
EFFICIENCY OF MUTUAL FUND SCHEMES DURING COVID-19: EMPIRICAL ANALYSIS IN INDIAN CONTEXT USING DEA APPROACH

Dr. Manpreet Kaur

Associate Professor, SOIL School of Business Design, Manesar, Gurugram

Email ID: manpreet3015@yahoo.com

Akasha Sandhu

**Assistant Professor, School of Management and Liberal Studies, Northcap
University Gurugram**

ABSTRACT

The disruptions created by COVID-19 has lasting implications on the countries across the world. Apart from impacting key sectors of the economy, COVID has significantly affected the financial sector causing volatility and changes in asset valuation. There is no doubt that mutual funds still remain the popular mode of investment during COVID-19 followed by equities. However, shrinking fees, reducing profit margins and ever-changing investors preferences along with the pandemic imposed new set of challenges for the fund managers. Using data envelopment analysis, this paper examines the efficiency of open-ended equity funds and select debt schemes during COVID-19. The analysis reveals that during COVID, equity schemes pertaining to large and multi-cap segment were efficient. But the efficiency of mid and small cap equity schemes was affected due to the high expenses' ratio and volatility. Interestingly, all open-ended debt schemes were efficient during COVID with mean efficiency score more than equity schemes. As no single fund house is found to be efficient in all the segments, the investor can pick efficient schemes to construct optimum portfolio of mutual funds.

Keywords: *Mutual Funds, DEA, COVID-19, Net Asset Value, Sharpe Ratio*

JEL Classification: G20, C23

I. Introduction

The emergence of pandemic has resulted in substantial damage impacting all the economic spheres such as production, consumption and investment. The financial sector is no exception. The returns and risk associated with the investment vary from scheme to scheme. The pandemic period is also referred as “the greater financial crises” (Weltman, 2020). Mutual Funds (MF) being the safe investment avenue is most preferred form of investment for risk averse investors. Due to market volatility driven by COVID fund managers may need to reposition their investment portfolios. There has been increase in the number of new investors for mutual funds especially during COVID-19 due to the popular belief that these funds are actively managed by professionals and generate superior returns by beating the recession. However due to

COVID-19, the returns on equity-oriented schemes exhibited negative trend. Further, Franklin Templeton wrapped up around six debt schemes during COVID-19. The first case of COVID-19 was reported in China in December 2019. It was declared as global pandemic in March 2020 by The World Health Organization (WHO) effecting countries all over the world. India reported its first case of COVID in January 2020 followed by persistent increase in cases over next two months. As a result, lockdown was imposed in March 2020. The major impact of COVID-19 in India was witnessed by the end of June 2020. By that time, it impacted various sectors of the economy including financial markets such as banks, stock markets, mutual funds and insurance. Driving the business sector unpredictability, COVID has brought important changes in asset valuation consistently leading to changes in the investment operations.

This study aims at examining the efficiency of Mutual fund schemes during COVID-19 in order to test their capacity to beat the market and earn superior returns. Mutual fund industry in India goes back to 1963, when Unit Trust of India (UTI) was constituted by Government of India and Reserve Bank of India. With the section of various Mutual Fund players, and various items across resource classes, the business has made considerable progress. Throughout the long term, this industry has developed from being a UTI-ruled coordinated to one where there is adjusted support of the public sector and the private sector. With greater consolation from Association of Mutual Funds in India (AMFI) and the administration, this industry can develop multi-fold. Over decades, the Indian Mutual Fund Industry has seen a great deal of advancement and development. It has become more composed and transparent as far as its working, since the initiation few mutual fund organizations have been offering first class mutual fund schemes. It is not about timing the market but about time in the market.

