MIE 1622 Assignment 3 Report

Analyze your results

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Portfolio 1:

Out-of-sample: VaR 99.0% = $37999625.38, CVaR 99.0% = $45610879.55
In-sample MC1: VaR 99.0% = $36791135.73, CVaR 99.0% = $44400101.93
In-sample MC2: VaR 99.0% = $38687644.24, CVaR 99.0% = $47047319.63
In-sample No: VaR 99.0% = $26451042.37, CVaR 99.0% = $29380952.18
In-sample N1: VaR 99.0% = $25838327.21, CVaR 99.0% = $28695891.61
In-sample N2: VaR 99.0% = $26903697.74, CVaR 99.0% = $29887871.74

Out-of-sample: VaR 99.9% = $55208324.98, CVaR 99.9% = $62518801.48
In-sample MC1: VaR 99.9% = $53549717.06, CVaR 99.9% = $61905467.69
In-sample MC2: VaR 99.9% = $57034166.92, CVaR 99.9% = $65996636.01
In-sample No: VaR 99.9% = $33055748.09, CVaR 99.9% = $35449518.70
In-sample N1: VaR 99.9% = $32279949.36, CVaR 99.9% = $34614612.92
In-sample N2: VaR 99.9% = $33630727.69, CVaR 99.9% = $36068832.77


Portfolio 2:

Out-of-sample: VaR 99.0% = $27586139.91, CVaR 99.0% = $33543767.15
In-sample MC1: VaR 99.0% = $26291813.96, CVaR 99.0% = $32043143.20
In-sample MC2: VaR 99.0% = $28236926.05, CVaR 99.0% = $34646556.92
In-sample No: VaR 99.0% = $21191721.89, CVaR 99.0% = $23374176.39
In-sample N1: VaR 99.0% = $20588325.25, CVaR 99.0% = $22697718.48
In-sample N2: VaR 99.0% = $21552946.91, CVaR 99.0% = $23778311.17

