund on the basis of expense ratio. Its expense ratio is 0.13 and which is the least among the selected funds.

- Kotak India EQ Contra Fund is the best when sortino ratio is taken as the index. Its sortino ratio is 1.48.

- Based on DEA analysis with 6 parameters as input and 2 parameters as output, it was found out of eighteen mutual funds selected, only six fund's performance were efficient, and other twelve were inefficient during the study duration.

- The efficiency scores of inefficient mutual funds lie from 0.07-0.77. The mean efficiency of all the mutual funds is 0.62282.

CONCLUSION

Using DEA technique, investors can measure the efficiency of the mutual funds better than any other individual analysis. This method helps in determining the efficient and slack of performance of individual parameter taken for study. This study also helps Fund Managers to understand the parameters to be worked to make fund efficient in comparison

to benchmark funds. The current efficiency can be measured by using two or more index variables. This could be sacrificed for a better long-term effectiveness. In all other method of analysis, we are able to consider only limited input and output, whereas DEA gives the leverage of analyzing multiple inputs and outputs. So, in this study, based on the six inputs and two outputs, it is found the most efficient funds are Mirae Asset Hybrid Equity Fund, SBI Banking & Financial Services Fund, Kotak Small Cap Fund, Kotak India EQ Contra Fund, Aditya Birla Sun Life Equity Fund and Aditya Birla Sun Life Pure Value Fund.

ACRONYMS

AIC- Atal Incubation Centres
AIM- Atal Innovation Mission
AMC- Asset Management Company
ASEAN- Association of Southeast Asian Nations
ATL- Atal Tinkering Labs
AUM- Asset Under Management
BIRAC- Biotechnology Industry Research Assistance Council
CCR- Charnes, Cooper & Rhodes
CDMA- Code Division Multiple Access
CRS- Constant Rate to Scale
CVaR- Conditional Value-at-Risk
DEA- Data Envelopment Analysis
DMU- Decision Making Unit
DIPP- Department of Industry Policy and Promotion
DST- Department of Science and Technology
ESCAP- Economic and Social Commission for Asia and the Pacific
FDI- Foreign Direct Investment
FMV- Fair Market Value
GSM- Global System for Mobile Communications
HNI- High Net-worth Individuals
HR- Human Resource
IAN- Indian Angel Network
IIMB- Indian Institute of Management , Bangalore
IISc- Indian Institute of Science
ISRO- Indian Space Research Organization
IT- Information Technology
JAM- Jan Dhan Aadhaar Mobile
MAR- Minimum Acceptable Return
MER- Management Expense Ratio
MF- Mutual Fund
MoM- Minutes of Meeting
MSDE-Ministry of Skill Development & Entrepreneurship
MSME- Micro, Small and Medium Enterprises
NDA- Non Disclosure Agreement
NAV- Net Asset Value
NGO- Non-Governmental Organizations
PMKVY- Pradhan Mantri Kaushal Vikas Yojana
R&D- Research and Development
SaaS- Software as a Service
SEBI- Securities Exchange Board of India
SEED- Science for Equity Empowerment and Development
SME- Small and Medium Enterprises
SIDBI- Small Industries Development Bank of India
STEM- Science, Technology, Engineering and Mathematics
STEP - Support to Training and Employment Programme for Women
TBI-Technology Business Incubator
TREAD-Trade related Entrepreneurship Assistance and Development
UMTS- Universal Mobile Telecommunications System
UTI – Unit Trust of India
VaR- Value-at-Risk
VC- Venture Capital

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