The Mutual Industry of India offers surfeit of schemes and accommodates varied investor needs. MF offer a phenomenal road for retail financial backers to take benefit from the upswings in capital markets. The extent of gains from mutual funds can be attributed to the choice of correct asset for investment. Further, to receive greatest reward from mutual asset speculations, it is significant for financial backers to broaden across various classifications of funds, for example, equity, debt and gold. While financial backers, everything being equal, can put resources into protections market all alone, a mutual asset is a superior decision for the solitary explanation that all advantages arrive in a bundle. There are currently 44 Asset Management Companies in India. The Asset Under Management (AUM) of the Indian MF Industry has grown 4 times in a span of 10 years from Rs 7.10 trillion as on August-2010 to Rs. 27.49 trillion as on August-2020. Owing to such rise, this growth is expected to quadruple by 2025. The major contributor is equity AUM with 42.1% share followed by debt schemes with 28.8% share of AUM while liquid/money market accounted for 23.3% in September 2019. According to the data from AMFI the number of schemes that invest internationally have increased threefold from 1.44 lakh in October-2019 to 4.40 lakh in October 2020 causing AUM of these schemes to increase from Rs 2,470 crore to Rs 6,482 crore in one year.

Mutual funds can be for the short term or for longer term depending on one's investment skyline and objective. There are various kinds of mutual asset schemes – which invest into various securities – in equity in addition to debt protections that are appropriate for multiple investor needs. Furthermore, there are different short-term schemes where investors can invest for short-term varying from couple of days to half a month to a couple of years e.g., Liquid Funds with maturity of under 91 days.

While Equity Schemes are generally reasonable for a more drawn-out term, debt mutual funds are appropriate for investors with short term (under 5 years) investment objective. An equity fund is a scheme that invests predominantly in equity stocks including large cap, multi cap, mid cap and small cap. A debt fund scheme invests in fixed income instruments, such as Government Bonds, corporate bonds, and money market instruments etc. that offer capital appreciation. Debt funds are also known as Income Funds or Bond Funds. Unlike equity schemes, debt mutual funds offer higher safety but offer moderate returns. On the contrary, equity funds are risky but offer high returns in long term. In this paper, we have tried to examine the efficiency of both open-ended debt and equity Mutual Fund Schemes during COVID-19. Since the pandemic the investors, globally, are more inclined towards sustainable stocks and funds and also view sustainability as a necessity rather than a luxury. Companies with higher sustainability ratings have seen double the growth in invested capital as opposed to companies with lowest sustainability ratings (Pastor, 2020).

The rest of the organized as follows: Section-II contains the review of literature. Data and methodology is provided in section-III. The empirical results are contained in section-IV followed by concluding remarks.

II. Literature Review

The recent studies related to the impact of COVID-19 primarily focused on analyzing the effect on stock markets and financial markets in general (Demirguc-Kunt, 2020, Financial Stability Board, 2021, Kozak, 2021). There is dearth of studies on analyzing the impact of COVID-19 on mutual funds in particular. During the COVID-19 pandemic, an analysis of US equity mutual funds by **Pastor & Vorsatz, (2020)** show that funds underperform their benchmarks, contradicting the most prevalent hypothesis that funds overpower their benchmarks in times of crisis/recession. They argued that most active equity MFs in US don't outperform their passive benchmarks in the covid-19 crisis, contravening the popular hypothesis that active funds outplay in times of crisis. Fund performance is evaluated based on sustainability ratings, star ratings, value funds v/s growth funds. Funds with both higher sustainability and star ratings perform better than the funds having lesser ratings. Growth funds outperform value funds. Well managed Indian mutual funds are unable to beat the market as they co-move with the market (Maheen, 2021). The ability to get higher return depends on the timing and the choice of scheme. **Alam (2019)** analyzed stock selection ability & market timing ability of fund managers on a sample of 183 active equity funds and concludes that active portfolio management may not provide higher yield in comparison to passive investment strategy for Indian investors as fund managers possess a bit of stock selection skills but do not have any market timing ability. It excludes the crisis period but there is no effect on the results. **Sathish & Srinivasan (2016)** examined the performance evaluation of 20 equity open ended MF schemes from the period January 2010 to December 2014. They found that almost all the schemes have performed well with ICICI Prudential being the best performing fund. However, Franklin India savings plus fund, Kotak equity arbitrage fund and IDFC money manager fund exhibited under performance during the period of study. Tripathi & Japee (2020) evaluated 15 open-ended equity mutual fund schemes from 1st Jan2015-31st Dec 2019 and stated that only 10 funds outperformed because of the drastic fall in Nifty in 2019. **Bangash et.al. (2018)** examine the efficiency of mutual funds in Pakistan by using DEA technique. Their study concludes that expenses of almost all mutual funds exceed their returns. Out of 44 MF's only 7 MF's were cost-effective. By employing DEA technique, **Sharma & Sharma (2018)** analyzed 33 open ended mutual funds in India from a period of 2008-09 to 2012-2013. They included ratios of the input variables and found that input expense ratio showed very less inefficiency in all the inputs which