Out-of-sample: VaR 99.9% = $41788707.97, CVaR 99.9% = $47647389.57
In-sample MC1: VaR 99.9% = $39322007.11, CVaR 99.9% = $45719923.61
In-sample MC2: VaR 99.9% = $42383910.08, CVaR 99.9% = $50334879.22
In-sample No: VaR 99.9% = $26111487.56, CVaR 99.9% = $27894578.43
In-sample N1: VaR 99.9% = $25343393.64, CVaR 99.9% = $27066792.60
In-sample N2: VaR 99.9% = $26569441.27, CVaR 99.9% = $28387589.92
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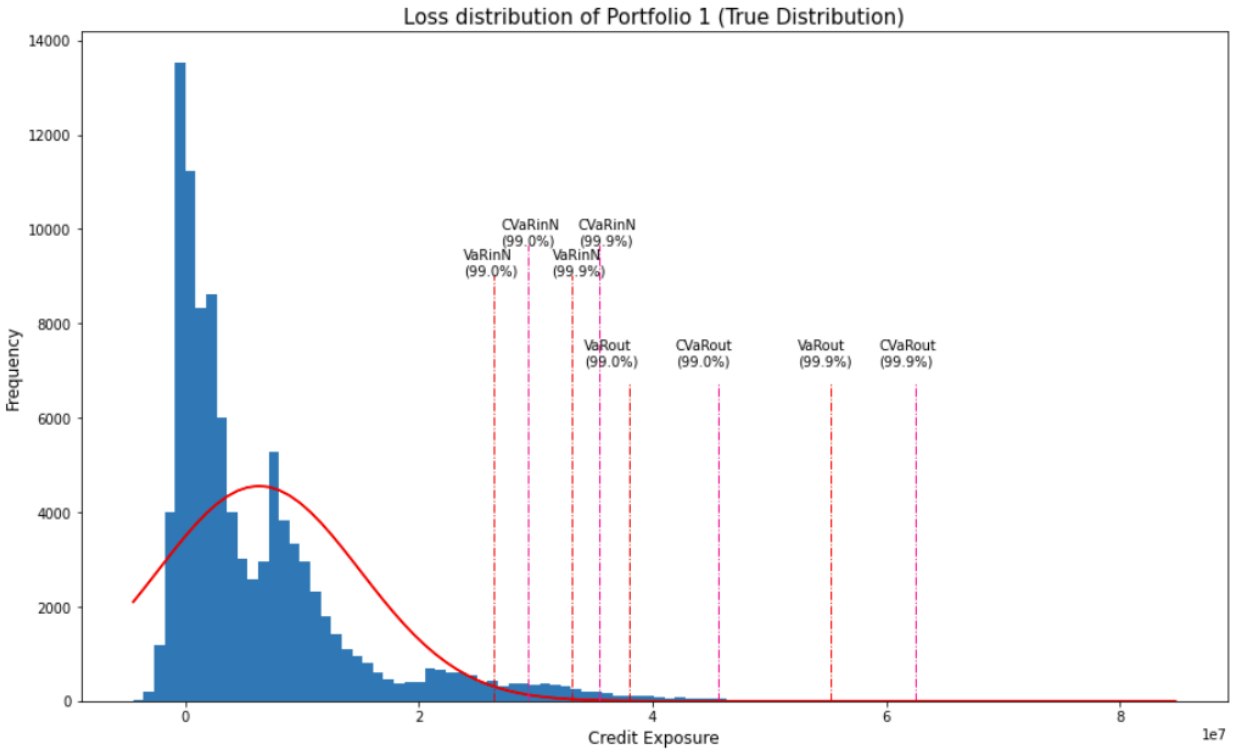
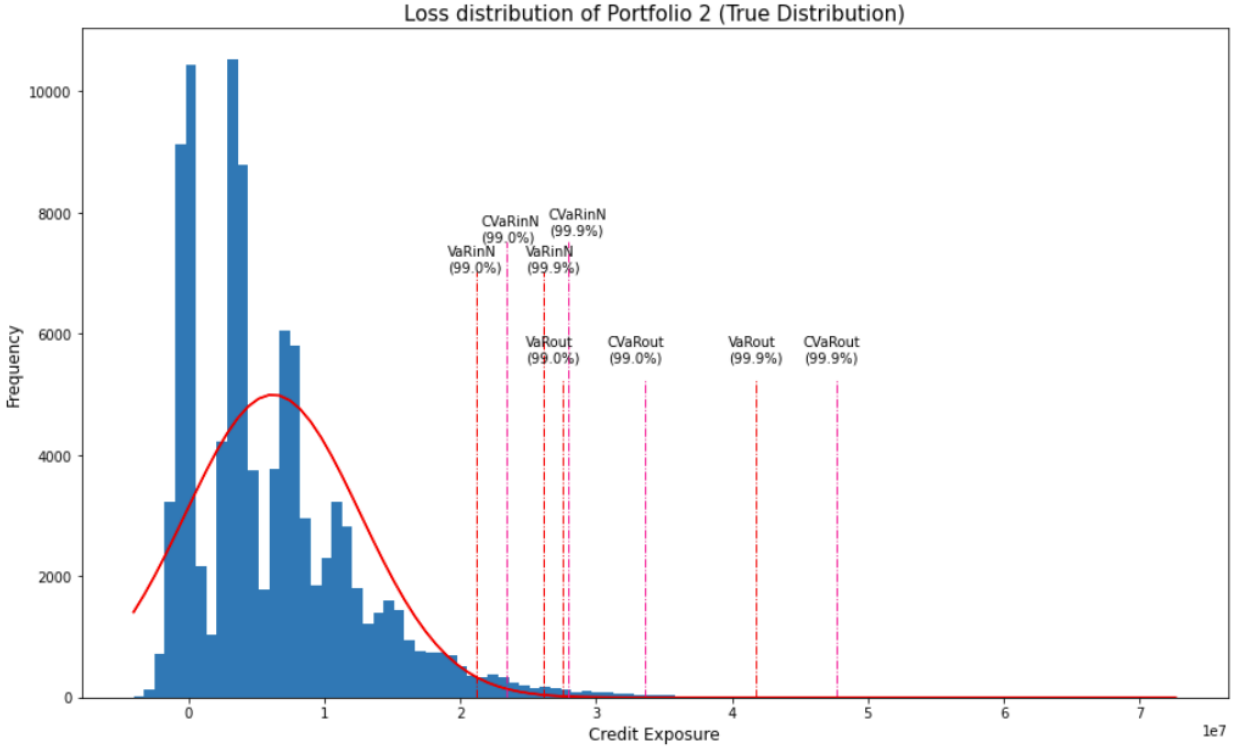
