Project Week 05

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Fintech 545

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.

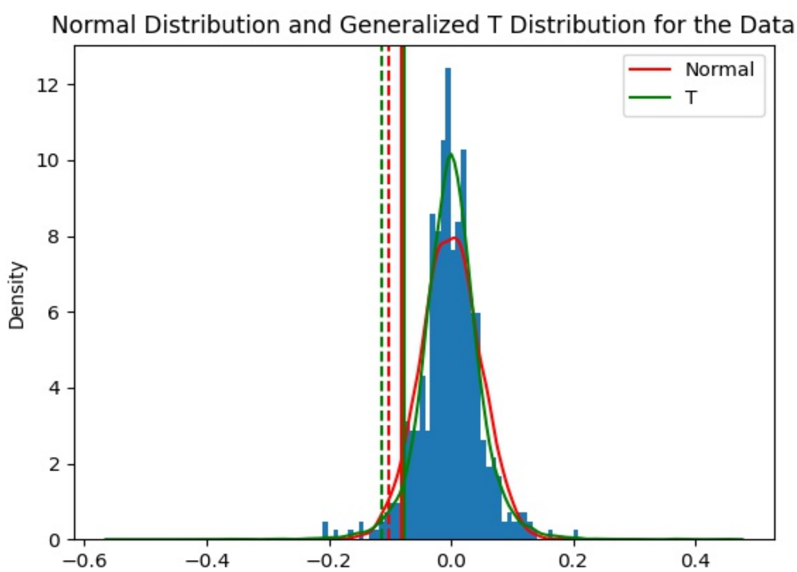
Overlay the graphs the distribution PDFs, VaR, and ES values. What do you notice? Explain the differences.

To compare two distributions, I first fitted the data using both a Normal Distribution and a Generalized T distribution. Then I calculated the VaR and ES and plotted the distribution PDF for both fitted distributions. The calculated VaR and ES are shown in Table 1 and the overlayed graphs for the Normal Distribution and the Generalized T distribution are shown in Figure 1.

Table 1

	VaR	ES
Normal Distribution	0.0808938463048445	0.101691689154875
Generalized T Distribution	0.0758687174004162	0.11328488395374

Figure 1



From the graph, we can see that the VaR for the Normal Distribution is greater than the VaR for the Generalized T Distribution, and the ES for the Normal Distribution is smaller than the ES for the Generalized T Distribution. The reason for such a difference is that the Generalize T Distribution has a fatter tail than the Normal Distribution, and the ES can better capture these extreme cases, which results in a greater value of ES for the Generalize T Distribution.

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.*
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.

The library for risk management has been created in my main repository with the name "yt191_risk_management". It includes the 5 functionalities mentioned above. The library can be installed using pip. The test cases for each function can be seen in my code for Problem 2.

