

Problem 1:

Use the data in problem1.csv. Fit a Normal Distribution and a Generalized T distribution to this data.

Calculate the VaR and ES for both fitted distributions.

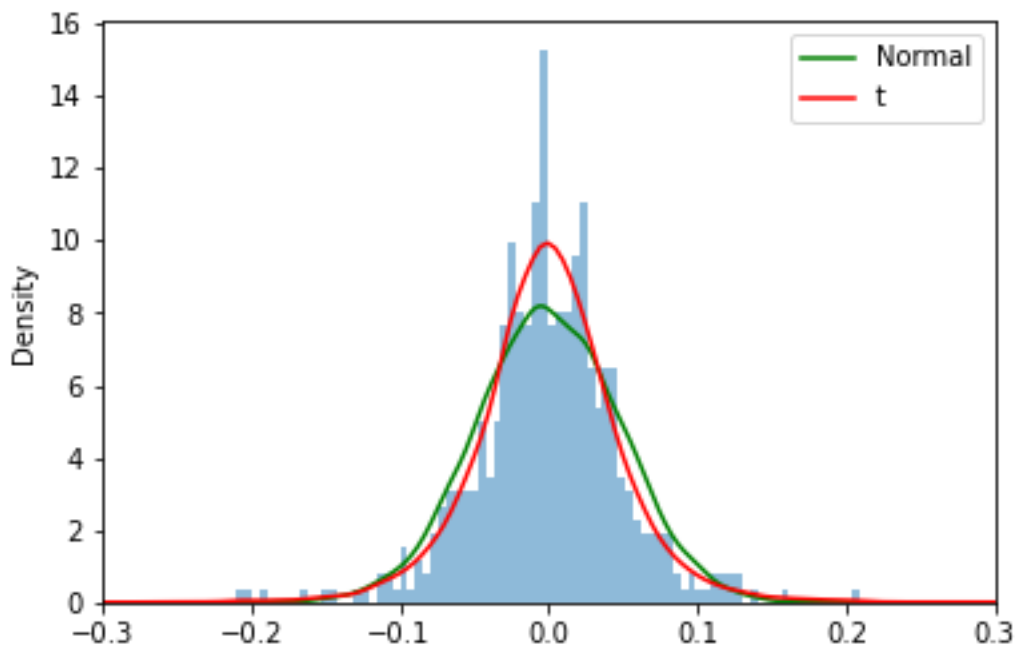
Overlay the graphs the distribution PDFs, VaR, and ES values. What do you notice? Explain the differences.

A: the steps used here is fit problem1 by Normal Distribution and a Generalized T distribution.

Then Calculate the VaR and ES for both fitted distributions. The result I got is:

	Normal	t
VaR	0.0801	0.0776
ES	0.1017	0.1132

By overlay the graph we have



From VaR and ES we can see that the VaR of t distribution is smaller than normal distribution. But the Expected shortfall of t distribution is smaller than normal distribution. This means the minimum loss of t distribution is small, but the mean is larger. From the graph we can see that the figure of t distribution is fatter tailed, that leads to the result we discussed.

Problem 2:

In your main repository, create a Library for risk management. Create modules, classes, packages, etc as you see fit. Include all the functionality we have discussed so far in class. Make sure it includes

1. Covariance estimation techniques.
 - 1.1 Exponentially weighted covariance matrix is used.
2. Non PSD fixes for correlation matrices

Near psd and Higham's method is used.
3. Simulation Methods

simulation directly from a covariance matrix or using PCA with an optional parameter for % variance explained.

Four combination of simulated covariance is used.
4. VaR calculation methods (all discussed)

Normal distribution, normal distribution with an Exponentially Weighted variance, MLE fitted T distribution, fitted AR(1) model, Delta Normal, Monte Carlo simulation and Historical are used.
5. ES calculation

Combine in VaR calculation

Create a test suite and show that each function performs as expected.

Test case is what we did in the previous work and the functions are shown to be success.

Problem 3:

Use your repository from #2.

Using Portfolio.csv and DailyPrices.csv. Assume the expected return on all stocks is 0. This file contains the stock holdings of 3 portfolios. You own each of these portfolios.

Fit a Generalized T model to each stock and calculate the VaR and ES of each portfolio as well as your total VaR and ES. Compare the results from this to your VaR from Problem 3 from Week 4.

The result I got is shown as:

	A	B	C	All
VaR	7972	6760	5741	20287
ES	10512	8756	7600	26925

Week4's result of VaR is

	A	B	C	All
Delta Normal (\$)	5760.2	4494.6	3786.6	13577.1
Historical VaR (\$)	9005.1	7273.8	5773.5	21103.4

From this we can see that the VaR calculated by Generalized T model is in the bigger than the delta normal VaR but smaller than the Historical VaR. And the VaR calculated by Generalized T model is closer to the Historical VaR.

This result may cause by the volatile of the raw data. This lead to the data with fat tailed. In this situation the VaR calculated by delta normal which based on the assumption of normal distribution might fail the assumption. And the VaR calculated is far from the historical result.

But when the t distribution model is used, the situation is considered, so the VaR calculated by Generalized T model is closer to the Historical VaR.