

A DEA COMPARISON OF SYSTEMATIC AND LUMP SUM INVESTMENT IN MUTUAL FUNDS

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Abstract: Investors have a plethora of investment options, either directly or indirectly. On top of it, new ways of making investment have come up with the advent and development of technology. This is particularly true about the mutual fund industry in that a new way of investment in mutual funds by paying a fixed amount of money on equal intervals, known as systematic investment plan (SIP). It resembles to a recurring deposit scheme of a bank or post office. The SIP has gained a sizable popularity and hence a structured study in Indian context is in place. And it is also important to understand and analyze investor's perception and expectations and unveil some extremely valuable information to support financial decision making of mutual funds. The objective of the present paper include comparison of SIP with lump sum investment using data envelopment analysis (DEA) .No such study has been conducted on comparing SIP with lump sum in India. Hence the maiden effort in this direction will be a very useful for the policy makers, regulators and fund managers for designing strategies for future implications. Since a sizable population is still using the traditional investment options and are deprived of the benefits of SIP, the findings of the proposed research would be of immense benefits to the society.

Keywords: Mutual Fund, SIP, DEA, Cluster Analysis

1. Introduction

Financial markets are constantly becoming more efficient by providing more promising solutions to the investors. Being a part of financial markets although mutual funds industry is responding very fast by understanding the dynamics of investor's perception towards rewards, still they are continuously following this race in their endeavor to differentiate their products as well as differentiating on the methods of investments responding to sudden changes in the economy. Thus, it is high time to understand and analyze investor's perception and expectations as well as compare the different investment options available with an individual investor. Financial markets are becoming more exhaustive with financial products seeking new innovations and to some extent innovations are also visible in designing

mutual funds portfolio but these changes need alignment in accordance with investor's expectations. Earlier the investors had options like bank recurring deposit , public provident fund , post office deposit (such as NSC , KPV , etc) and for particularly for the mutual fund investors had to go with lump sum investment .

The present study aims to compare the SIP (Systematic Investment Plan) with Lump sum Investment and also to put on some knowledge about key factors that influence investor's investment behavior. It is an attempt to find out factors affecting individual decision making on basis of age, gender and occupation.

Responses of randomly selected individuals have been compiled, analyzed and observed and they have been analyzed in accordance with few other factors, which have given many interesting facts and have helped to understand different influencing factors for an investor to invest in different class of assets.

1.2. Literature Review

In earlier times, the mutual fund performance index was built on the theory of the capital asset pricing model (CAPM), which the three traditional performance indices, Treynor (1965), Sharpe (1966) and Jensen (1968), were derived from. The Treynor index (Treynor, 1965) shows the excess return per unit of the systematic risk, the Sharpe index (Sharpe, 1966) presents the excess return per unit of the total risk and the Jensen's α (Jensen, 1968) defines the difference between actual portfolio return and estimated benchmark return. The results of these studies appear to depend, to a large extent, on the bench market portfolio used and the measurement of risk, and the main criticism over the use of CAPM is the validity of its underlying assumption. Although these performance indices evaluate a fund's performance, they still lack the ability to consider transaction costs and fees. For fund performance evaluation methods, Murthi et al. (1997) offered an alternative by proposing a measure of portfolio performance derived from DEA. Using DEA, investment performance can be gauged by measuring the efficiency of an individual fund relative to all other funds in a

sample. McMullen and Strong (1998) evaluated the performance of 135 stock mutual funds in America by traditional DEA model. DEA was introduced by Charnes/Cooper/Rhodes (1978). DEA builds upon the method for computation of the technical efficiency. The efficiency of a fund can then be determined by the relative distance between the actually observed output and this efficient frontier. Thus, a fund is classified as inefficiently if its outputs (e.g., return) and inputs (e.g., risk) are below the best practice frontier. Murthi, Choi and Desai (1997) employed DEA to appraise 731 mutual funds using the actual return as the output variable and four input variables - expense ratio (accounts for management fees, marketing expenses and other operational expenses), load (a charge at the time of investment and/or withdrawal also referred to as sales charge), turnover. Grinblatt and Titman (1993) introduced a measure that does not require the use of a benchmark. However, they failed to account for transaction costs. 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), 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 (1997). 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. Galagedera and Silvapulle (2002) used DEA to measure the relative efficiency of 257 mutual funds.

2. Data Envelopment Analysis

2.1. Methodology

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). In this project DEA is used to compare between SIP and Lump Sum Investment and using solver. For the comparison:

2.2. Inputs for DEA:

1. Minimum Investment (u1): this is minimum limit for an investor to invest in that particular fund through either SIP or lump sum.
2. Standard deviation (u2): 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.
3. β (BETA): A measure of the volatility, or systematic risk, of a security or a portfolio in comparison to the market as a whole.

Table 1: Inputs for DEA of Reliance Equity Opportunities

SCHEMES	INPUTS			
	Minimum		Standard	
	Investment	Beta	Deviation	
Reliance Equity Opportunities :				
SIP Investment	1000	0.29	8.03	
Lump sum Investment	5000	0.87	4	

2.3. Outputs for DEA:

1. Three Year Return (v1): It is calculated on the basis of NAV changes for last 3 years. This is taken to be the absolute return.
2. Sharpe Ratio (v2): The Sharpe ratio is calculated by subtracting the risk-free rate - such as that of the 10-year U.S. Treasury bond - from the rate of return for a portfolio and dividing the result by the standard deviation of the portfolio returns. The Sharpe ratio formula is:

$$\text{Sharpe Ratio} = \frac{\bar{r}_p - r_f}{\sigma_p}$$

\bar{r}_p = Expected portfolio return

r_f = Risk Free Rate

σ_p = Portfolio Standard Deviation

3. Five Year Return (v3): It is historical data retrieved from different resources for finding the changes in NAV value from last 5 years.

