

Fintech545 Week5 Project

Elinor Cheng, yc493

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1 Problem 1

Calculation results for $\alpha = 5\%$:

Type of Return	Value at Risk	Expected Shortfall
Normal Distribution	0.0813	0.1079
Generalized T distribution	0.0765	0.1178

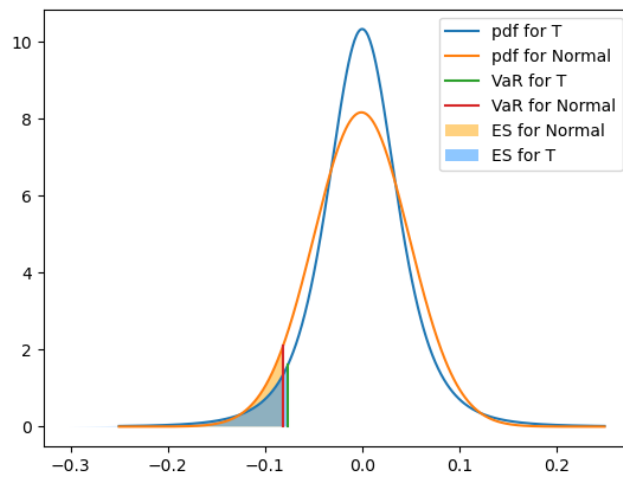


Figure 1: PDF, VaR, ES for fitted Normal distribution and T distribution

2 Problem 2

- `variance.py`
 - `ew_var` Calculate the exponentially weighted variance(covariance)
 - `ew_cov` Calculate the exponentially weighted covariance matrix
- `risk_stats.py`
 - `return_calculate` Calculate the return using different methods
 - `return_var` Calculate the VaR using different methods
 - `return_es` Calculate the ES using different simulation methods
- `simulate.py`
 - `chol_psd` Cholesky for PSD matrix
 - `near_psd` Find the nearest PSD for non-PSD matrix

- `higham_psd` Find the nearest PSD for non-PSD matrix using Higham algorithm
- `PCA_sim` PCA simulation
- `multi_norm_sim` Direct simulation
- `copula_sim` Simulation from copula.

3 Problem 3

Simulate return for each stocks and calculate the VaR and ES with $\alpha = 5\%$ for each portfolios:

Portfolio	Value at Risk	Expected Shortfall
Portfolio A	10639.8163	14040.6715
Portfolio B	9327.6726	10863.0229
Portfolio C	7929.0838	9722.5536
Total Portfolio	27542.8435	34389.5302

Compare to the results for Week 4 Problem 3:

		Multivariate Normal Distribution (EW Covariance)	Multivariate T Distribution (EW Covariance)	Multivariate Normal Distribution	Multivariate T Distribution
Portfolio A	VaR(\$)	5476.7251	9681.9645	7862.6238	8568.246
	VaR(%)	1.826%	3.2279%	2.6213%	2.8566%
Portfolio B	VaR(\$)	4385.8638	6892.2111	6637.4965	7573.7378
	VaR(%)	1.4898%	2.3412%	2.2547%	2.5727%
Portfolio C	VaR(\$)	3723.3961	7153.5154	5752.6525	6724.801
	VaR(%)	1.3788%	2.6490%	2.1303%	2.4903%
Total Holdings	VaR(\$)	13491.6581	224320.8905	19311.4454	19719.8069
	VaR(%)	1.5609%	25.9517%	2.2341%	2.2814%

The VaR calculation results are greatly larger than the results of Week 4. Through observing the correlation matrix of the Copula I found that the Spearman correlation coefficients among the assets are larger than their Pearson correlation coefficients, which lead to larger VaR calculation results.