Problem 3

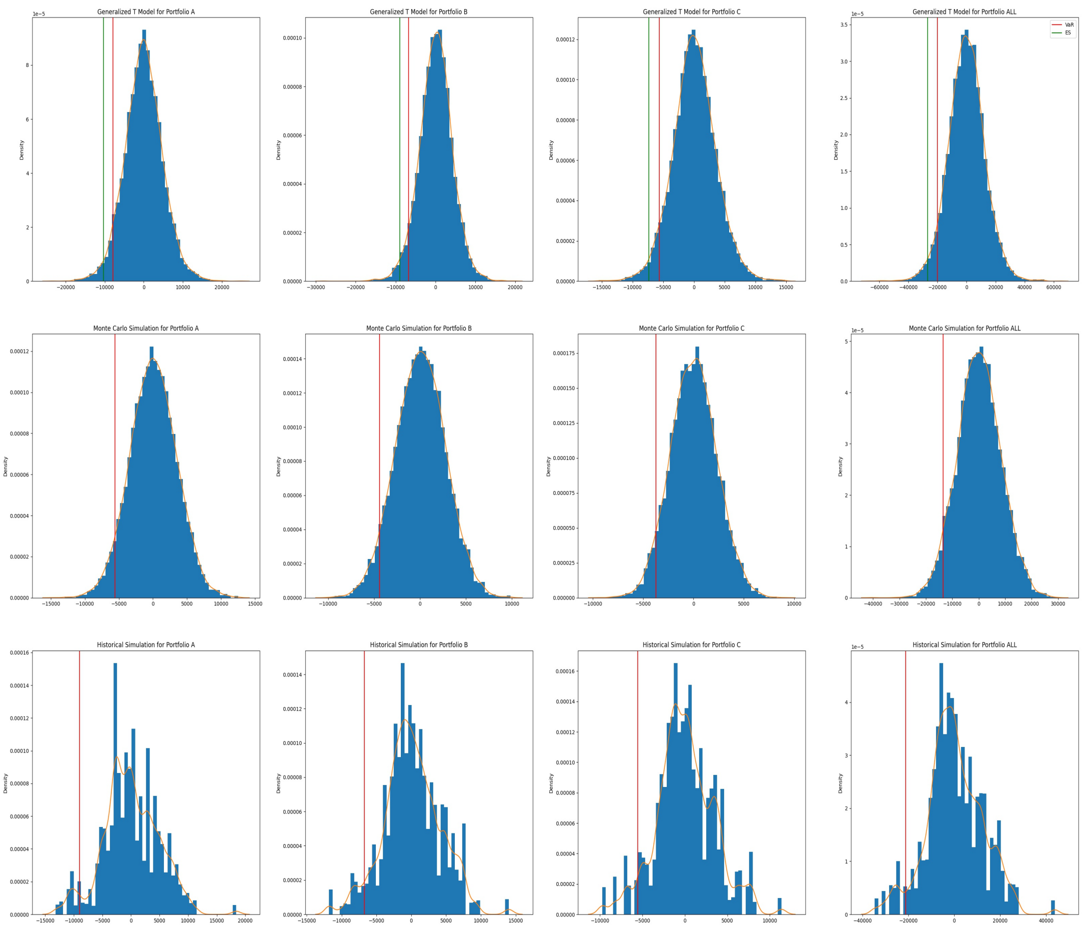
Use your repository from #2.
Using Portfolio.csv and DailyPrices.csv. Assume the expected return on all stocks is 0.
This file contains the stock holdings of 3 portfolios. You own each of these portfolios.
Fit a Generalized T model to each stock and calculate the VaR and ES of each portfolio as well as your total VaR and ES. Compare the results from this to your VaR form Problem 3 from Week 4.

To fit a Generalized T model, I first calculated the present value and returns for the portfolio. Then I calculated the Spearman correlation matrix and use it to conduct simulations. Then I converted the results using normal distribution cdf and get the return matrix for the fitted model. I calculated the VaR and ES for the Generalized T model and plotted the distribution for each portfolio. To compare this with the result from last week, I calculated the VaR for Delta Normal, Monte Carlo Simulation, and Historic Simulation. The results of the calculation can be seen in Table 2 and the graphs for each kind of distribution can be seen in Figure 2.

Table 2

	Portfolio A	Portfolio B	Portfolio C	Portfolio All
VaR for Generalized T	7877.910494894	6737.4751129296	5641.9166370403	20070.42154766
ES for Generalized T	10306.89182991	8928.069844001	7360.1017799939	26692.93682252
VaR for Delta Normal	5670.202920147	4494.598410778	3786.589010809	13577.075418977
VaR for Monte Carlo	5596.559219355	4406.348353488	3746.095395657	13405.916796843
VaR for Historic	9005.067216161	6723.382643045	5558.724403456	21103.398010768

Figure 2



From the graph and the table, we can see that the calculated VaR for the Generalized T Distribution is greater than that of Monte Carlo and Delta Normal, and it is closer to the VaR for the Historic Simulation. The shape for the Generalized T Distribution is also closer to the shape for Historic Simulation. This shows that the Generalized T model's ability to capture the effect of extreme cases on the fat tail makes it a result closer to the Historic Simulation. As shown in last week's responses, the data for the simulation is not normally distributed, therefore a Generalized T performs better by not underestimating the extreme values, and has a result that is closer to the actual historical performance.