Mutual Fund in India: Data Exploration and Analysis

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INTRODUCTION

A mutual fund is a type of financial vehicle made up of a pool of money collected from many investors to invest in securities like stocks, bonds, money market instruments, and other assets. Mutual funds are operated by professional money managers, who allocate the fund's assets and attempt to produce capital gains or income for the fund's investors. A mutual fund's portfolio is structured and maintained to match the investment objectives stated in its prospectus.

Mutual funds give small or individual investors access to professionally managed portfolios of equities, bonds, and other securities. Each shareholder, therefore, participates proportionally in the gains or losses of the fund. Mutual funds invest in a vast number of securities, and performance is usually tracked as the change in the total market cap of the fund—derived by the aggregating performance of the underlying investments.

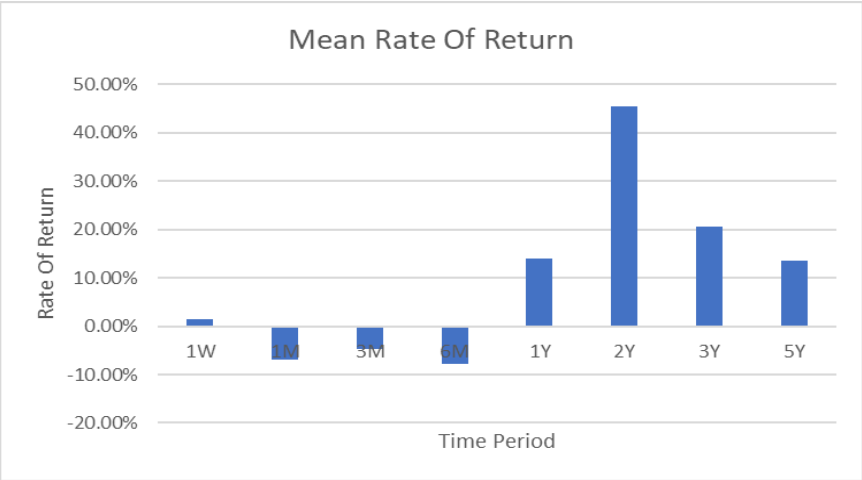
There are four broad types of mutual funds: Equity (stocks), fixed income (bonds), money market funds (short-term debt), or both stocks and bonds (balanced or hybrid funds).

The price of a mutual fund share is referred to as the net asset value (NAV) per share, sometimes expressed as NAVPS. A fund's NAV is derived by dividing the total value of the securities in the portfolio by the total amount of shares outstanding. Outstanding shares are those held by all shareholders, institutional investors, and company officers or insiders. Mutual fund shares can typically be purchased or redeemed as needed at the fund's current NAV, which—unlike a stock price—doesn't fluctuate during market hours, but it is settled at the end of each trading day.

I have used the data retrieved from Money Control Mutual Fund web portal, for India's mutual fund market. The data contains various mixture of funds like ELSS, Contra fund, Focused fund, Flexi cap fund, etc. It shows the annualized historical returns over a period.

EXECUTIVE SUMMARY

The data that was considered for analysis consists of various types of mutual funds with their Rate Of Return (ROR) over various terms like 1 week, 1 month, 6 months to 5 years.



Below are the hypotheses considered:

- **Ho: Null Hypothesis:** Mutual funds are risky and does not give good returns.

  Average rate of return (μ) <= ~8 %

- **Ha: Alternate Hypothesis:** Mutual funds are safe and give good returns.

  Average rate of return (μ) > 8%

The analysis showed that mutual funds are although risker, they offer a great opportunity of profits for investors who stick to their investments for longer terms. When invested for shorter term, less than 1 year, the funds showed negative return or loss.

