Value-at-risk model performance

Update

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Value-at-Risk assessment for a year with war and interest rate hikes

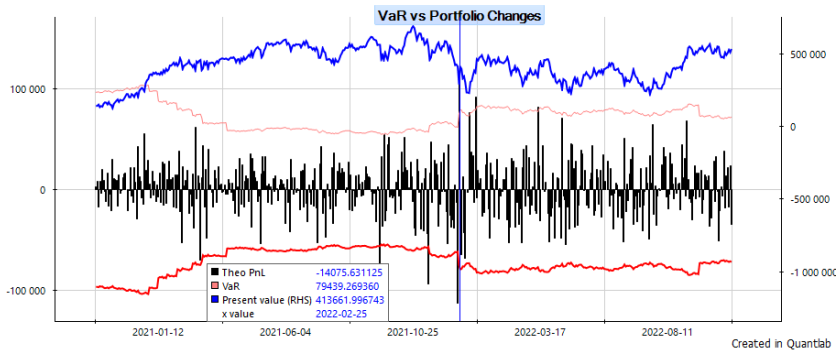
The financial industry uses value-at-risk models for many different purposes. It is commonly used for measurement of capital, fund exposures, and limiting trading risk. Backtesting analysis show the (non)performance of the various models during the last years. We show stylised facts of three different models, for holdings of stocks and bonds.

(NOTE! that this is a follow-up on a previous post with the same assets but different time window.)

UPDATE: Benchmarking three models for a Future Contract on OMXS30

Comparing theoretical PnL with VaR prognosis over 500 bus.days 2021-01-01 to 2023-01-01

Model: UW Historical Sim - Rolling window: 250 days - Conf level: 99% VaR



Kupiec Test - 95% Level Test Coinfidence

Number of exceptions	Nonrejection region for number exceptions N.
3.00	0.6 < N < 9.4

Christoffersen Test - 95% Level Test Coinfidence

Test name	Test statistic	Nonrejection region for test statistic T
Independence Test	0.31	T < 3.84
Conditional Coverage Test	0.53	T < 5.99

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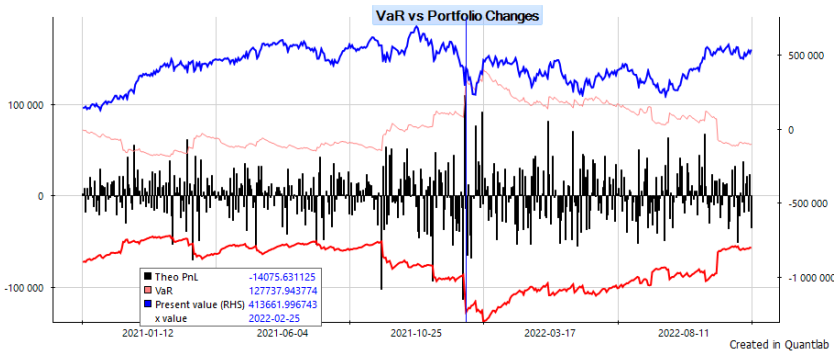
Model: Filtered Hist Sim - Vol-time-decay: 0,97 - Rolling window: 250 days - Conf level: 99% VaR



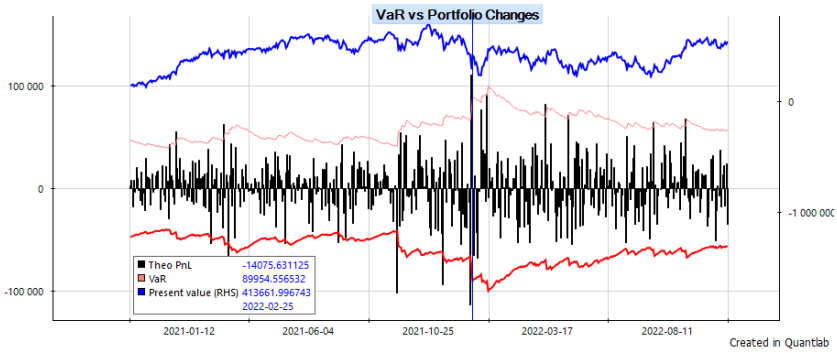
Kupiec Test - 95% Level Test Coinfidence

Number of exceptions	Nonrejection region for number exceptions N.
6.00	0.6 < N < 9.4

Christoffersen Test - 95% Level Test Coinfidence

Test name	Test statistic	Nonrejection region for test statistic T
Independence Test	0.29	T < 3.84
Conditional Coverage Test	1.01	T < 5.99

Model: DG Analytical - Covar-time-decay: 0,97 - Rolling window: 250 days - Conf level: 99% VaR



Kupiec Test - 95% Level Test Coinfidence

Number of exceptions	Nonrejection region for number exceptions N.
7.00	0.6 < N < 9.4

Christoffersen Test - 95% Level Test Coinfidence

Test name	Test statistic	Nonrejection region for test statistic T
Independence Test	0.33	T < 3.84
Conditional Coverage Test	1.87	T < 5.99

