Counter Party Credit Risk

Equity Spot
Equity Vol surface
Forward rates
Commodity spot
FX spot
...

Risk Factor

Value (MTM)
Asset Class
...

PD Term structure
Recovery rate
Funding Curve
...

Bank

Trade

Counterparty

PD Term structure
Recovery rate
...

Credit Risk Mitigants

Netting Set #
Trade #

Netting

Collateral

Initial Margin
Variation Margin
TH
MTA
...

Bilateral Exposure

A   B

$V(t)$

$V(0)$

0   t
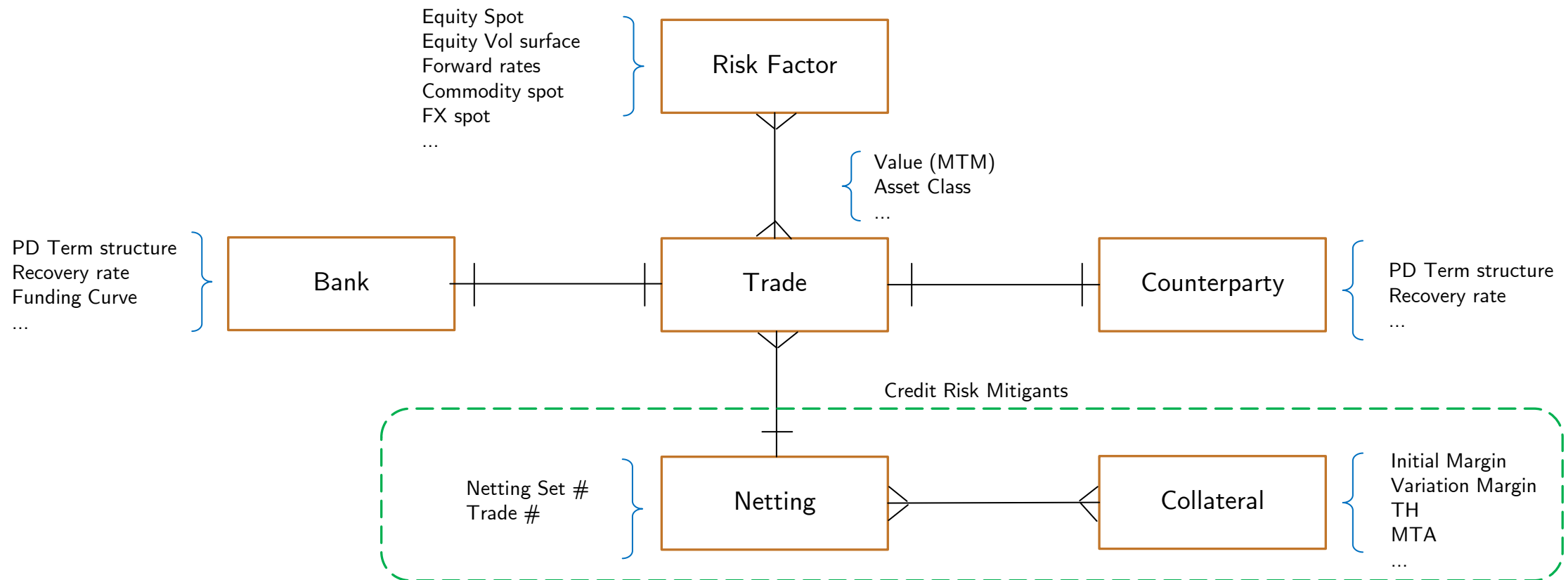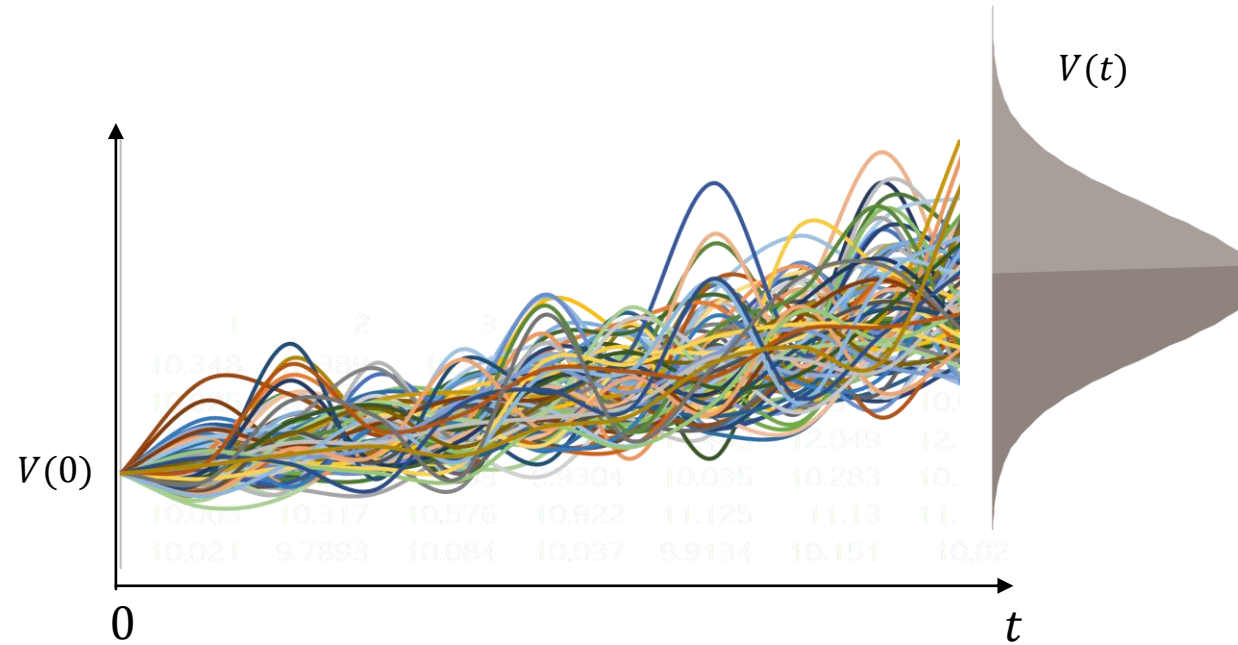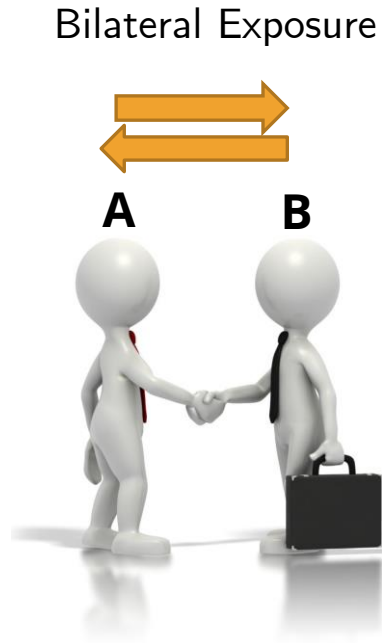
V_0 = MTM of the trade or CE (current exposure)