indicating that variances in MF performance are more prone to exposure accompanying the investment. Only a small number of funds were performing consistently in the 5-year period of study thus indicating that growth style of portfolio management is more likely to perform inconsistently. **Prasanna (2012)** incorporates DEA to analyze the performance of MFs in India wherein he applied DEA to allocate standard deviation, maximum drawdown and monthly downside deviation were the input variables, and taking profitable month's percentage and compounded monthly returns as output variables. For a sample of 35 ETFs started by different AMCs in India till December 2006, efficiency scores were calculated and it was found that large funds were inefficient implying that fund size doesn't lead to higher yield. **Guo et.al. (2012)** evaluated Chinese mutual funds between over a period of one year (January 1, 2010 to December 31, 2010) by using DEA methodology. Their data comprised of 27 open-ended mutual funds and was examined in the higher moments framework through DEA. Their study concluded that when there is a higher moment, the efficiency score of investment rises and the number of effective funds are more because larger number of output indicators in DEA leads to more DMU effective.

Bhagyashree & Kishori (2016) analyzed the performance of open-ended growth oriented mutual funds over a period of 4 years (April 2011-March 2015). Their study showed that 14 out of 30 mutual funds outperformed their benchmarks and all the funds showed positive returns. The results also revealed that Reliance Regular Savings Fund Equity, SBI Contra Fund, HDFC Equity Fund were few of the schemes that underperformed due to diversification problem and Sharpe ratio was positive for all schemes inferring that returns of the funds were more than risk free rate. **Pangestuti et.al. (2017)** analyzed 42 equity mutual funds in Indonesia and apart from only applying Sharpe and Treynor ratio also applied adjusted Sharpe index and adjusted Jensen index and Sortino ratio. Results revealed that equity mutual funds included in the study were already well diversified as they showed consistent performance with Sharpe Index and Treynor ratio. It is evident from the above discussion that there are very few studies that examined the impact of COVID-19 on mutual funds. The previous studies done analyzed the performance of mutual funds in the normal scenario. In this backdrop, this study is done to examine the impact of COVID-19 on the efficiency of mutual funds. Furthermore, the study will provide empirical evidence on efficiency of debt funds during COVID-19 which is not examined in earlier studies, not even in the normal conditions. The study will facilitate the investors to choose highly efficient schemes so that their investment objectives are attained. The specific objectives of the study are stated below:

1. To examine the efficiency of open-ended equity large cap, multi cap, mid-cap and small-cap mutual fund schemes during COVID-19.
2. To examine the efficiency of select open-ended debt mutual fund schemes during COVID-19

III. Data and Methodology

The data is collected from the monthly fact sheet of each mutual fund house from Association of Mutual Funds of India (AMFI). From the total 39 mutual fund companies we have selected top 21 companies incorporated before 2015 with high AUM. Based on the study by Banker et.al. (1984) and Hollingsworth and Smith (2003), we have employed BCC-DEA model as our data contains variables which are expressed as ratios. The first case of COVID was reported in November-2019 in China. The monthly observations of variables are taken for time period November-2019 to October-2020. To measure the performance of portfolios or mutual funds, data envelopment analysis (DEA) has been used.