Part 1: COLLECTION OF DATA SET

The dataset used in this project was obtained from Moneycontrol.com

This is what my data looks like as a bird's view

Scheme Name	Plan	Category Name	Crisil Rank	AuM (Cr)	1W	1M	3M	6M	YTD	1Y	2Y	3Y	5Y	1
SBI Contra Fund - Direct Plan - GrowthContra Fund	Direct Plan	Contra Fund	5	4,490.53	1%	-5%	-1%	-3%	-3%	21%	60%	24%	14%	-
Aditya Birla Sun Life Tax Plan - Direct Plan - GrowthELSS	Direct Plan	ELSS	4	382.63	0%	-7%	-7%	-13%	-10%	-2%	21%	7%	7%	-
BOI AXA Tax Advantage Fund - Direct Plan - GrowthELSS	Direct Plan	ELSS	5	595.57	1%	-8%	-7%	-13%	-13%	8%	39%	23%	16%	-
Canara Robeco Equity Tax Saver - Direct Plan - GrowthELS	Direct Plan	ELSS	4	3,629.47	1%	-6%	-8%	-11%	-10%	8%	38%	20%	15%	-
IDFC Tax Advantage (ELSS) Fund - Direct Plan - GrowthELS	Direct Plan	ELSS	5	3,741.56	1%	-7%	-4%	-6%	-6%	14%	53%	20%	15%	-
Kotak Tax Saver Scheme - Direct Plan - GrowthELSS	Direct Plan	ELSS	4	2,670.33	1%	-7%	-4%	-8%	-6%	12%	40%	17%	13%	-
Mahindra Manulife ELSS Kar Bachat Yojana - Direct Plan -	Direct Plan	ELSS	4	461.74	1%	-8%	-6%	-8%	-8%	13%	41%	17%	11%	-
Mirae Asset Tax Saver Fund - Direct Plan - GrowthELSS	Direct Plan	ELSS	4	11,962.66	1%	-6%	-6%	-10%	-8%	9%	44%	21%	17%	-
PGIM India ELSS Tax Saver Fund - Direct Plan - GrowthELS	Direct Plan	ELSS	4	388.12	1%	-7%	-5%	-5%	-6%	13%	43%	18%	13%	-
Quant Tax Plan - Direct Plan - GrowthELSS	Direct Plan	ELSS	5	1,316.08	3%	-8%	-1%	-3%	-2%	19%	69%	37%	23%	-
Union Long Term Equity Fund - Direct Plan - GrowthELSS	Direct Plan	ELSS	4	497.04	1%	-6%	-5%	-10%	-9%	13%	39%	18%	12%	-
Canara Robeco Flexi Cap Fund - Direct Plan - GrowthFlexi	Direct Plan	Flexi Cap Fur	4	7,284.78	1%	-6%	-8%	-11%	-10%	9%	35%	18%	14%	-
Edelweiss Flexi Cap Fund - Direct Plan - GrowthFlexi Cap F	Direct Plan	Flexi Cap Fur	4	925.87	0%	-7%	-7%	-10%	-10%	9%	38%	16%	13%	-

- This data contains various mutual fund schemes of various mutual fund companies of India.
- It has total of 64 rows and 14 columns with both numeric and textual data, this set is sufficient for analysis.
- It represents the mutual fund scheme name, category, Crisil rank and its rate of return over the period of 1 week, 1 month, 3-month, 6-month, 1 year, 2 years, 3 years and 5 years.
- It contains NAV & Returns data as on 18-May-22.
- If 3m column is 10% it means, fund has given 10% return in last 3 months and If 1Y column is 10% that means, fund has given 10% returns in last 1 year.

