

# **PROJECT ON VALUE AT RISK**

Financial Risk Management Class

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Submitted by

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Steps to choose top 25 Stocks and Calculate VaR:

1. I have chosen the top most stocks listed in Fortune 500 Series in 1999. The list was retrieved from the website: [money.cnn.com/fortune/fortune500\\_archive/full/1999/](http://money.cnn.com/fortune/fortune500_archive/full/1999/).
2. The stocks that I had selected are follows:

AAPL
Chevron
Ford Motors
WalMart
Exxon-Mobil
General Electric
IBM
CITI
Boeing
ATT
Bank of America
Hewlett_Packard
Coke
DuPont
Proctor & Gamble
Pfizer
Microsoft
AIG
Morgan Stanley
JCP
Target
HomeDepot
Verizon
Kroger
Merck

3. Then I downloaded daily and monthly Adjusted Close share price data from 2000 to 2005 from yahoo finance.
4. Finally I calculated periodic Return to calculate the VaR of the portfolio. VaR values are in \$ terms.

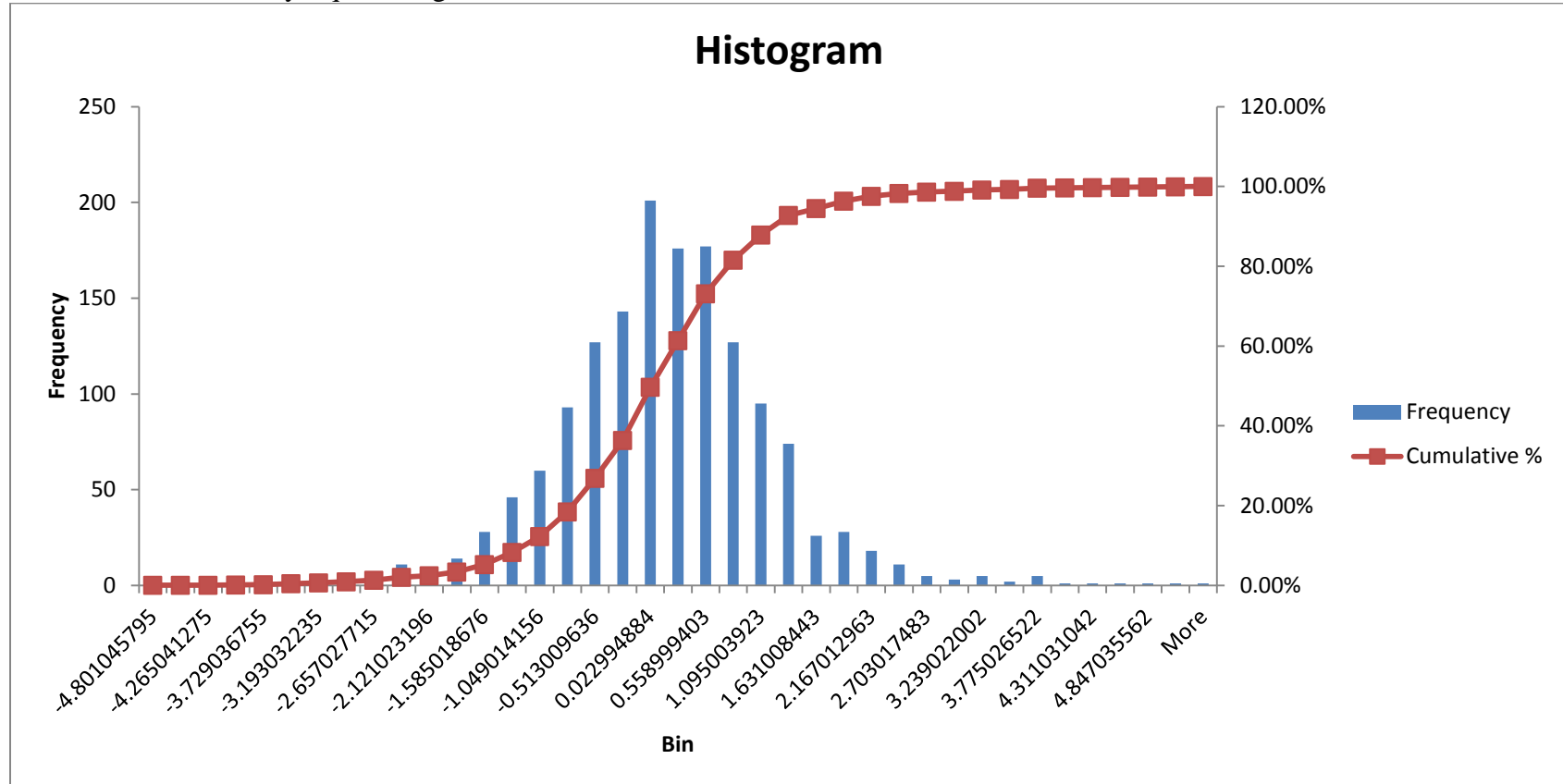
Question 1: Descriptive Statistics of Monthly & Daily Portfolio/ Stock Returns. Please refer to the attached Excel spreadsheets. However, I am providing the Portfolio level descriptive statistics here:

