

Problem1

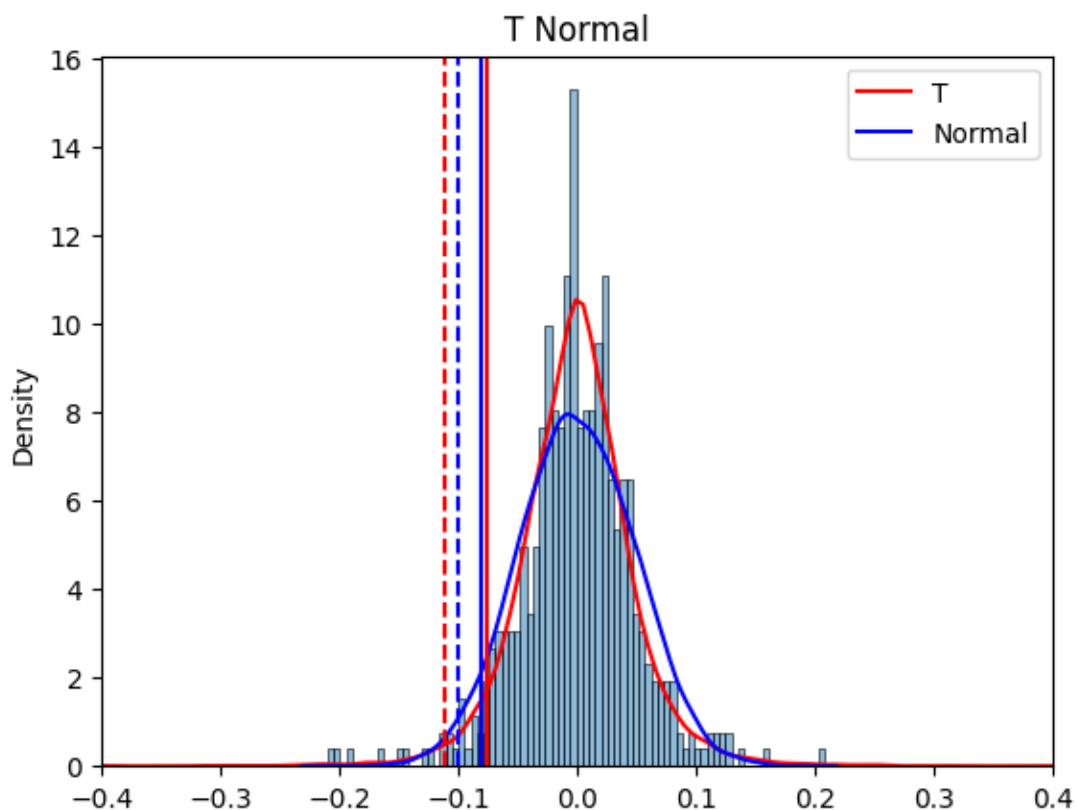
Question:

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.

Solution:

To solve this question, I create a library including these two functions “cal_VaR_ES_normal” and “cal_VaR_ES_T”. The results and plot are shown below.

Distribution	VaR	ES
T	0.0755961035	0.1114500238
Normal	0.0816808151	0.1016229479



We notice that Normal distribution has slightly larger VaR with slightly smaller ES than T distribution. T distribution has shaper curve and fatter tails and this means Normal distribution has larger VaR. On the other hand, this means t-distribution has more probability mass in the tails and increases the ES.

Problem2

Question:

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.
2. Non PSD fixes for correlation matrices
3. Simulation Methods
4. VaR calculation methods (all discussed)
5. ES calculation

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

Solution:

Using “pip install mjzy” to install my module.

Problem3

Question:

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.

Solution:

Portfolio	All	A	B	C
T (ES)	26273.29537	10468.401212	8795.5895228	7439.5330334

Portfolio	Normal	Monte Carlo	Historic	T (new)
Total	13577.0771	13308.9016	21103.3980	19820.96258
A	5670.2035	5614.9593	9005.0672	7924.110067
B	4494.5990	4475.6403	7273.7691	6693.189182
C	3786.5895	3732.2504	5773.4722	5653.332593

We notice that the results from T distribution are similar to Historical simulation as both methods take into account the market's historical data. The VaRs from T distribution are slightly smaller than Historical simulation and larger than Normal simulation and Monte Carlo simulation. This may be because Historical simulation takes into account with more actual extreme data in the past and its VaR may be slightly larger. Monte Carlo and Normal distribution are both assume a normal distribution while T distribution has heavier tails, so the VaRs of Monte Carlo simulation and Normal distribution are smaller.