We have employed Data Envelopment Analysis to examine the efficiency of mutual funds in large-cap, multi-cap, mid-cap and small-cap segment. Further, we have also tried to examine their efficiency in select debt schemes. DEA allows the use of multiple inputs/outputs without imposing any functional form on data or making assumptions of inefficiency. DEA provides a good outlook as it accounts for various inputs and outputs concurrently while still offering a single real number as a performance index. DEA offer superior advantages over other techniques such as CAPM, risk-return measure as no benchmark is required to evaluate the performance of particular scheme. It captures how well a MF company performs relative to its peers. The relative efficiency is measured based on multiple attributes (expense ratio, asset under management, risk etc.) which is not feasible in any other technique. It also overcomes the problem of unit invariance. The values of negative returns are translated into positive values by adding a large positive number in return of all the MF companies for the time period covered. Based on the prior studies (Sedzro and Sardano, 1999; Morey and Morey, 1999; Choi and Murthi, 2001; Sengupta and Zohar, 2001; Basso and Funari, 2001, Daraio and Simar, 2006, Gao et.al., 2020, Galdegera, 2003, Galdagera et al. 2018, Tsolas, 2020), the output variables are listed below:

1. Return: It is the compounded annual growth rate (CAGR) for 1 year of a particular scheme whether equity or debt.
2. Net Asset value: It refers to net asset value which is calculated by dividing total asset value after deducting all liabilities and expenses with number of units outstanding.

The input variables include:

1. Total expense ratio: It refers to the management and operational fees charged by the mutual fund companies from the investors to manage their money. It affects the profitability of the investors and varies from 0.1% to 2.5%. Higher expense ratios are not desirable from investors perspective.
2. Fund size: It is the average assets under management (AUM) by mutual fund or a firm and refers to the current market value of investment of a particular scheme.
3. Sharpe Ratio: It is a measure of risk-adjusted returns. It is computed by dividing the excess return on a mutual fund over benchmark by standard deviation.
4. Beta: It captures the volatility of a particular mutual fund scheme vis-a-vis the market.
5. Standard Deviation: It is a statistical measure of the range of investment performance. Higher value indicates greater volatility and wide range of performance.
6. Modified duration: It is measure of price sensitivity of bond for unit change in yield.
7. Yield to maturity: Return expected on a bond if held till maturity.

We have taken growth option diversified mutual funds that include only capital gain but not dividend.

IV. Empirical Results and discussion

As stated earlier, the objective of this paper is to analyze the efficiency of open-ended MF schemes in India. Using DEA approach, we tried to identify the most efficient MF schemes during COVID-19. The results presented in Table 1 show that in case of large cap funds, many MF companies were efficient

during pandemic. In case of large cap funds, out of the total of 20 fund houses, 11 (55%) are found to be relatively efficient whereas only 5 were inefficient with efficiency score less than 0.8.

Table 1: Efficiency scores in large-cap scheme

DMU Name	Efficiency Scores	Rank
Axis Mutual Fund	1.00000	1
Baroda Mutual Fund	1.00000	1
Canara Robeco Mutual Fund	1.00000	1
Edelweiss Mutual Fund	1.00000	1
Franklin Templeton Mutual Fund	1.00000	1
HDFC Mutual Fund	1.00000	1
BNP Paribus Mutual Fund	1.00000	1
IDBI Mutual Fund	1.00000	1
PGIM Mutual Fund	1.00000	1
INVESCO Mutual Fund	1.00000	1
Kotak Mutual Fund	1.00000	1
Union Mutual Fund	0.93080	12
DSP Mutual Fund	0.87394	13
UTI Mutual Fund	0.84314	14
IDFC Mutual Fund	0.83146	15
AB Sunlife Mutual Fund	0.79458	16
L & T Mutual Fund	0.70126	17
SBI Mutual Fund	0.62704	18
ICICI Mutual Fund	0.61362	19
Nippon Mutual Fund	0.10951	20
Mean Efficiency score	0.86622	

The mean technical efficiency score of 0.8662 implying that the overall performance of large cap fund schemes of various mutual fund companies was above average. There is a possibility to improve once the economy starts recovering from the pandemic. The lowest efficiency score was of Nippon Mutual Fund with a value of 0.1095. In order to become efficient, this fund needs lot of improvement regarding usage of inputs. It is worth mentioning that this fund house is relatively new as compared to other houses.

