MIE1622 Assignment 3 Report
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Portfolio 1:

Out-of-sample: VaR 99.0% = $46408752.38, CVaR 99.0% = $52569598.30
In-sample MC1: VaR 99.0% = $39944010.71, CVaR 99.0% = $48589595.55
In-sample MC2: VaR 99.0% = $29992401.52, CVaR 99.0% = $37435744.66
In-sample No: VaR 99.0% = $38138938.28, CVaR 99.0% = $42277066.07
In-sample N1: VaR 99.0% = $27564067.16, CVaR 99.0% = $30648552.39
In-sample N2: VaR 99.0% = $21803153.28, CVaR 99.0% = $24187017.46

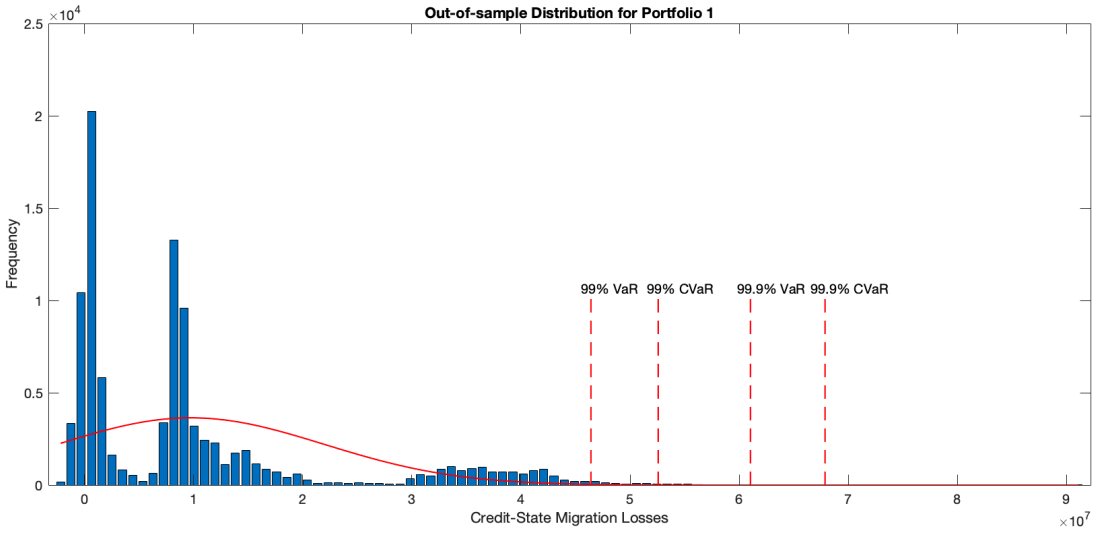
Out-of-sample: VaR 99.9% = $61027813.00, CVaR 99.9% = $67870975.72
In-sample MC1: VaR 99.9% = $58994809.22, CVaR 99.9% = $67067329.91
In-sample MC2: VaR 99.9% = $46973699.80, CVaR 99.9% = $54977579.88
In-sample No: VaR 99.9% = $47467251.44, CVaR 99.9% = $50848150.28
In-sample N1: VaR 99.9% = $34517222.22, CVaR 99.9% = $37037282.75
In-sample N2: VaR 99.9% = $27176943.72, CVaR 99.9% = $29124588.65