Part 2: EXPLORATORY DATA ANALYSIS

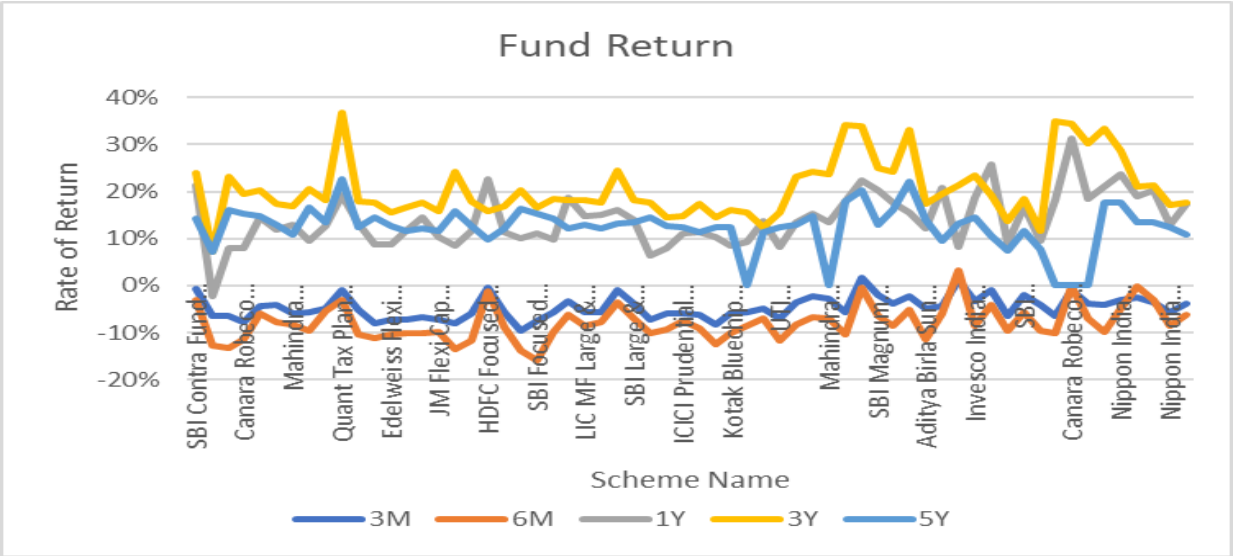
2.1 Descriptive statistics of data set

It describes or summarizes the characteristics such as a mean, standard error, median, mode, range, minimum, maximum etc. of the data set. It represents the collective properties of the elements of the data set such as

DESCRIPTIVE STATISTICS OF MUTUAL FUNDS RATE OF RETURN								
Statistics	***1W***	***1M***	***3M***	***6M***	***1Y***	***2Y***	***3Y***	***5Y***
Mean	1.37%	-6.96%	-4.64%	-7.91%	14.06%	45.37%	20.59%	13.52%
Standard Error	0.12%	0.15%	0.31%	0.47%	0.71%	1.38%	0.80%	0.40%
Median	1.18%	-7.00%	-5.10%	-8.54%	13.30%	43.20%	18.29%	12.95%
Mode	1.19%	-6.04%	-8.02%	-3.08%	#N/A	39.35%	#N/A	13.44%
Standard Deviation	0.91%	1.17%	2.40%	3.68%	5.60%	10.88%	6.33%	3.03%
Sample Variance	0.01%	0.01%	0.06%	0.14%	0.31%	1.18%	0.40%	0.09%
Kurtosis	-41.72%	-24.76%	-10.31%	67.78%	100.10%	-1.38%	64.67%	184.84%
Skewness	54.82%	-21.47%	50.91%	65.76%	37.26%	72.11%	99.94%	78.68%
Range	3.87%	5.51%	11.28%	19.13%	33.48%	49.78%	29.54%	15.48%
Minimum	-0.24%	-9.68%	-9.63%	-15.91%	-2.15%	21.32%	7.28%	7.25%
Maximum	3.63%	-4.17%	1.65%	3.22%	31.33%	71.10%	36.82%	22.73%
Sum	84.89%	-431.56%	-287.79%	-490.40%	871.73%	2813.19%	1276.30%	770.53%
Count	6200.00%	6200.00%	6200.00%	6200.00%	6200.00%	6200.00%	6200.00%	5700.00%