**Portfolio Descriptive Statistics**

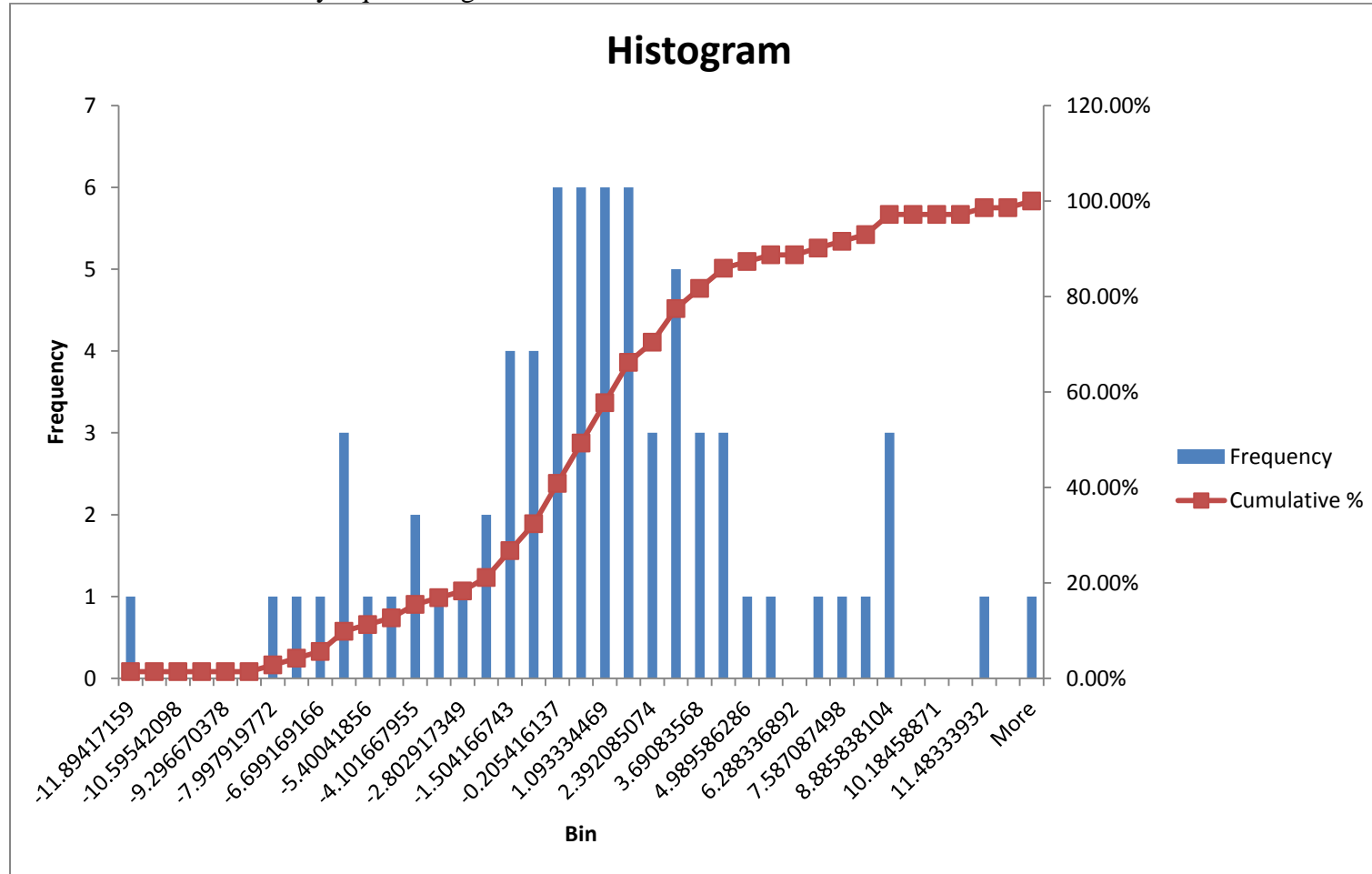
<i>%Port_Ret</i>		
	Daily	Monthly
Mean	0.028547081	0.480601064
Standard Error	0.027239428	0.535677802
Median	0.032151574	0.445492084
Mode	#N/A	#N/A
Standard Deviation	1.057437247	4.513701391
Sample Variance	1.118173532	20.37350025
Kurtosis	2.468886975	0.736495364
Skewness	0.156663857	0.086093173
Range	10.18408588	24.67626151
Minimum	-4.801045795	-11.89417159
Maximum	5.383040081	12.78208992
Sum	43.0204504	34.12267552
Count	1507	71

**Question 2: Daily VaR (95%): -1.60743, Monthly VaR (95%): -7.51008. Daily VaR (90%): -1.21520, Monthly VaR (90%): -6.01665**

Historical VaR for Daily Equal Weighted Stock Return Portfolio



# Historical VaR for Monthly Equal Weighted Portfolio



### Monte Carlo VaR

To calculate the 90% and 95% Daily VaR, I used the function NORMINV (prob, mean, std.dev). I provided the prob=.1 and prob = .05 for 90% & 95% VaR respectively. Also for mean and Standard deviation, I have used the mean & standard deviation of Portfolio Returns assuming that the Portfolio Return is **Normal** in nature.