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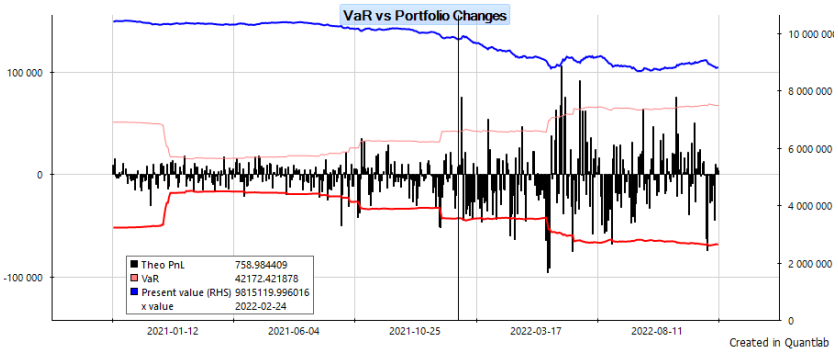
UPDATE: Benchmarking three models for SEK Mortg Bond (Swedhyp193)

Comparing theoretical PnL with VaR prognosis over 500 bus.days 2021-01-01 to 2023-01-01

Model: UW Historical Sim - Rolling window: 250 days - Conf level: 99% VaR



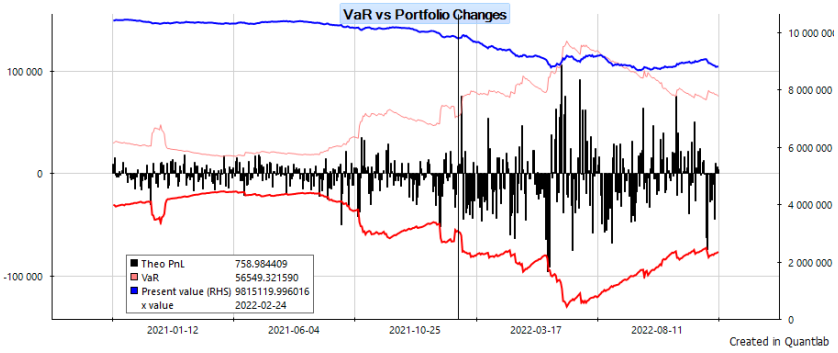
Kupiec Test - 95% Level Test Coinfidence

Number of exceptions	Nonrejection region for number exceptions N.
24.00	0.6 < N < 9.4

Christoffersen Test - 95% Level Test Coinfidence

Test name	Test statistic	Nonrejection region for test statistic T
Independence Test	2.39	T < 3.84
Conditional Coverage Test	43.68	T < 5.99

Model: Filtered Hist Sim - Vol-time-decay: 0,97 - Rolling window: 250 days - Conf level: 99% VaR



Kupiec Test - 95% Level Test Coinfidence

Number of exceptions	Nonrejection region for number exceptions N.
8.00	0.6 < N < 9.4

Christoffersen Test - 95% Level Test Coinfidence

Test name	Test statistic	Nonrejection region for test statistic T
Independence Test	0.37	T < 3.84
Conditional Coverage Test	2.99	T < 5.99

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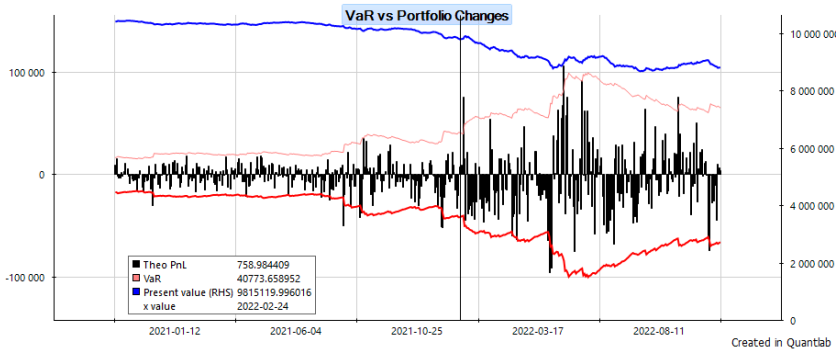
Model: DG Analytical - Covar-time-decay: 0,97 - Rolling window: 250 days - Conf level: 99% VaR



Kupiec Test - 95% Level Test Coinfidence

Number of exceptions	Nonrejection region for number exceptions N.
18.00	0.6 < N < 9.4

Christoffersen Test - 95% Level Test Coinfidence

Test name	Test statistic	Nonrejection region for test statistic T
Independence Test	9.29	T < 3.84
Conditional Coverage Test	32.42	T < 5.99

Results and discussion

The analysis performed in this text assesses the risk of two different positions using three different Value-at-Risk (VaR) models: Filtered Historical Simulation, Unweighted Historical Simulation, and Standard VaR. The results show that the Filtered Historical Simulation is the only model that passed statistical tests for the number of exceptions and clustering independence.

In the case of the equity index future position, the Unweighted Historical Simulation model performed well as it showed fewer VaR breaches than expected (3 out of 500 days) during a period of high volatility. Specifically, the expected number of breaches at a 99% confidence level was around 5, and the actual number of breaches was 3, which indicates that the model is well calibrated for this position in this specific time frame. However, the credit risky mortgage bond position had a large number of VaR breaches (24) during the same period, which was much higher than expected.

The expected number of breaches at the same confidence level is around 5, and the test statistic bounds would be 1 to 9 breaches. This indicates that the model is not well calibrated for this position and this time frame. The analysis also suggests that interest rates and credit spreads have become volatile and that this is prior to
war in Ukraine.

It can be concluded that VaR is a valuable tool for measuring risk, but it should be used with caution. VaR model should be properly calibrated and evaluated during times of stress. One should remember that VaR is a statistical measure and not a definite prediction of future events,

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and it can provide a speed gauge of risk taking, to evaluate the potential loss in different scenarios but it should not be solely relied on as it can't predict the next black swan event.

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