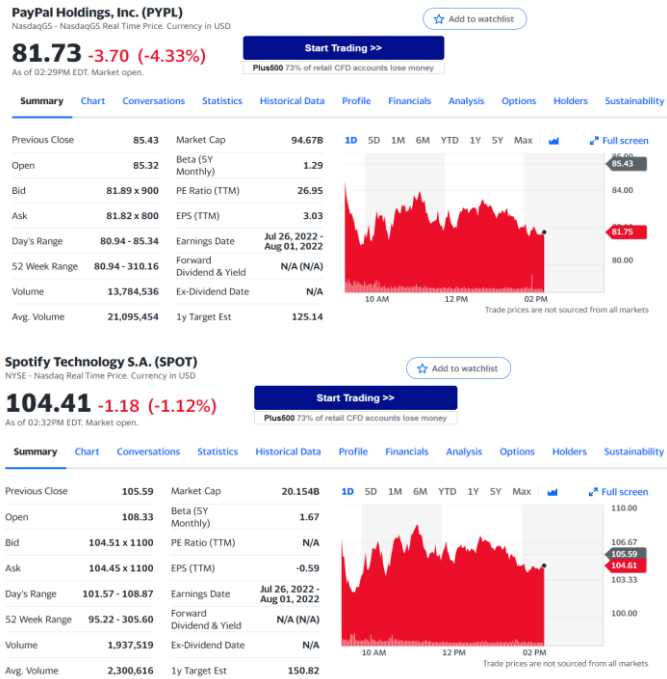


REPORT 5, VaR (Value at Risk) Calculation Using different Methods

Bahador Amjadi

2040470

In this report, we try to calculate the Value at Risk of a portfolio constructed based on two different underlyings. Several methods are incorporated and in all of them, the additivity feature is also checked. The underlyings chosen for the task are as below:



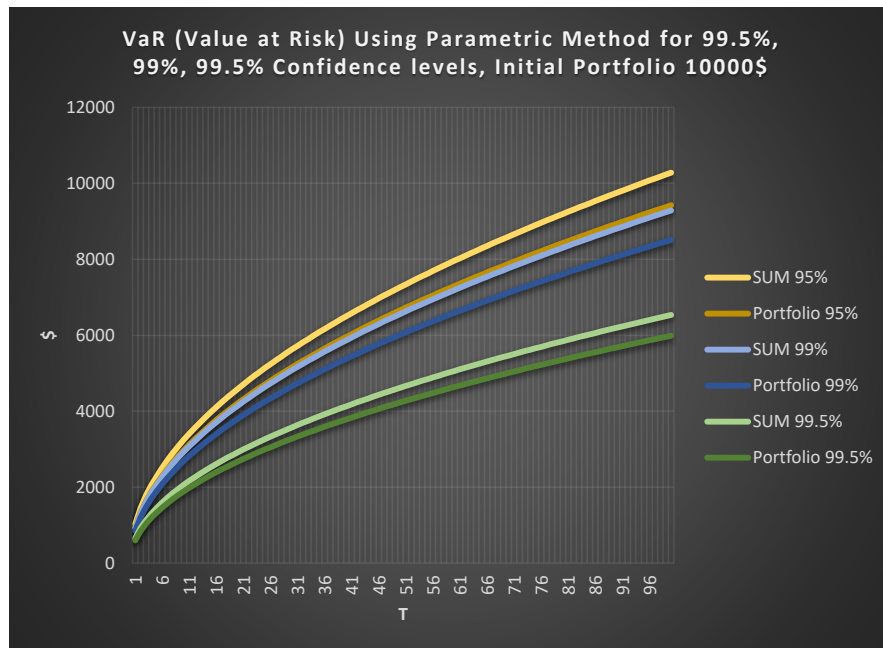
PART 1

We build an equibalanced portfolio based on the two mentioned stock prices. This is done in a way that the portfolio of each day is determined based on the combination of the shares we had on the previous day. and the combination on each day is adjusted according to the equibalanced assumption. Then we find the 6-month time window daily returns of the portfolio and with the returns in our hands, we can calculate the corresponding average and standard deviation. This process is also carried out for each stock independently (needed for additivity check).

	Average	Sigma
Spotify	-0.007080351	0.040773407
PayPal	-0.00636303	0.038930615
Portfolio	-0.006721691	0.036528053

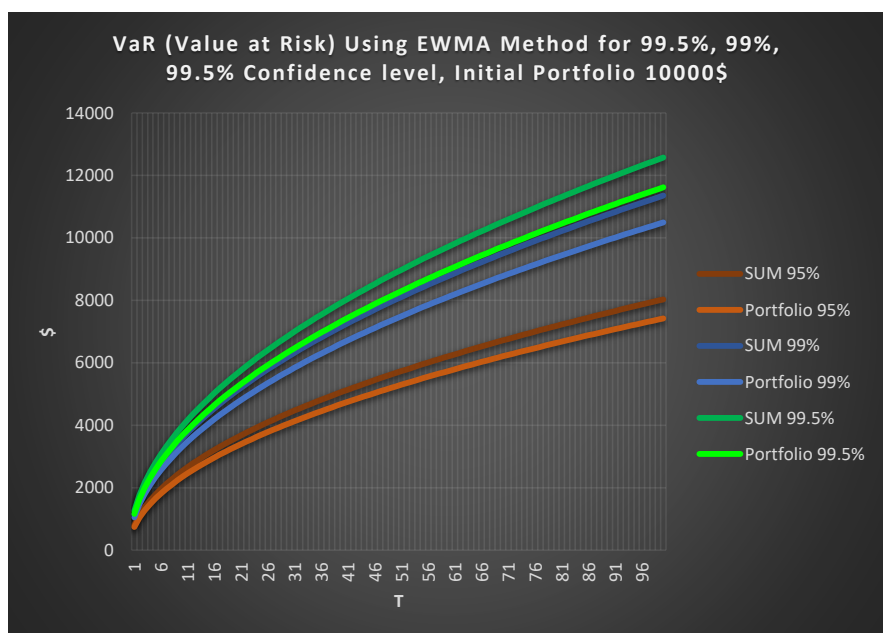
PART 2

For the second part we need to compute the parametric single and joint Normal VaR at (95%, 99%, and 99.5%) confidence levels with $T = 1, 2, \dots, 100$ days window. The parametric estimation of the VaR depends on the sigma, portfolio value T , and confidence level. VaR of our portfolio is plotted as a function of T and confidence level alongside. The sum of two VAR series based on independent assets is also added to the plots providing us with a comparison view.



PART 3

In this part, we use the EWMA method using $\lambda = 0.94$. Once the Sigma is found we repeat the same procedure as the first part. EWMA relies on weighed historical returns. In a way closer days have more contribution to the sigma.



PART 4

Monte Carlo simulation lets us perform many simulations fed with random inputs from a predetermined distribution having a specific std deviation. We run the simulations with different random seeds. We run it over 150 iterations. The results for VaR after 50 steps is shown below:

Initial Portfolio	Spotify.Share	Paypal.Share	R
10000	0.5	0.5	0
Portfolio.Sigma	Spotify.Sigma	Paypal.Sigma	T
0.57	0.6	0.57	50

Confidence Level	Portfolio VaR	Spotify VaR	Paypal VaR
95%	3749.663136	1936.068532	1869.42696
99%	4608.559729	2733.034047	2414.747574

PART 5

One of the ways to find VaR is through historical values of returns. We look at the past data and find the corresponding average and sigma. Plugging these two values as input of a normal distribution, we can find the VaR for different confidence levels and Time. (the horizontal axis is removed because of unnecessary space occupation)