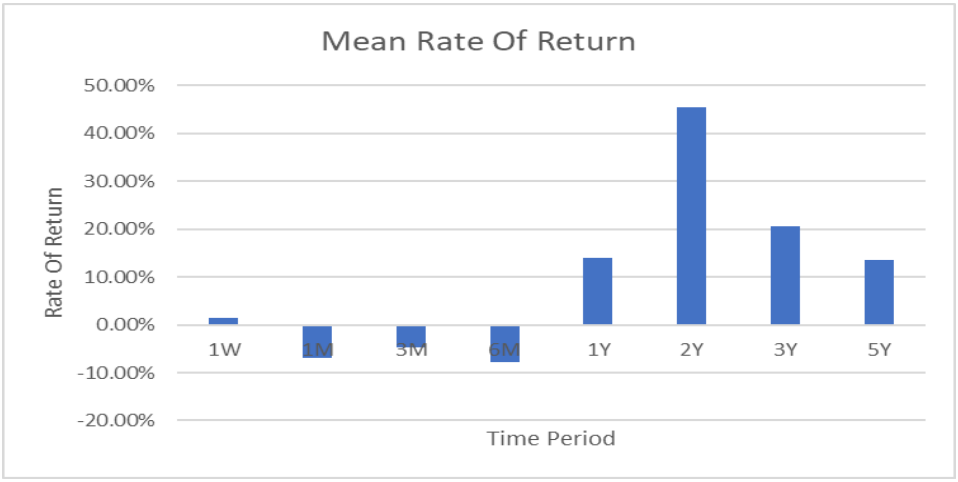
- The mean rate of return of all funds in the data set for the period of 3 months is -4.64, 6 months is -7.91% whereas for the period of 1y is 14.06%, 2y is 45.37% and 5y is 13.52%
- The sample above shows that mutual funds show a downward trend initially, then it takes an upward growth. Hence, it is beneficial for long term investments.
- Also, mutual funds are not very stable funds unlike Fixed Deposits, they keep fluctuating over the span of investment.

2.2 Line Graph: *Rate of Returns of the funds*



It shows how the rate of return of any fund changes over time. It shows the rate of return of any fund is negative (loss) for a shorter duration of time that is for 3months and 6 months but over the longer duration that is for 1yr, 3yr and 5yr the fund gives a positive (profit) return and most of the funds gives a return of more than 10%.

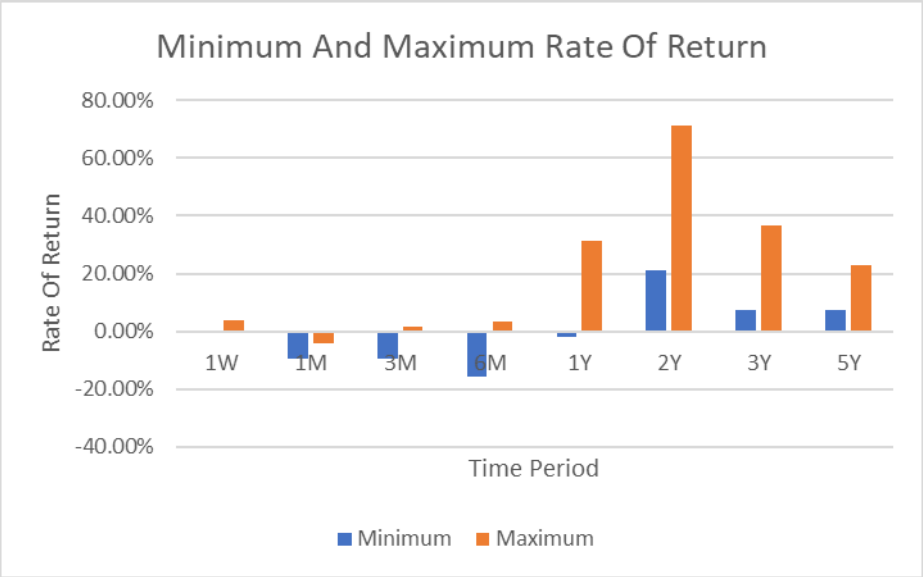
2.3 Bar Graph: *Mean Rate of Return*



It represents the mean rate of return of all funds spanning a period from 1 week to 5 years. The mean rate of return of all funds over the period of 1 month, 3 months and 6 months is negative that means the funds were not performing well and funds are making loss. But for the period of 1, 2, 3 and 5 years,

the average rate return of funds is positive, and Rate Of Returns (ROR) are more than 10% and the average ROR of all funds is highest in 2nd Year and it is around 45%.