Regarding the performance of multi-cap schemes of various fund houses, the results of DEA are represented in table 2. It is evident from the Table 3 that multi-cap mutual fund schemes of Baroda, Aditya Birla, Canara, Franklin Templeton, HDFC, BNP Paribus, IDBI, UTI and PGIM have performed well in pandemic as they lie on the efficiency frontier. Around 50 % of the MF companies did well in multi-cap schemes. In case of multi-cap scheme, Nippon has least efficiency of 0.165. The mean efficiency score is 0.852

Table 2: Efficiency scores in multi-cap schemes

DMU Name	Efficiency	Rank
Baroda Mutual Fund	1.00000	1
AB Sunlife Mutual Fund	1.00000	1
Canara Robeco Mutual Fund	1.00000	1
Franklin Templeton Mutual Fund	1.00000	1
HDFC Mutual Fund	1.00000	1
BNP Paribus Mutual Fund	1.00000	1
IDBI Mutual Fund	1.00000	1
UTI Mutual Fund	1.00000	1
PGIM Mutual Fund	1.00000	1
DSP Mutual Fund	0.96301	10
INVESCO Mutual Fund	0.95706	11
Axis Mutual Fund	0.95597	12
Union Mutual Fund	0.89104	13
ICICI Mutual Fund	0.77285	14
Kotak Mutual Fund	0.75908	15
Edelweiss Mutual Fund	0.70343	16
IDFC Mutual Fund	0.65597	17
SBI Mutual Fund	0.61462	18
L & T Mutual Fund	0.60220	19
Nippon Mutual Fund	0.16572	20
Mean Efficiency Score	0.85205	

An investor may choose to invest in multi-cap fund schemes of good number of mutual fund houses based on the lowest NPV. Noted further, axis multi-cap fund is comparatively less efficient in this multi-cap fund segment.

It is evident from the results in Table 3, that out of the total 16 fund houses, 6 were found to be highly efficient in mid-cap segment. It is pertinent to note that the many fund houses do not have mid-cap schemes. Consequently, the total MF schemes analyzed in this segment is limited to 16. Only 37% (6 out of 16) were there on the efficiency frontier. Interestingly, in mid-cap segment, Nippon is found to be on efficiency frontier, though it was least efficient in large and multi-cap segment.

Table 3: Efficiency scores in mid-cap Schemes

DMU Name	Efficiency	Rank
Axis Mutual Fund	1.00000	1
Baroda Mutual Fund	1.00000	1
PGIM Mutual Fund	1.00000	1
DSP Mutual Fund	1.00000	1
INVESCO Mutual Fund	1.00000	1

Nippon Mutual Fund	1.00000	1
Franklin Templeton Mutual Fund	0.97031	7
Edelweiss Mutual Fund	0.76822	8
UTI Mutual Fund	0.76531	9
Kotak Mutual Fund	0.72288	10
AB Sunlife Mutual Fund	0.69468	11
BNP Paribus Mutual Fund	0.56421	12
SBI Mutual Fund	0.53804	13
L & T Mutual Fund	0.51758	14
HDFC Mutual Fund	0.47413	15
ICICI Mutual Fund	0.29984	16
Mean Efficiency Score	0.7697	

The lowest efficiency score is 0.299 of ICICI mutual fund which can be attributed to high value of AUM as compared to return. The mean efficiency score is 0.7697 which is less than large and multi-cap schemes.

