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MIE1622 Assignment 3 Tutorial

Credit Risk Modeling and Simulation

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Overview

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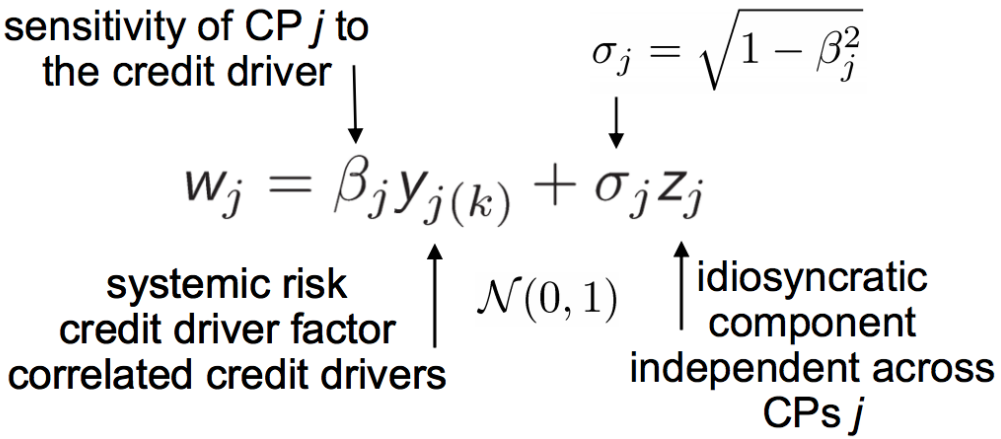
- Generate 6 groups of VaR and CVaR result for each portfolio and each confidence level:
  - ❖True distribution and corresponding normal distribution with mean and variance from true distribution;
  - ❖Monte Carlo 1 and corresponding normal distribution with mean and variance from MC1 distribution;
  - ❖Monte Carlo 2 and corresponding normal distribution with mean and variance from MC2 distribution.
- Compare the effectiveness for MC methods.

Credit worthiness Index



sqrt_rho = (chol(rho))';
% Cholesky decomp of rho (for generating correlated Normal random numbers)

Loss for each bond

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- [Ltemp, CS] = max(prob, [], 2);
- exposure(:, 1) = (1-recov_rate) .* exposure(:, 1);
- CS_Bdry = norminv(cumsum(prob(:,1:C-1), 2));

Use exposure and CS_Bdry to determine losses

Hint : try find() or bsxfun() or others…

Var and CVar Estimation

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From MC simulation:

- Given a random sample of size N, let $\lambda_{(k)}$ be the k^{th} order statistic, i.e., $\lambda_{(1)} \leq \lambda_{(2)} \leq \ \ldots \leq \lambda_{(N)}$
  - An estimate of VaR_α is $\mathrm{VaR}_{\alpha,N} = \ell_{(\lceil N\alpha \rceil)}$
  - An estimate of CVaR_α is

$$\mathrm{CVaR}_{\alpha,N} = \frac{1}{N(1-\alpha)} \left[(\lceil N\alpha \rceil - N\alpha)\, \ell_{(\lceil N\alpha \rceil)} + \sum_{k=\lceil N\alpha \rceil + 1}^{N} \ell_{(k)} \right]$$

Var and CVar Estimation

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From Normal Distribution:

VaR for Normally distributed losses:

$$\mathrm{VaR}_\alpha^{\mathcal{N}} = \mu_{\mathcal{L}} + \Phi^{-1}(\alpha) \cdot \sigma_{\mathcal{L}}$$

CVaR for Normally distributed losses:

$$\mathrm{CVaR}_\alpha^{\mathcal{N}} = \mu_{\mathcal{L}} + \frac{\phi(\Phi^{-1}(\alpha))}{1-\alpha} \cdot \sigma_{\mathcal{L}}$$

Φ is the cdf of $\mathcal{N}(0,1)$
ϕ is the pdf of $\mathcal{N}(0,1)$

Mu and sigma from MC simulation

Show Your Work and Thinking

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Small suggestion: If MC takes too much time, you can try sparse() which will be helpful