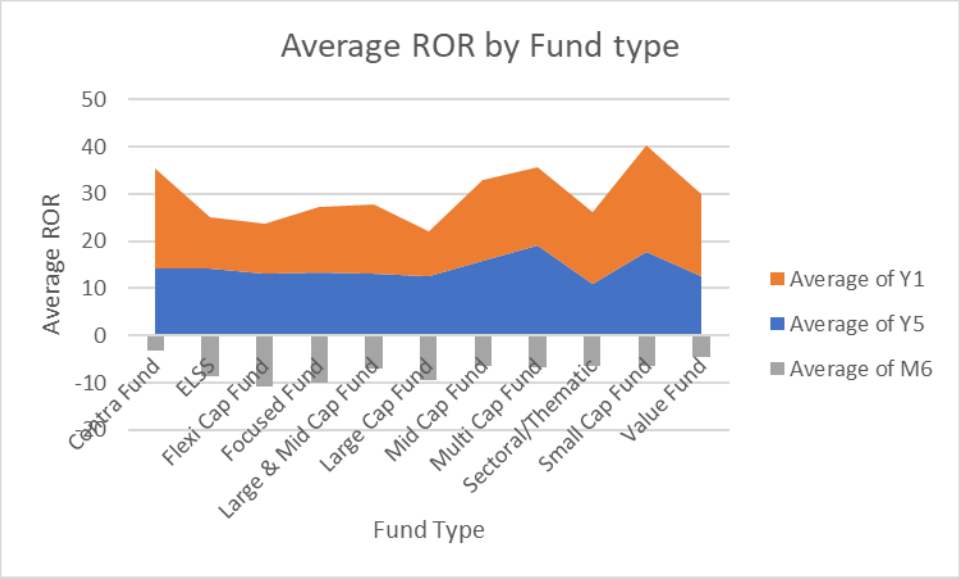
2.4 Bar Graph: Minimum and Maximum Rate of Return



The above chart shows the minimum and maximum ROR for the time periods. It shows that, for periods upto 6 months, the funds perform poorly and shows very little to low maximum ROR. But for periods above 1 year, the funds progressed very well and gave the maximum ROR in 2nd year, but continues to be profitable for longer periods.

2.5 Stacked Area / Clustered Column Graph: Average ROR by fund type

Row Labels	Average of Y5	Average of Y1	Average of M6
Contra Fund	**14.27**	**21.23**	**-3.08**
ELSS	**14.24**	**10.776**	**-8.769**
Flexi Cap Fund	**13.02857143**	**10.56**	**-10.92285714**
Focused Fund	**13.4025**	**13.7625**	**-9.9325**
Large & Mid Cap Fund	**13.01666667**	**14.68**	**-7.118333333**
Large Cap Fund	**12.44875**	**9.618888889**	**-9.548888889**
Mid Cap Fund	**15.796**	**17.13**	**-6.538333333**
Multi Cap Fund	**19.195**	**16.535**	**-6.865**
Sectoral/Thematic	**11.04625**	**15.13875**	**-6.4675**
Small Cap Fund	**17.69**	**22.508**	**-6.41**
Value Fund	**12.56**	**17.405**	**-4.51**
Grand Total	**13.51807018**	**14.06016129**	**-7.909677419**



The above data and graph shows the average ROR for the term of 6 months, 1 year and 5 years by the mutual fund type. This depicts that all the funds performed poorly for a 6 month term, gave maximum return for the 1 year term and made handsome profit for 5 years term as well. So, one should invest in mutual funds for a period of at least one year.