In case of small-cap, the total MF houses are reduced to 11 as this scheme is operated by few fund houses. Only three schemes out of 11 were found to be efficient which include, Axis, Nippon and Union. HDFC small cap fund was least efficient having an efficiency score of 0.0784. The mean efficiency score is found to be 0.659 which is lowest of large-cap, multi-cap and mid-cap schemes (Table 4).

Table 4: Efficiency scores in small-cap Schemes

DMU Name	Efficiency	Rank
Axis Mutual Fund	1.00000	1
Nippon Mutual Fund	1.00000	1
Union Mutual Fund	1.00000	1
Kotak Mutual Fund	0.91213	4
DSP Mutual Fund	0.86256	5
SBI Mutual Fund	0.80827	6
ICICI Mutual Fund	0.68235	7
Franklin Templeton Mutual Fund	0.62042	8
L & T Mutual Fund	0.14315	9
AB Sunlife Mutual Fund	0.14271	10
HDFC Mutual Fund	0.07842	11
Mean efficiency score	0.65909	

Regarding open ended debt mutual funds, we have taken only two popular schemes offered by 17 fund houses, namely, Corporate Debt fund and Gilt fund schemes.

Table 5 reflect the efficiency scores of corporate debt schemes of 17 fund houses, out of which 7 were fully efficient with a score of 1 which include, Edelweiss, BNP Paribus, PGIM, INVESCO, DSP, Kotak, and Nippon. Franklin Templeton has a lowest efficiency score of 0.675. This may be perhaps due to winding up of various debt schemes by the fund house during COVID pandemic. The mean efficiency score is 0.8606 which is greater than the open-ended equity schemes.

Table 5: Efficiency scores of corporate debt scheme

DMU Name	Efficiency	Rank
Edelweiss Mutual Fund	1.00000	1
BNP Paribus Mutual Fund	1.00000	1
PGIM Mutual Fund	1.00000	1
DSP Mutual Fund	1.00000	1
INVESCO Mutual Fund	1.00000	1
Kotak Mutual Fund	1.00000	1
Nippon Mutual Fund	1.00000	1
Canara Robeco Mutual Fund	0.93809	8
AB Sunlife Mutual Fund	0.87482	9
HDFC Mutual Fund	0.78504	10
ICICI Mutual Fund	0.75737	11
Axis Mutual Fund	0.75395	12
L & T Mutual Fund	0.74657	13
UTI Mutual Fund	0.73588	14
IDFC Mutual Fund	0.68224	15
Union Mutual Fund	0.68159	16
Franklin Templeton Mutual Fund	0.67592	17
Mean Efficiency Score	0.8606	

In case of Gilt fund schemes, 7 schemes were found to be fully efficient. In this segment also Franklin Templeton is least efficient with a lowest score of 0.6899.

Table 7: Efficiency score of Gilt fund Schemes

DMU Name	Efficiency	Rank
Axis Mutual Fund	1.00000	1
Baroda Mutual Fund	1.00000	1
AB Sunlife Mutual Fund	1.00000	1
IDBI Mutual Fund	1.00000	1
IDFC Mutual Fund	1.00000	1
UTI Mutual Fund	1.00000	1
INVESCO Mutual Fund	1.00000	1
Edelweiss Mutual Fund	0.99925	8
DSP Mutual Fund	0.99191	9

Nippon Mutual Fund	0.97407	10
SBI Mutual Fund	0.96831	11
ICICI Mutual Fund	0.87328	12
Kotak Mutual Fund	0.84392	13
PGIM Mutual Fund	0.83997	14
HDFC Mutual Fund	0.83709	15
Canara Robeco Mutual Fund	0.83569	16
L & T Mutual Fund	0.72093	17
Franklin Templeton Mutual Fund	0.68996	18
Mean Efficiency score	0.9208	

The mean efficiency score in case of gilt-fund schemes is 0.9208 which is highest of all the schemes analyzed in this study. Mutual fund schemes investing in government securities prove to be the most efficient during pandemic. This finding assert that investor must invest some part of their investment in secured mutual funds such as gilt schemes in order to hedge against uncertainties such as COVID-19.