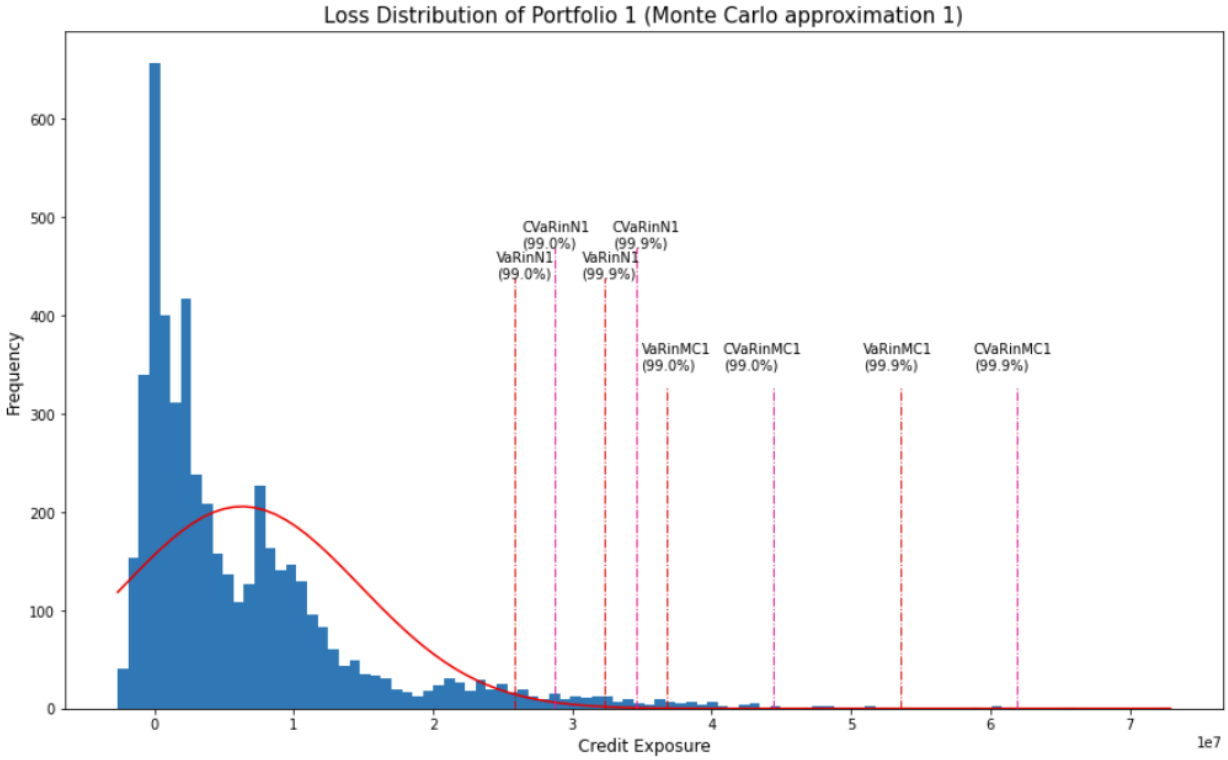
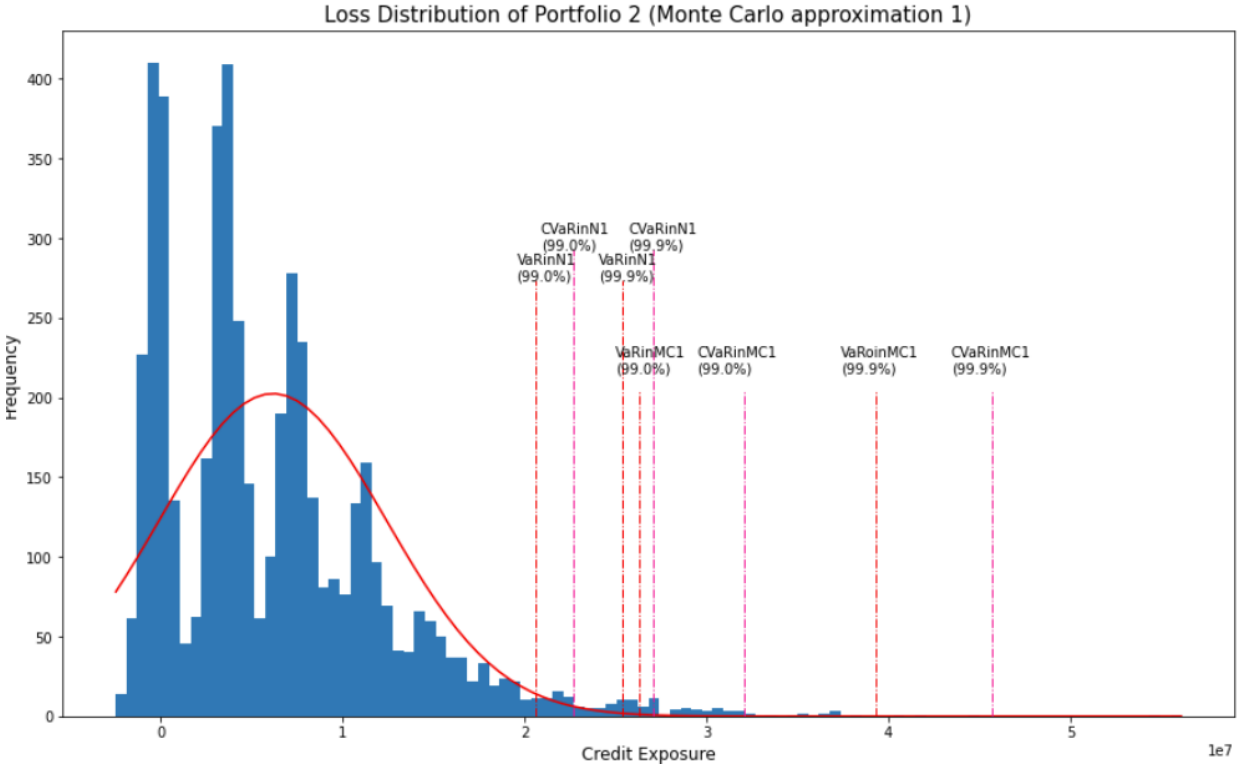
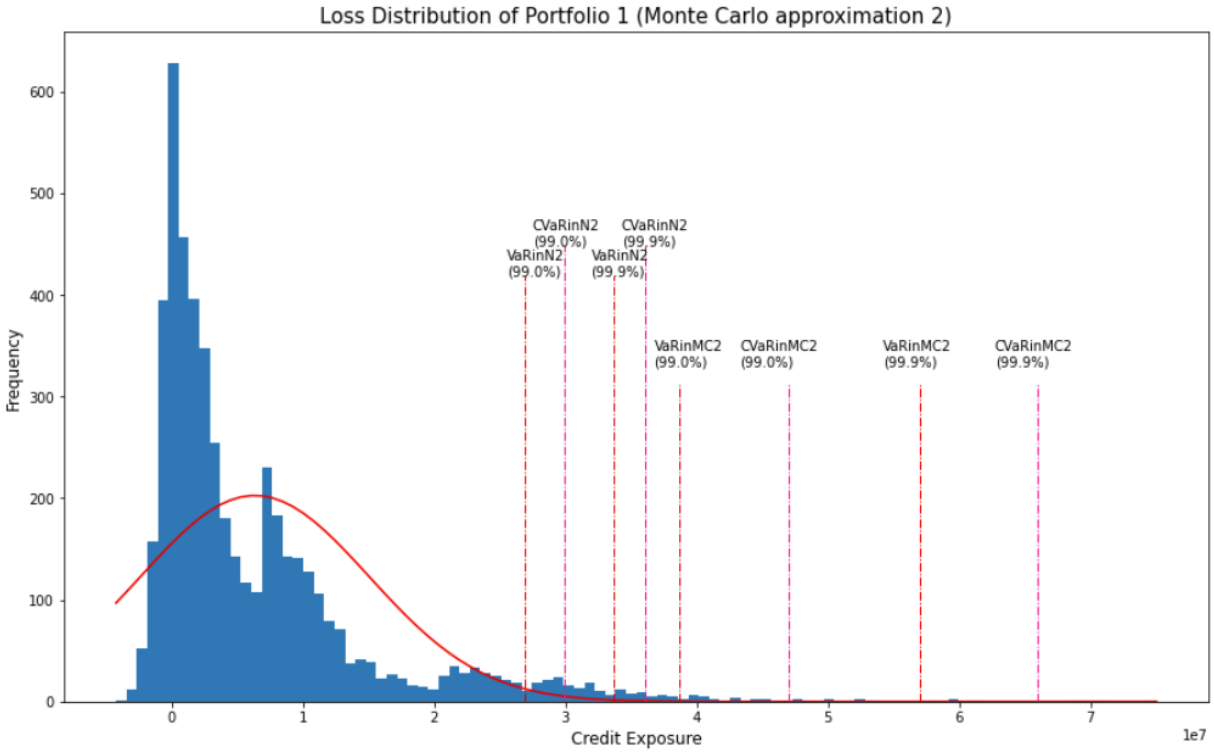
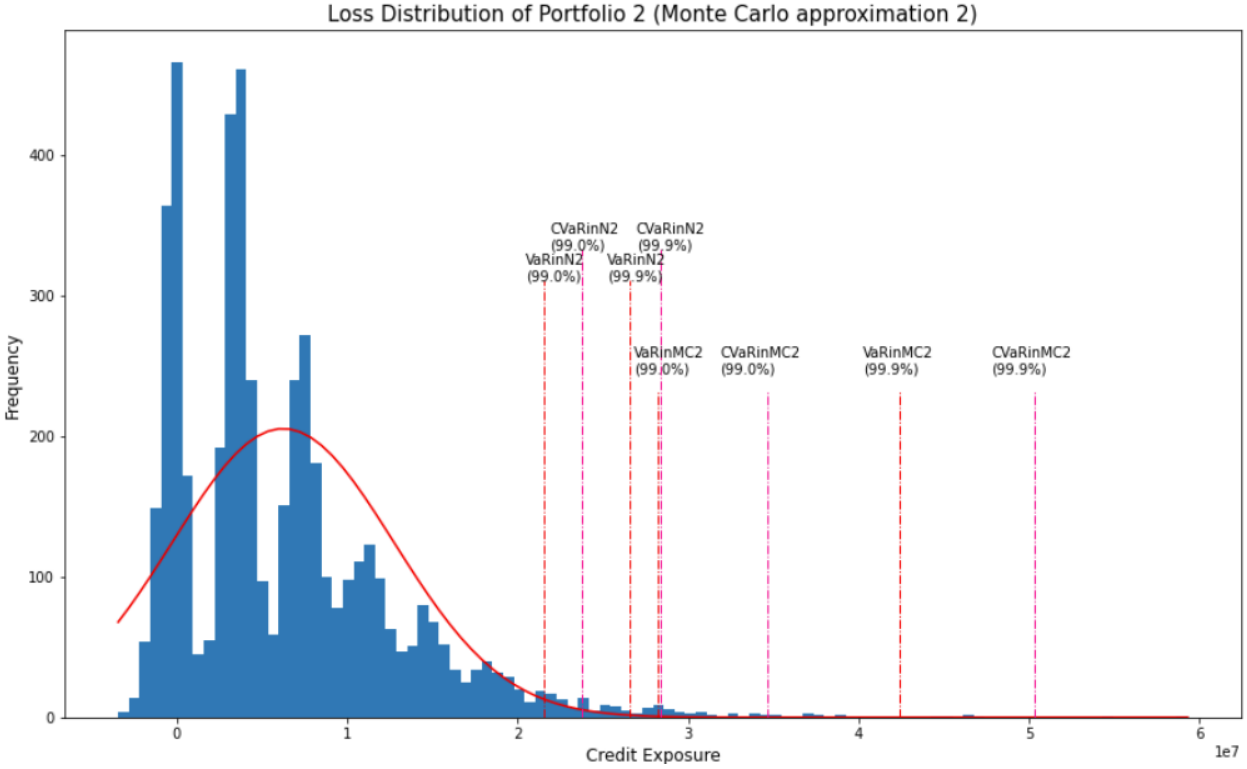

