Collateral Management Analytics

Collateral refers to the practice of providing assets to secure an obligation. Collateral can take many forms: property, inventory, equipment, receivables, oil reserves, etc.

Collateralisation agreements are often used to secure repo, securities lending and derivatives transactions. Under this agreement, a party who owes an obligation to another party posts collateral, usually cash or securities, to secure the obligation.

In the event that the party defaults on the obligation, the secured party may seize the collateral. The arrangement can be unilateral where only one party is obliged to post collateral, or bilateral where both parties may be obliged to post collateral.

Alternatively, the net obligation may be collateralised, in which case the party who is the net obligator posts collateral for the value of the net obligation.

Periodically, the secured obligation is revalued and the collateral is adjusted to reflect changes in value. The securing party adjusts the collateral holdings depending on the current revaluation of the security.

A counterparty can enter into a collateral agreement in order to enhance their credit quality. A collateral agreement obligates the counterparty to margins in cash with the dealer to cover costs in the event of default.

At time T, the contract either defaults or survives. The default probability is p and the survival probability is q where q = 1-p. The survival payoff is X and the default value is φX where φ is the recovery rate.

The value is the discounted expectation of all the possible payoffs, i.e.,

$$V(t) = (p\varphi X + qX)D(t)$$

Where D(t) is the discount factor.

At time T, the contract either defaults or survives. The default probability is p and the survival probability is q where q = 1-p. If the party survives, the survival payoff is X and the taker returns the collateral to the giver. In this case, collateral has no effect at all. If the party defaults, the default payment is the collateral C.

The value is the discounted expectation of all the possible payoffs and given by

$$V_c(t) = (pC + qX)D(t)$$

If we assume that the collateral asset is cash only, the credit exposure is given by

$$E_c(t) = \begin{cases} MTM_t & if\ MTM_t \leq TH + MTA \\ TH + MTA & if\ MTM_t > TH + MTA \end{cases}$$

If the collateral is non cash, $MTM_t = \max\left(\sum_i MTM_t^i, 0\right) + MTM_t^C$ where MTM_t^C is the value of the collateral asset. In other words, we need to simulate the value change of the collateral asset during margin period of risk.

You can find more details at

https://finpricing.com/lib/EqSpread.html