Fundamental Review Trading Book (FRTB)

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Overview

Introduction

Standardised Approach

Internal Approach

Conclusion

Bibliography

Introduction

- Portfolio:

Instrument	Notional	Maturity	Coupon
Corporate Bond AA issuer	40$m	2y	1.00%
Corporate Bond AA issuer	80$m	3y	1.25%
Corporate Bond AA issuer	160$m	3y	1.75%
IRS pay fix	280$m	4y	1.0095%

- Bootstrapped curves:

Introduction

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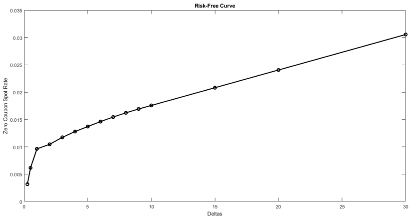

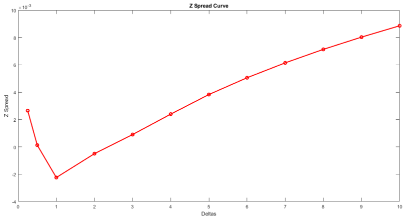

Standardised Approach

$$WS_k = RW_k s_k$$

where s_k is :

- $\text{PV01} = \frac{V_t(r_t + 0.0001, cs_t) - V_t(r_t, cs_t)}{0.0001}$
- $\text{CS01} = \frac{V_t(r_t, cs_t + 0.0001) - V_t(r_t, cs_t)}{0.0001}$

$$K_{ir} = \sqrt{\left(\sum_k WS_k^2 + \sum_{l \neq k} \rho_{lk} WS_l WS_k\right)^+}$$

where k are the given vertices

$$K_{sa} = K_{ir} + K_{cs} = 3.951e^7\$$$

Standardised Approach

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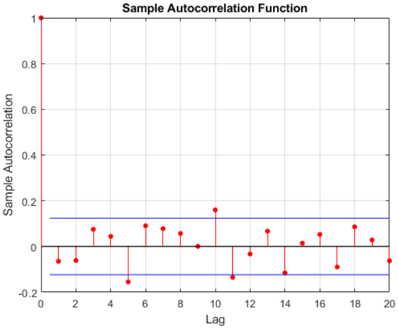
Internal Approach

Time Serie Analysis

We have started by some tests on the auto correlation, normality and also stationarity of risk factors.



Autocorrelation plot for the change of zero rates on one year vertex. Dashed lines mark the standard 95% confidence intervals for the autocorrelations

Internal Approach

Monte Carlo Method

In order to simulate the Loss we need to simulate the risk factors:

$$Y^{(t)}(t_0 + \Delta t, T_i) = R^{(t)}(t_0 + \Delta t, T_i) + Z^{(t)}(t_0 + \Delta t, T_i)$$

From the daily risk factor we could find the no-overlapping risk factors:

$\Delta R^i_{\Delta T}(t) = \sum_{k=0}^{\Delta T-1} \Delta R^i_1(t-k)$
$\Delta Z^i_{\Delta T}(t) = \sum_{k=0}^{\Delta T-1} \Delta Z^i_1(t-k)$
$t := \Delta T, 2\Delta T, ..., [N/\Delta T]\Delta T$

where we have that :

$R^{(t)}(t_0 + \Delta t, T_i) = R(t_0, T_i) + \Delta R^i_{\Delta T}(t)$
$Z^{(t)}(t_0 + \Delta t, T_i) = Z(t_0, T_i) + \Delta Z^i_{\Delta T}(t)$

Internal Approach

Delta and Gamma methods

Using the $PV01$ and $CS01$ computed before:
$L^{\delta}_{t+1} = -\partial_t V_t \Delta T - \sum_{i=1}^{n} PV01_i \Delta R_i - \sum_{i=1}^{n} CS01_i \Delta Z_i + \epsilon$

Second order of taylor expansion:

$$L^{\gamma}_{t+1} = L^{\delta}_{t+1} - \frac{1}{2}\sum_{i=1}^{n} \Gamma_i^{(1)} \Delta R_i^2 - \frac{1}{2}\sum_{i=1}^{n} \Gamma_i^{(2)} \Delta Z_i^2 + \epsilon.$$

In order to compute the second derivative we have used the fact that:

$$\Gamma_i^{(1)} = \frac{V_t(R_i + bp) + V_t(R_i - bp) - 2V_t}{bp^2}$$

$$\Gamma_i^{(2)} = \frac{V_t(Z_i + bp) + V_t(Z_i - bp) - 2V_t}{bp^2}$$

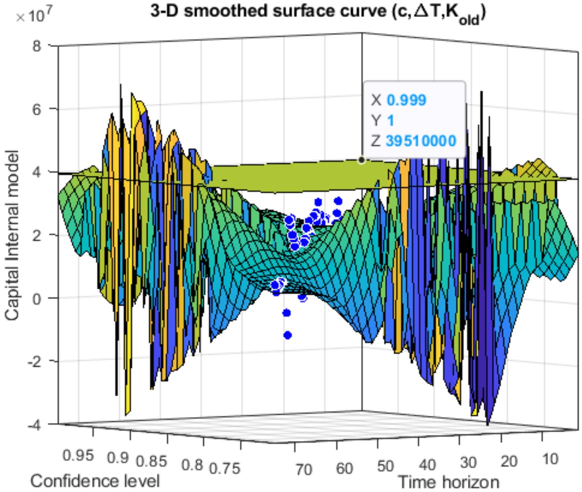
Internal Approach

$$K_{old} = m(VaR_c + SVaR_c)$$

Monte Carlo	Delta Normal	Gamma Normal	Historical Simulation
1.7196e+07	1.7474e+07	1.7294e+07	1.5334e+07

Table: K_{old} using ΔT=10 an c=99%

Conclusion


3-D smoothed surface curve (c,ΔT,K_old)
×10^7
8
6
4
2
0
-2
-4
Capital Internal model
X 0.999
Y 1
Z 39510000
0.95 0.9 0.85 0.8 0.75
Confidence level
70 60 50 40 30 20 10
Time horizon

Conclusion

- For a confidence level c=99% and time horizon of 10 day we found that the standardised capital is greater two times than internal one.
- The nearest value of K_{old} and K_{sa} is achieved on $\Delta T = 37$ days and c=99%.

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