Part 3: HYPOTHESIS TESTING

Step 1: Defining the hypothesis

Given the general belief among people that mutual funds tend to be risker and are not safe to invest. Following is the null hypothesis:

- **Ho: Null Hypothesis:** Mutual funds are risky and does not give good returns.

  Average rate of return (μ) <= ~8 %

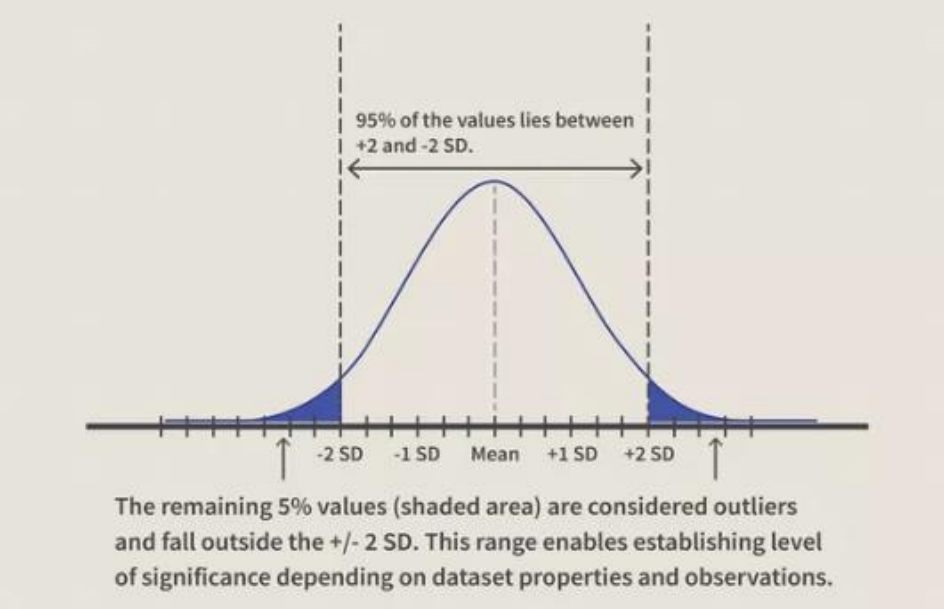
- **Ha: Alternate Hypothesis:** Mutual funds are safe and give good returns.

  Average rate of return (μ) > 8%

Step 2: Setting the criteria

For a normal distribution, 95% of the values lie within two standard deviations of the population mean. Hence, this normal distribution and central limit assumption for the sample dataset allows us to establish 5% as a significance level. It makes sense as, under this assumption, there is less than a 5% probability (100-95) of getting outliers that are beyond two standard deviations from the population mean. For financial calculations (including behavioral finance), 5% is the generally accepted limit. If we find any calculations that go beyond the usual two standard deviations, then we have a strong case of outliers to reject the null hypothesis.

Graphically, it is represented as follows:



Step 3: Calculating the statistics

3.1 Statistics for 1 week:

```
        One Sample t-test

data:  weekOneReturn
t = -57.509, df = 61, p-value = 1
alternative hypothesis: true mean is greater than 8
95 percent confidence interval:
 1.176617      Inf
sample estimates:
mean of x
 1.369194
```

As P value is 1, we accept the Null hypothesis that Mutual funds are risky and does not give many returns and average rate of return (μ) <= ~8

3.2 Statistics for 1 month:

```
        One Sample t-test

data:  OneMonthReturn
t = -100.8, df = 61, p-value = 1
alternative hypothesis: true mean is greater than 8
95 percent confidence interval:
 -7.208527       Inf
sample estimates:
mean of x
-6.960645
```

As P value is 1, we accept the Null hypothesis that Mutual funds are risky and does not give many returns and average rate of return (μ) <= ~8

3.3 Statistics for 3 months:

```
        One Sample t-test

data:  ThreeMonthReturn
t = -41.403, df = 61, p-value = 1
alternative hypothesis: true mean is greater than 8
95 percent confidence interval:
 -5.151744       Inf
sample estimates:
mean of x
-4.641774
```