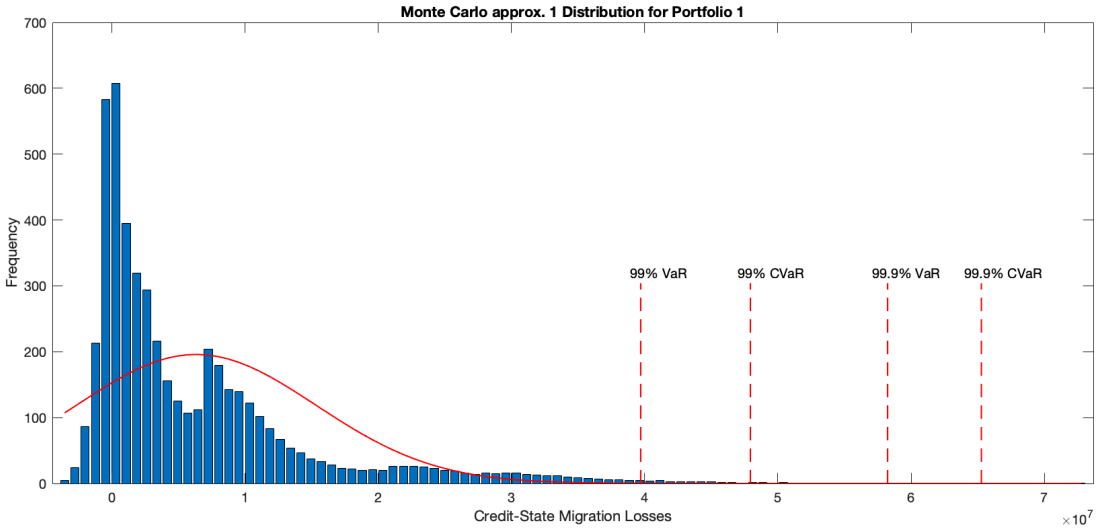
Portfolio 2:

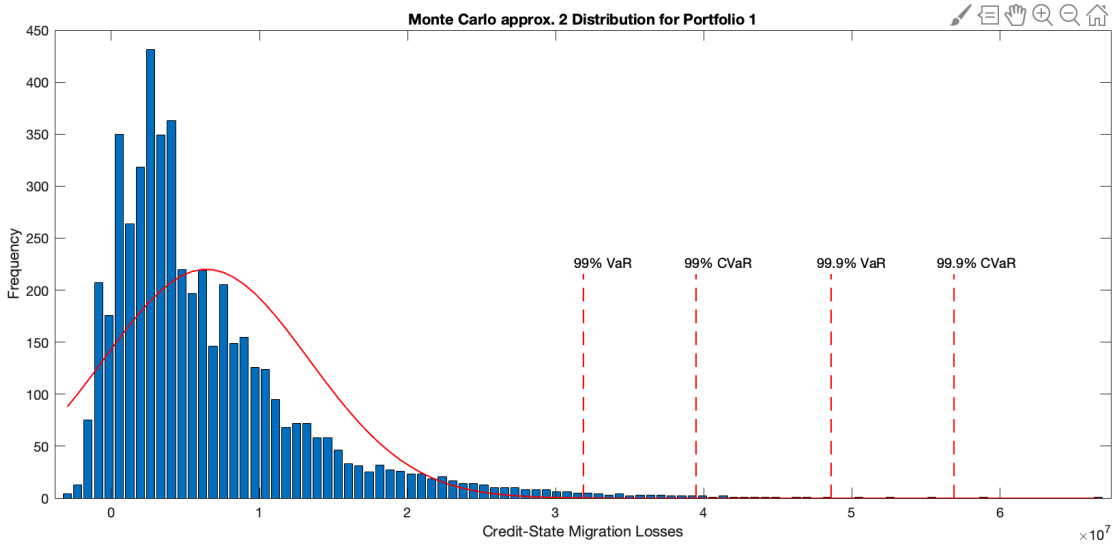
Out-of-sample: VaR 99.0% = $32978335.66, CVaR 99.0% = $38389783.47
In-sample MC1: VaR 99.0% = $29951884.89, CVaR 99.0% = $36877279.63
In-sample MC2: VaR 99.0% = $27139313.14, CVaR 99.0% = $33600927.49
In-sample No: VaR 99.0% = $26048710.01, CVaR 99.0% = $28679251.60
In-sample N1: VaR 99.0% = $22497887.12, CVaR 99.0% = $24865018.36
In-sample N2: VaR 99.0% = $20078615.95, CVaR 99.0% = $22171797.22

