"A project on Quantitative Techniques

Contents

SECTION1: Problem Definition

There is a data for annual mean return available for mutual funds that are classified as load and no-load funds. Load funds requires and investor to pay some amount as initial fee however no-load fund doesn't require any initial fee. It is argued that it is worth to pay some amount as initial fee as load mutual funds has higher annual return compare to no-load mutual funds.

In this study, I have tried to find the statistical answers to the question whether load mutual funds indeed have higher annual rate of return or not.

Two methods I have used;

1. Null Hypothesis test
2. ANOVA to find if such arguments are valid and is there any variability in rate of annual return because of load and no-load fund types.

SECTION2: Brief description of the data

A sample of 30 load mutual funds and 30 no-load mutual funds are taken. The focus of the data is on the mean annual return for the funds over a five-year period.

Data as below:

Mutual Funds - Load	Return		Mutual Funds - No Load	Return
American National Growth	15.51		Amana Income Fund	13.24
Arch Small Cap Equity	14.57		Berger One Hundred	12.13
Bartlett Cap Basic	17.73		Columbia International Stock	12.17
Calvert World International	10.31		Dodge & Cox Balanced	16.06
Colonial Fund A	16.23		Evergreen Fund	17.61
Common Sense Growth	16.04		Fidelity Fund	20.61
Corefund Core Equity	18.77		Forthis Advtg Cap App	13.38
Davis Convert Seurities	18.21		Founders Blue Chip Fund	17.15
Deleware Small Cap	17.27		Goldman Core Fixed Income	10.38
Dreyfus Premium Value	11.95		Heartland Value	18.15
Federated Stocks & Bonds	13.81		Janus Fund	15.82
First Invest FD for Income	12.44		Manstay Cap Appriciation	17.29
Flag Inv Emerging Growth	15.39		Merrill Spec Value	16.42
Fortis Equity Capital	13.46		Mutual Beacon	19.49
FPA Capital	23.66		Oberweis Emerging Growth	11.06
Franklin STR GL UT	17.38		Paine Webber Growth & Income	13.89
Gabelli Value Fund	22.45		Pimco Total Return	8.43
IDS New Dimensions	18.38		Prudential Equity	18.29
John Hancock Growth & Income	18.06		Putnam Growth & Income	17.80
Lord Abbett Dev Growth	22.75		Royce FD Micro-Cap	17.05
Merrill Basic Value	20.35		Scudder Development	12.80
MFS World Tot Return	13.09		Smith Barney Appreciation	15.09
New England Growth Opp	18.16		Stein Roe Capital Oppty	19.70
Oppenhmr Quest Small Cap	14.47		T Rowe Price Balanced	13.57
Phoenix Worldwide	15.78		Thompson Plumb Growth	18.58
Princor Bond	8.40		USAA Growth & Tax Strat	11.89
Stagecoach Disd Income	16.52		Vanguard Equity Income	19.00
United Contl Income	12.59		Vanguard Windsor	20.71
Victory OH Regional	18.24		Vontobel Intl Equity	13.56
Zweig SR TR Apprec	14.80		Weith Value	19.82

Source of the data is Webfile:

https://www.cengage.com/cgi-wadsworth/course_products_wp.pl?fid=M63&product_isbn_issn=9781133629658&chapter_number=0&resource_id=21&altname=WEBfiles

SECTION 3: Questions that need answers

1. Formulate the Null Hypothesis so that rejection of H0 concludes financial advisor is correct in saying load mutual fund has higher annual rate of return.
2. Conduct hypothesis test and find p-value at Alpha 0.05
3. Compute population variance for both load and non-load mutual funds with 95% confidence level.
4. Build the ANOVA table for the same data set
5. Using ANOVA find out if the mean of the 2 samples are same? Is the result consistent with previous test for NULL Hypothesis?

Answers1:

$H0: \mu1 - \mu2 \leq 0$

(Mean annual rate of return for load mutual fund is less than no-load mutual funds)

$Ha: \mu1 - \mu2 > 0;$

(Mean annual rate of return for load mutual fund has higher value than no-load mutual funds)

Answers2:

t-Test: Two-Sample Assuming Unequal Variances
One-tail, right hand test will be applicable in this case.

	load	*No-load*
Mean (μ)	16.22566667	15.70466667
Variance (s^2)	12.38831506	10.98724644
Observations	30	30
Hypothesized Mean Difference	0	
df	58	
t Stat	0.590224625	
P(T<=t) one-tail	0.278666388	
t Critical one-tail	1.671552762	

Since, p-value (0.2786) > pα/2 (0.05), hence there is no enough evidence to reject the Null Hypothesis.

So, it cannot be concluded that load mutual funds have higher rate of return than no-load mutual funds.

Answers3:

Estimate for Population Variance interval: σ Unknown

Using Chai-square distribution we can separately estimate for σ for both populations.

$$\frac{(n-1)S^2}{\chi^2_{0.975,n-1}} \le \sigma^2 \le \frac{(n-1)S^2}{\chi^2_{0.025,n-1}}$$

Mutual Funds - Load:

$7.85 \le \sigma {}^\wedge 2 \le 22.34$

Mutual Funds - Load:

$6.97 \le \sigma {}^\wedge 2 \le 19.85$

Answers4:

ANOVA Table						
Source of Variation	**Sum of Squares**	**Degrees of Freedom**	**Mean Square**	**F - value**	**p-value**	**F(alpha .05)**
Treatments	SSTR	1	4.071615	2.870552		252.2
Error	SSE	58	11.68778			

Answers5:

F –value (2.87) < Fα0.05 (252.2);

So H0 cannot be rejected. It can be concluded that mean of the 2 samples are same.

Inference – There is no significant difference between annual rate of returns of mutual funds of type load and no-load.

SECTION 4: Limitation of the approach

Limitation of ANOVA in this case: Ideally number of samples should be >= 3 to conduct the ANOVA procedure, however the concepts is still used to demonstrate the process. It provides another method to compare the result of hypothesis test.

SECTION5: Conclusion

For the given data set and after applying statistical methods, it is found that there is no significant difference between rate of annual return for load and no-load type of mutual funds.

SECTION6: Data & Calculation Sheet.

Mutual.xlsx