As P value is 1, we accept the Null hypothesis that Mutual funds are risky and does not give many returns and average rate of return (μ) <= ~8

3.4 Statistics for 6 months:

```
        One Sample t-test

data:  SixMonthReturn
t = -34.016, df = 61, p-value = 1
alternative hypothesis: true mean is greater than 8
95 percent confidence interval:
 -8.690861       Inf
sample estimates:
mean of x
-7.909677
```

As P value is 1, we accept the Null hypothesis that Mutual funds are risky and does not give many returns and average rate of return (μ) <= ~8

3.5 Statistics for 1 year:

```
        One Sample t-test

data:  OneYearReturn
t = 8.5178, df = 61, p-value = 2.842e-12
alternative hypothesis: true mean is greater than 8
95 percent confidence interval:
 12.87184      Inf
sample estimates:
mean of x
 14.06016
```

As p-value = 2.842e-12, which means it is very close to zero, so we reject the Null hypothesis and accept the alternative hypothesis that Mutual funds are safe and give good returns and average rate of return (μ) > 8%

3.6 Statistics for 2 years:

```
        One Sample t-test

data:  TwoYearReturn
t = 27.055, df = 61, p-value < 2.2e-16
alternative hypothesis: true mean is greater than 8
95 percent confidence interval:
 43.06674      Inf
sample estimates:
mean of x
 45.37403
```

As P-value < 2.2e-16, which means it is very close to zero, so we reject the Null hypothesis and accept the alternative hypothesis that Mutual funds are safe and give good returns and average rate of return (μ) > 8%

3.7 Statistics for 3 years:

```
        One Sample t-test

data:  ThreeYearReturn
t = 15.655, df = 61, p-value < 2.2e-16
alternative hypothesis: true mean is greater than 8
95 percent confidence interval:
 19.24275      Inf
sample estimates:
mean of x
 20.58548
```

As P-value < 2.2e-16, which means it is very close to zero, so we reject the Null hypothesis and accept the alternative hypothesis that Mutual funds are safe and give good returns and average rate of return (μ) > 8%

3.8 Statistics for 5 years:

```
        One Sample t-test

data:  FiveYearReturn
t = 13.738, df = 56, p-value < 2.2e-16
alternative hypothesis: true mean is greater than 8
95 percent confidence interval:
 12.8463     Inf
sample estimates:
mean of x
 13.51807
```

As P-value < 2.2e-16, which means it is very close to zero, so we reject the Null hypothesis and accept the alternative hypothesis that Mutual funds are safe and give good returns and average rate of return (μ) > 8%

PART 4: ANOVA ANALYSIS

```
> summary(Anova_Result)
             Df Sum Sq Mean Sq F value Pr(>F)
ind           7 141702   20243   729.4 <2e-16 ***
Residuals   483  13405      28
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

As P-value < 2e-16, which means it is very close to zero, so we reject the Null hypothesis and accept the alternative hypothesis that Mutual funds are safe and give good returns and average rate of return (μ) > 8%

So, as part of the Anova analysis, I have combined all the data and found that mutual funds are profitable and safer if invested for longer terms.

Conclusion

My analysis done as part of this project leads me to conclude that the **Ho: Null hypothesis is wrong**, i.e., Mutual funds not that risker and it gives a handsome return if invested for longer terms.

Also, the **Ha: Alternative hypothesis is correct**, i.e., Mutual funds are not only safe but also gives profitable returns.

Every investment option comes with a risk attached. No investment is perfectly safe, including deposits. The risk level of mutual funds varies across types as it directly depends on the underlying assets. Therefore, you should invest in a mutual fund scheme only if you are willing to assume the risk that comes attached to it.

With long-term investments, your mutual funds are compounded for a greater number of times. This enhances the returns earned. Hence, investing with a **long-term horizon** not only mitigates market volatility and risk but also helps in maximizing the profits.