Out-of-sample: VaR 99.9% = $45224487.59, CVaR 99.9% = $51359607.43
In-sample MC1: VaR 99.9% = $45778034.76, CVaR 99.9% = $51937513.03
In-sample MC2: VaR 99.9% = $41379344.20, CVaR 99.9% = $48542371.83
In-sample No: VaR 99.9% = $31978569.36, CVaR 99.9% = $34127752.63
In-sample N1: VaR 99.9% = $27833957.58, CVaR 99.9% = $29767931.50
In-sample N2: VaR 99.9% = $24797138.77, CVaR 99.9% = $26507292.36

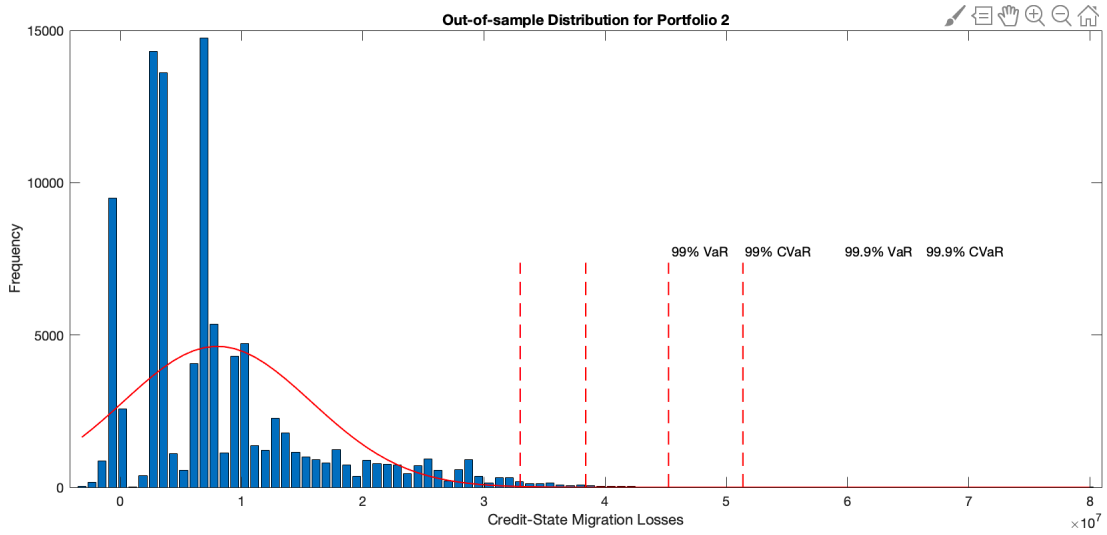
Portfolio 1 (Out-of-sample, MC1 and MC2)