Values for MC VaR:

**Daily VaR: -1.32661(90%) and -1.71078 (95%)**

**Monthly VaR: -5.30393 (90%) and -6.94377 (95%)**

### Covariance VaR

To calculate VaR by Covariance method, I first downloaded Fama-French factors from Kenneth French's website located at: [http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data\\_library.html](http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html).

Then I ran a regression of the Portfolio\_Return against the 3 FF Factors: Mkt-RF, SMB and HML using SAS. The Parameter estimates are as follows:

Parameter Estimates for Daily Portfolio Return						
Variable	Label	DF	Parameter	Standard	t Value	Pr >  t
			Estimate	Error		
<b>Intercept</b>	Intercept	<b>1</b>	0.02858	0.01166	2.45	0.0143
<b>Mkt</b>	Mkt	<b>1</b>	0.84567	0.01256	67.33	<.0001
<b>SMB</b>	SMB	<b>1</b>	-0.30272	0.01903	-15.91	<.0001
<b>HML</b>	HML	<b>1</b>	0.18221	0.02238	8.14	<.0001
	Parameter Estimates for Monthly Portfolio Return					
Variable	Label	DF	Parameter	Standard	t Value	Pr >  t
			Estimate	Error		
<b>Intercept</b>	Intercept	<b>1</b>	0.46994	0.33811	1.39	0.1692

<b>Mkt</b>	Mkt	<b>1</b>	0.82462	0.07154	11.53	<.0001
<b>SMB</b>	SMB	<b>1</b>	0.04666	0.07507	0.62	0.5364
<b>HML</b>	HML	<b>1</b>	0.0377	0.09803	0.38	0.7018

I also needed to estimate the Variance-Covariance Matrix, which is as follows:

VAR-COVAR Matrix for Daily Data			
	Mkt	SMB	HML
Mkt	1	0.040336432	-0.52728
SMB	0.040336432	1	-0.14549
HML	-0.52728084	-0.14549217	1
VAR-COVAR Matrix for Monthly Data			
	Mkt	SMB	HML
Mkt	1	2.223277083	-7.42026
SMB	2.223277083	1	-10.5649
HML	-7.42025787	-10.5648568	1

Finally, the VaR Values at 95% are as follows:

**Daily: -1.35 (pretty close to VaR generated by Historical Simulation)**

**Monthly VaR: -6.892 (Using Beta with SPX, since COVAR with Fama French failed for this portfolio).**

#### **SPX Regression Summary w.r.t Monthly Portfolio Return**

##### **SUMMARY OUTPUT**

<i>Regression Statistics</i>	
Multiple R	0.92550999
R Square	0.856568741
Adjusted R Square	0.854490027

Standard Error	1.721786126
Observations	71

#### ANOVA

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	1221.591	1221.591242	412.0667	8.27473E-31
Residual	69	204.5538	2.964547465		
Total	70	1426.145			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>
Intercept	0.538468577	0.204358	2.634923896	0.010383	0.130784922
SPX_Ret	95.43247214	4.70124	20.2994257	8.27E-31	86.05375507

#### VaR Summary

		VaR				
Portfolio Type	Historical (90% C.I.)	Historical (95% C.I.)	MC (90% C.I.)	MC (95% C.I.)	Covariance (90% C.I.)	Covariance (95% C.I.)
Daily	-1.2152	-1.60743	-1.32661	-1.71078	-1.057372	-1.353502
Monthly	-6.01665	-7.51008	-5.30933	-6.94377	-5.384766	-6.892834
Transformed to Monthly	-5.699793231	-7.539515005	-6.222352451	-8.024269474	-4.959514293	-6.348487112

\* No. of Trading Days in a month assumed to be 22, so Monthly VaR= Daily VaR\* sqrt(22)



### Expected Shortfall:

I have calculated Expected Shortfall/ Expected Tail Loss at 95% and 90% Intervals using both Daily & Monthly Data generated by Historical Simulation. I calculated the average of the bottom 10% and 5% losses (Portfolio Returns, sorted from lowest to highest).

### Expected Tail Loss at 90% Interval:

**Daily: -1.861753648**

**Monthly: -7.69507**

### Expected Tail Loss a

### Expected Tail Loss at 95% Interval:

**Daily: -2.33669345**

**Monthly: -9.27504**

### Question 3: Back testing

#### Daily Level

So, using all the three VaR values at 95% C.I., I find the number of exceptions =65.

Expected # of exceptions=  $1507 \times .5 = 75$ .

Using Binomdist of 65 or more exceptions

0.879292

prob.level=0.05

Should not reject the model at 95%  
C.I.

### Monthly Level

Here # of Exceptions depend on the type of VaR I use		
expected exceptions= $71 \cdot .05 = 3.55$		
MC # of Exceptions	binomdist	
8	0.008795	Reject the model
Hist. Exceptions		
3	0.477132	Do not reject the model
CoVariance		
4	0.281759	Do not reject the model