V. Concluding Remarks

In this paper, we tried to examine the performance efficiency of MF during COVID-19 in various equity and debt open-ended schemes by using non-parametric technique DEA. We have taken the sample of 21 fund houses to represent the mutual fund industry. Schemes which were operational since 2015 were taken into consideration. Due to the market volatility driven by COVID-19, there are continuous changes in the asset valuations. As a result, fund managers need to reposition their investment to sustain investors' confidence in the mutual funds. It can be inferred from the empirical results that most of the fund houses are efficient in large and multi-cap segment during COVID. The outbreak is not a bearish trigger for large-cap value stocks (Henry, 2020). Our results broadly support this fact as most of the large and multi cap equity schemes were efficient during COVID. However, in case of mid-cap and small cap segment, only few schemes are on efficiency frontier due to high expense ratio and volatility. Following the input minimization model, the greater reductions in inputs are needed for the funds to become fully efficient, especially for new mutual companies.

Interestingly, there is not a single fund house which is efficient in all the segments. This implies that investor can cautiously select the best schemes based on the efficiency scores. Based on the NAV and expense ratio, investor should invest money in efficient schemes to maximize his return. It is further evident from the efficiency ratios that debt funds tend to become more efficient during COVID-19 with mean efficiency scores greater than 0.85.

The results will help the investor and fund managers to form a good investment strategy for their portfolios and reposition their investment. While choosing the debt schemes, investor can make a wise selection based on Duration and yield. During the period of study, Axis Mutual fund is found to efficient on all the segment except Corporate and multi-cap scheme. On the contrary, there are MF companies which specialize in one segment such as UTI, Nippon, IDBI, INVESCO, Edelweiss. The inefficient funds should emphasize on improvement in their operational efficiency to sustain growth in future. As the results are sample specific, future researches can use this framework to appraise the performance of other

funds with a longer duration to validate the findings. Furthermore, dynamic DEA approach can be used with more attributes instead of static DEA model used in this study to investigate the dynamic evaluation of performance.

References:

- Alam, Mahfooz. (2019). Mutual Fund Performance: Evidence from India. *International Journal of Recent Technology and Engineering (IJRTE)*. Vol. 08, pp 2277-3878.
- Basso, Antonella & Funari, Stefania, 2001. "A data envelopment analysis approach to measure the mutual fund performance," *European Journal of Operational Research*, Elsevier, vol. 135(3), pages 477-492
- Banker, R.D, Charnes, A. and Cooper, W.W. (1984), Some Models for Estimating Technical and Scale Inefficiencies in Data Envelopment Analysis, *Management Science*, 30(9),
- Bangash, R., A. Hussain & M. H. Azhar (2018). Performance Evaluation of Mutual Funds: A Data Envelopment Analysis. *Global Social Sciences Review*, 3(2), 212-236.
- Bhagyasree, N., & Kishori, B. (2016). A Study on Performance Evaluation of Mutual Funds Schemes in India, *Economics*
- Choi, Y.K. and Murthi, B.P.S. (2003), Relative Performance Evaluation of Mutual Funds: A Non-Parametric Approach, *Journal of Business Finance & Accounting*, 28(7-8).
- Daraio, Cinzia & Simar, Léopold. (2006). A Robust Nonparametric Approach to Evaluate and Explain the Performance of Mutual Funds. *European Journal of Operational Research*. 175. 516-542.
- Demirguc-Kunt, Asli; Pedraza, Alvaro; Ruiz-Ortega, Claudia. 2020. Banking Sector Performance During the COVID-19 Crisis. Policy Research Working Paper;No. 9363. World Bank, Washington, DC.
- Financial Stability Report (2021), Lessons Learnt from the COVID-19 Pandemic from a Financial Stability Perspective. Final report.
- Galagedera, Don. (2003). Investment performance appraisal methods with special reference to data envelopment analysis. *Sri Lanka Journal of Management*. 8. 48-70.
- Gao J, O'Sullivan N, Sherman M (2020), An evaluation of Chinese securities investment fund performance. *Quarterly Review of Economics and Finance*. 2020;76:249–259.
- Guo, J., Ma, C. and Zhao, Z. (2012), Performance Evaluation of Investment Funds with DEA and Higher Moments Characteristics: Financial Engineering Perspective, *Systems Engineering Procedia* 3, 209 – 216
- Henry, P. (2020), COVID-19 and the investment management industry: Investment management operating at the speed of the markets, *Deloitte Insights Report*.
- Hollingsworth, Bruce & PC, Smith. (2003). Use of ratios in data envelopment analysis. *Applied Economics Letters*. 10. 733-735. 10.1080/1350485032000133381.