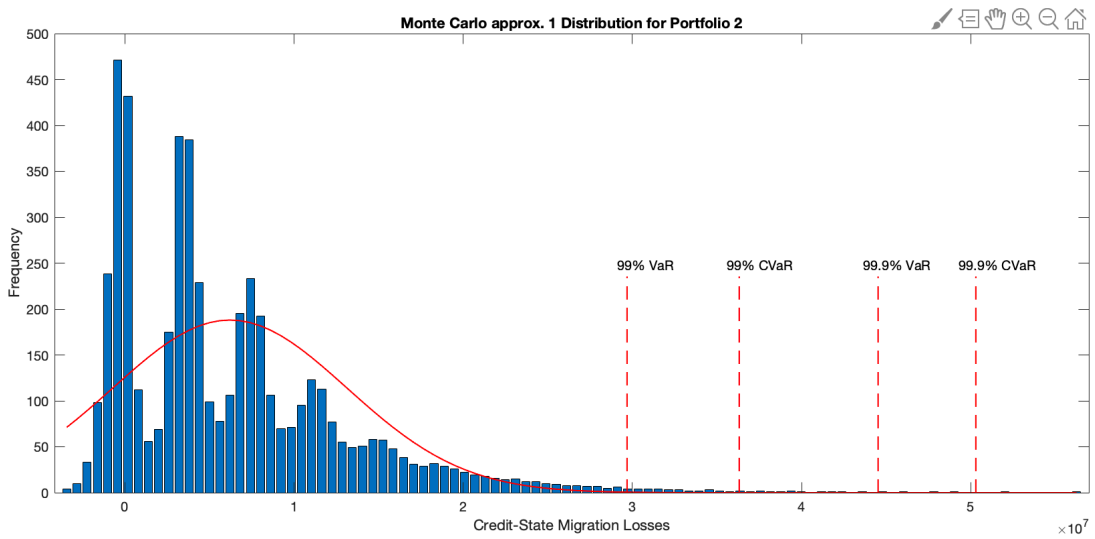


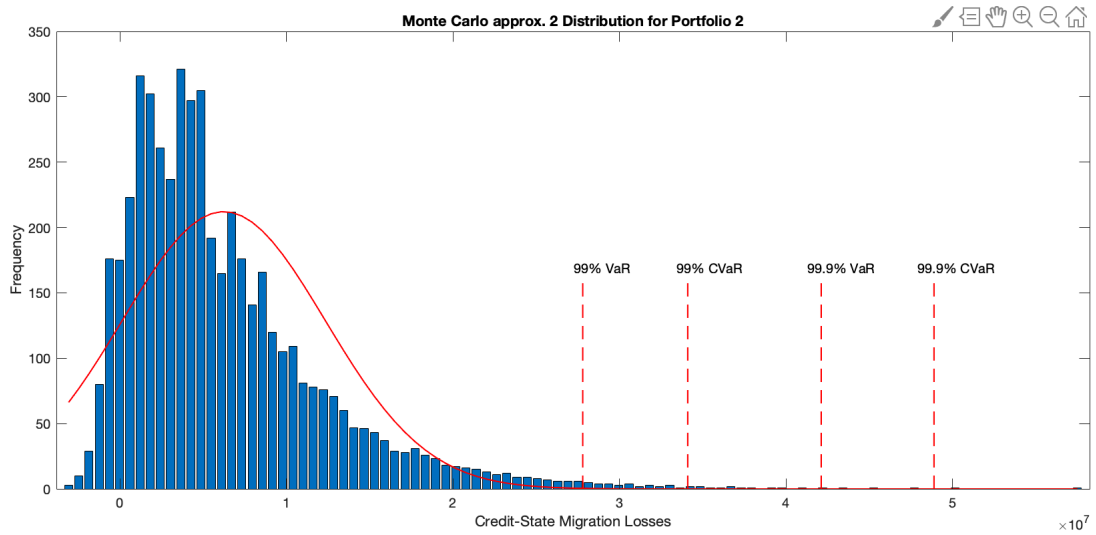




Portfolio 2 (Out-of-sample, MC1 and MC2)







- Analyze sampling error when comparing non-Normal approximations to the true (out-of-sample) loss distribution. Analyze model error when comparing Normal approximations to the true (out-of-sample) loss distribution.

  Based on outputs and plots, in both portfolio 1 and portfolio 2, the VaR and CVaR for in-sample MC1 is closer to VaR and CVaR for out-of-sample (true value) than in-sample MC2. So the Monte Carlo 1 loss distribution would be more similar to the true loss distribution than the MC2 distribution. This fact is true for both non-Normal and Normal approximations. Sampling error for MC1 is smaller than MC2, and MC1 would be a better generating process, which takes less time and has an better estimation.

- If you report the in-sample VaR and CVaR to decision-makers in your bank, what consequences for the bank capital requirements it may have?

  Comparing the MC1 and MC2 to true distribution, both MC1 and MC2 underestimated the VaR and CVaR, which means the bank underestimate the risk of the portfolio it holds. Based on the values of VaR and CVaR produced by MC1 and MC2, the bank would decide to hold less capital. When default happens, bank would face more monetary losses than it expected.

  Since all the corresponding VaR and CVaR for portfolio 1 are larger than for portfolio 2, so portfolio 2 would be a better choice.

- Can you suggest techniques for minimizing impacts of sampling and model errors?

  My suggestion is to generate random numbers with more different methods (other than MC1 and MC2) for the same portfolio. We can also do more trials and take the average to avoid bias. We can enlarge our data size, such as, using the data for 2 periods, to get an more accurate prediction.