V_t = Future value of the trade at time t (random)

$EFV(t) = $ (Expected Future Value) $= \mathbb{E}[V_t]$

Positive Exposure $= V_t^{+} = \max\{V_t, 0\}$

Negative Exposure $= V_t^{-} = \min\{V_t, 0\}$

$EE(t)=$ (Expected Exposure) $= \mathbb{E}\left[V_t^{+}\right]$

$ENE(t)=$ (Expected Negative Exposure) $= \mathbb{E}[V_t^{-}]$

$PFE(t) = $ (Potential Future Exposure) $= q_{\alpha}(V_t)$

$EPE=$ (Expected Positive Exposure) $= \underset{t\in(0,T)}{\text{Avg}} \mathbb{E}\left[V_t^{+}\right]$

$EEE(t)=$ (Effective Expected Exposure) $= Non\ decreasing\ EE(t)$

$EEPE=$ (Effective Expected Positive Exposure) $= \underset{t\in(0,T)}{\text{Avg}}\ EEE(t)$

Equity Class

Modelling Exposure Metrics

Generate simulated risk factors $S(t)$ for each time $t \in [0, T]$

stochastics.py

- Map risk factor to a stochastic process
- calibrate to market data
- Perform Monte Carlo Simulation (steps, paths, discretization method)
- Calculate and plot density at t

Generate simulated exposures $V(t)$ by plugging simulated $S(t)$ in the valuation formula for each time $t \in [0, T]$

Equity.py

- Map risk factor to an Equity Derivative
- Generate V(t) using analytical / semi-analytical formula (don't use Monte Carlo within Monte Carlo)
- Calculate and plot Exposure metric

Calculate Exposure profiles from simulated $V(t)$