Kozak (2021), The Impact of COVID-19 on Bank Equity and Performance: The Case of Central Eastern South European Countries, *Sustainability* **2021**, *13*(19), 11036. Available at <https://doi.org/10.3390/su131911036>

Morey, M.R. and Morey, R.C. (1999). Mutual fund performance appraisals: a multi-horizon perspective with endogenous benchmarking, *Omega*, *27*, 241-258.

Muhammad Sali Maheen, 2021. "Impact of COVID-19 on the performance of emerging market mutual funds: evidence from India," *Future Business Journal*, Springer, vol. 7(1), pages 1-8

Pangestuti, I., Wahyudi, S. and Robiyanto, R. (2017), Performance Evaluation of Equity Mutual Funds in Indonesia, *Jurnal Keuangan dan Perbankan*, *21*(4): 527–542

Pastor, Lubos and Vorsatz (2020), Blair, Mutual Fund Performance and Flows During the COVID-19 Crisis (August 13, 2020). Chicago Booth Research Paper No. 20-18, Fama-Miller Working Paper, Available at SSRN: <https://ssrn.com/abstract=3648302> or <http://dx.doi.org/10.2139/ssrn.3648302>

Prasanna, P.K. (2012). Performance of Exchange-Traded Funds in India. *International Journal of Biometrics*, *7*, 122.

Sathish P. and Srinivasan KS (2016), Performance evaluation of selected open ended mutual fund schemes in India: An empirical study, *Sona Global Management Review*, Vol 10(3), 92-105

Sedzro, K and Sardano, D. (1999). Mutual fund performance evaluation using data envelopment analysis, Working Paper, School of Business, University of Quebec at Montreal, Canada.

Sengupta, Jati & Zohar, T. (2001). Nonparametric Analysis of Portfolio Efficiency, *Applied Economics Letters*. *8*. 249-52.

Sharma G. and Sharma V. (2018), Performance evaluation of equity mutual funds using data envelopment analysis, *International Journal of Financial Services Management*, *9*(1), 1-13

Tripathi, S. and Japee, G. P. (2020), Performance Evaluation of Selected Equity Mutual Funds in India (March 28, 2020). *GAP GYAN - A GLOBAL JOURNAL OF SOCIAL SCIENCES*, 2020, Available at SSRN: <https://ssrn.com/abstract=3638852>

Sedzro, K and Sardano, D. (1999). Mutual fund performance evaluation using data envelopment analysis, Working Paper, School of Business, University of Quebec at Montreal, Canada.

Tsolas, I.E. (2020), Precious Metal mutual fund performance evaluation: A series Two-stage DEA Modelling Approach, *Journal of Risk and Financial Management*, *13*(87).

Weltman J (2020) ECR risk experts contemplate another financial crisis_Euromoney. [www.Euromoney.com](https://www.euromoney.com). <https://www.euromoney.com/article/b1ktp0wqc12jyb/ecr-risk-experts-contemplate-another-financial-crisis>