Table 2: Outputs for DEA for Reliance Equity opportunities

SCHEMES	OUTPUTS		
	3 year Return	Sharpe Ratio	5 year return
Reliance Equity Opportunities			
SIP Investment	30.83%	0.05	19.94%
Lump sum Investment	18.05%	0.02	14.08%

Variables for DEA:

Table 3: Input and Output variables for

INPUTS	VARIABLE	OUTPUTS	VARIABLE
Minimum Investment	u1	3 year return	v1
Beta	u2	Sharpe ratio	v2
Standard deviation	u3	5 year return	v3

2.4.1. Calculation for Efficiency of A (SIP Investment):

Table 4: Calculation of efficiency for SIP investment

Input Output variable/Investments	v1	v2	v3	U1	u2	u3		
SIP Investment(A)	30.83	0.05	19.94	-1000	-0.29	-8.03	<=	0
Lump Sum Investment(B)	18.05	0.02	14.08	-5000	-0.87	-4	<=	0
				1000	0.29	8.03	=	1
Objective Function	30.83	0.05	19.94					
Z	0.470687023							
Solution	0.015267176	0	0	0.001	0	0		
LHS	Constraints	RHS						
-0.529312977	<=	0						
-4.724427481	<=	0						
1	=	1						

Objective Function: (Max.) $30.83v_1 + .05 v_2 + 19.94 v_3$

Constraints: (a) $1000 u_1 + .29 u_2 + 8.03 u_3 = 1$

(b) $30.83 v_1 + .05 v_2 + 19.94 v_3 - 1000u_1 - 0.29u_2 - 8.03u_3 \leq 0$

(c) $18.05v_1 + .02 v_2 + 14.08 v_3 - 5000u_1 - .87u_2 - 4u_3 \leq 0$

$$\text{Eff (A) = } \frac{30.83 v_1 + .05 v_2 + 19.94 v_3}{1000u_1 + .29u_2 + 8.03u_3} \leq 1$$

Taking into consideration the constraints with maximizing the objective function for calculating the efficiency of A(SIP Investment) , solver was used to get the values of

solution as well as for getting the Z score which was compared later on with efficiency of B .

Z value is 0.470687023 (DEA score).

2.4.2. Calculation of Efficiency of B (Lump Sum Investment):

Table 5: Calculation of efficiency for Lump Sum investment

Input Output variable/Investments	v1	v2	v3	u1	u2	u3		
SIP Investment(A)	30.83	0.05	19.94	-1000	-0.29	-8.03	<=	0
Lump Sum Investment(B)	18.05	0.02	14.08	-5000	-0.87	-4	<=	0
				5000	0.87	4	=	1
Objective Function	18.05	0.02	14.08					
Z	0.103090264							
Solution	0	2.491416	0.003783	0.0002	0			
	Constraints							
LHS		RHS						
-2.77556E-17	<=	0						
-0.896909736	<=	0						
1	=	1						

Objective Function: (Max.) $18.05v_1 + .02 v_2 + 19.94 v_3$

Constraints: (a) $5000 u_1 + .87u_2 + 4u_3 = 1$

(b) $30.83 v_1 + .05 v_2 + 19.94 v_3 - 1000u_1 - 0.29u_2 - 8.03u_3 \leq 0$

(c) $18.05v_1 + .02 v_2 + 14.08 v_3 - 5000u_1 - .87u_2 - 4u_3 \leq 0$

$$\text{Eff (B) = } \frac{30.83 v_1 + .05 v_2 + 19.94 v_3}{5000u_1 + .87u_2 + 4u_3} \leq 1$$

Z score: **0.103090264**

2.5. Assigning DEA scores:

Table 6: Assigning DEA scores to SIP and Lump Sum investment

CODE	SCHEMES	DEA SCORE	RANK	EFFICIENT FUNDS
				BASED ON DEA SCORES
	Reliance Equity Opportunities			
A	SIP Investment	.47	1	Efficient
B	Lump Sum Investment	0.1	2	

The above DEA techniques show how SIP is more efficient than Lump Sum as it has a better Score of .47 as compared to lump sum which is scoring less than .1.

3. Limitations

- The study includes the data (used for SIP and other investment comparison) for only last 3 years.
- The sample size taken for Investors perception is limited to 188 only.
- The respondents were mostly from northern region and of the age group less than 30; this may lead to segmented results.
- Understanding the nature of the risk is not adequate unless the investor or analyst is capable of expressing it in some quantitative terms. Expressing the risk of a stock in quantitative terms makes it comparable with other stocks.
- Respondent's bias was another limiting factor.

4. Conclusion:

Many of people do not have invested in mutual fund due to lack of awareness although they have money to invest. As the awareness and income is growing the number of mutual fund investors are also growing. Similarly the main purpose of investment for most of the respondents is tax saving and they are preferring PPF as their investment option even though mutual funds offer ELSS option which is not so popular, so appropriate measures should be initiated to increase the awareness about the mutual

funds to the investors and the firm should offer the mutual fund according to the need or purpose of the investor.

The investors prefer to go for Fixed deposits in bank because of their less risky nature, some of the investors treat mutual funds risky but which is not supported by our calculations as shown above mutual funds always give good returns if investment is for long time period .

The firms should target for more and more young investors as well as for persons at height of their career. They should try to highlight the benefits of SIP such as rupee cost averaging, power of compounding, etc.

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