Loss distribution of Portfolio 1 (True Distribution)
Frequency
Credit Exposure
1e7
VaRinN (99.0%)
CVaRinN (99.0%)
VaRinN (99.9%)
CVaRinN (99.9%)
VaRout (99.0%)
CVaRout (99.0%)
VaRout (99.9%)
CVaRout (99.9%)


Loss distribution of Portfolio 2 (True Distribution)
Frequency
Credit Exposure
1e7
VaRinN (99.0%)
CVaRinN (99.0%)
VaRinN (99.9%)
CVaRinN (99.9%)
VaRout (99.0%)
CVaRout (99.0%)
VaRout (99.9%)
CVaRout (99.9%)


Loss Distribution of Portfolio 1 (Monte Carlo approximation 1)
Frequency
Credit Exposure
1e7
CVaRinN1 (99.0%)
CVaRinN1 (99.9%)
VaRinN1 (99.0%)
VaRinN1 (99.9%)
VaRinMC1 (99.0%)
CVaRinMC1 (99.0%)
VaRinMC1 (99.9%)
CVaRinMC1 (99.9%)


Loss Distribution of Portfolio 2 (Monte Carlo approximation 1)
Frequency
Credit Exposure
1e7
CVaRinN1 (99.0%)
CVaRinN1 (99.9%)
VaRinN1 (99.0%)
VaRinN1 (99.9%)
VaRinMC1 (99.0%)
CVaRinMC1 (99.0%)
VaRoinMC1 (99.9%)
CVaRinMC1 (99.9%)


Loss Distribution of Portfolio 1 (Monte Carlo approximation 2)
Frequency
Credit Exposure
1e7
VaRinN2 (99.0%)
CVaRinN2 (99.0%)
VaRinN2 (99.9%)
CVaRinN2 (99.9%)
VaRinMC2 (99.0%)
CVaRinMC2 (99.0%)
VaRinMC2 (99.9%)
CVaRinMC2 (99.9%)


Loss Distribution of Portfolio 2 (Monte Carlo approximation 2)
Frequency
Credit Exposure
1e7
VaRinN2 (99.0%)
CVaRinN2 (99.0%)
VaRinN2 (99.9%)
CVaRinN2 (99.9%)
VaRinMC2 (99.0%)
CVaRinMC2 (99.0%)
VaRinMC2 (99.9%)
CVaRinMC2 (99.9%)

	In-sample value	True distribution value	Percent difference (sampling error)
99% VaR, MC1, Portfolio 1	$36,791,135.73	$37,999,625.38	3.18%
99% CVaR, MC1, Portfolio 1	$44,400,101.93	$45,610,879.55	3.19%
99% VaR, MC2, Portfolio 1	$38,687,644.24	$37,999,625.38	1.81%
99% CVaR, MC2, Portfolio 1	$47,047,319.63	$45,610,879.55	3.78%
99.9% VaR, MC1, Portfolio 1	$53,549,717.06	$55,208,324.98	3.00%
99.9% CVaR, MC1, Portfolio 1	$61,905,467.69	$62,518,801.48	1.11%
99.9% VaR, MC2, Portfolio 1	$57,034,166.92	$55,208,324.98	3.31%
99.9% CVaR, MC2, Portfolio 1	$65,996,636.01	$62,518,801.48	6.30%
99% VaR, MC1, Portfolio 2	$26,291,813.96	$27,586,139.91	4.69%
99% CVaR, MC1, Portfolio 2	$32,043,143.20	$33,543,767.15	5.44%
99% VaR, MC2, Portfolio 2	$28,236,926.05	$27,586,139.91	2.36%
99% CVaR, MC2, Portfolio 2	$34,646,556.92	$33,543,767.15	4.00%
99.9% VaR, MC1, Portfolio 2	$39,322,007.11	$41,788,707.97	5.90%
99.9% CVaR, MC1, Portfolio 2	$45,719,923.61	$47,647,389.57	4.61%
99.9% VaR, MC2, Portfolio 2	$42,383,910.08	$41,788,707.97	1.42%
99.9% CVaR, MC2, Portfolio 2	$50,334,879.22	$47,647,389.57	6.43%

	Normal model value	True distribution value	Percent difference (model error)
99% VaR, N1, Portfolio 1	$25,838,327.21	$37,999,625.38	32.00%
99% CVaR, N1, Portfolio 1	$28,695,891.61	$45,610,879.55	44.51%
99% VaR, N2, Portfolio 1	$26,903,697.74	$37,999,625.38	29.20%
99% CVaR, N2, Portfolio 1	$29,887,871.74	$45,610,879.55	41.38%
99.9% VaR, N1, Portfolio 1	$32,279,949.36	$55,208,324.98	41.53%
99.9% CVaR, N1, Portfolio 1	$34,614,612.92	$62,518,801.48	50.54%
99.9% VaR, N2, Portfolio 1	$33,630,727.69	$55,208,324.98	39.08%
99.9% CVaR, N2, Portfolio 1	$36,068,832.77	$62,518,801.48	47.91%
99% VaR, N1, Portfolio 2	$20,588,325.25	$27,586,139.91	25.37%
99% CVaR, N1, Portfolio 2	$22,697,718.48	$33,543,767.15	39.32%
99% VaR, N2, Portfolio 2	$21,552,946.91	$27,586,139.91	21.87%
99% CVaR, N2, Portfolio 2	$23,778,311.17	$33,543,767.15	35.40%
99.9% VaR, N1, Portfolio 2	$25,343,393.64	$41,788,707.97	39.35%
99.9% CVaR, N1, Portfolio 2	$27,066,792.60	$47,647,389.57	49.25%
99.9% VaR, N2, Portfolio 2	$26,569,441.27	$41,788,707.97	36.42%
99.9% CVaR, N2, Portfolio 2	$28,387,589.92	$47,647,389.57	46.09%

Basing on the graphs and tables of sampling error and model error, we can conclude that model error is much bigger than sampling error. Moreover, model that uses normal distribution predicts a shorter range of loss which can be exceeded while comparing to the model that use non-Normal distribution with the same quantile.

Discussion

1. The bank may underestimate the tail risk, then the bank capital requirements maybe less than it should be. Hence, the bank is not fully prepared for the worst-case scenario, and this leads to a probability of having bigger financial difficulties than bank has expected.

2. We can set more scenarios to increase the accuracy and the adaptability of the model in various situations while using Monte Carlo approximation. As a result, the sampling error will decrease. Or if we are using certain model approximation instead of Monte Carlo approximation, we can find a better model other than Normal distribution, that is more fit to the historical data to increase the accuracy. Hence, the model error can be reduced into a lower level.