

About FRTB and revised PnL attribution test for internal models

Comment by
Robert Thorén, Partner
robert.thoren@algorithmica.com

Summary

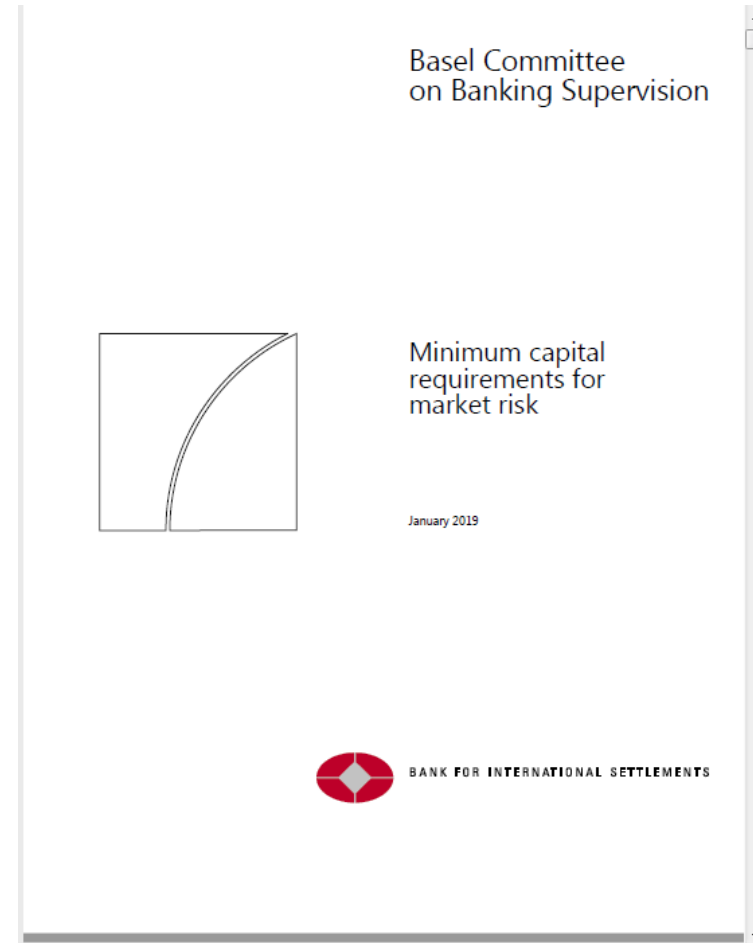
The old version of the PnL attribution test has rightfully been criticised for being overly punitive. Mainly because it could not handle well-hedged trading books as the divisor in the test metric could be close to zero, exploding the scaled variance.

In the latest revision of the rules, a more holistic approach has been devised.

By using two complementary measures namely;

- the Spearman rank correlation test and
- the Kolmogorov Smirnov test

it will no longer be impossible to pass the attribution test for reasonably well matched model- and risk factor set-up:s - even when having independent risk system and trading system giving an extra level of defence.



Spearman correlation

Recipe for Spearman correlation:

Ensure two vectors of equal size containing the Hypothetical Profit and Loss (HPL) from the trading system and the Risk Theoretical Profit and Loss (RTPL) from the risk system.

Using daily PnL for the last 250 trading days.

Rank both PnL vectors independently from smallest to largest daily PnL.

Calculate the “regular” correlation between the sorted vectors as

32.38 Banks must calculate the Spearman correlation coefficient of the two time series of rank values of R_{RTPL} and R_{HPL} based on size using the following formula, where σ_{RHPL} and σ_{RTPL} are the standard deviations of R_{RTPL} and R_{HPL} .

$$r_s = \frac{cov(R_{HPL}, R_{RTPL})}{\sigma_{RHPL} \times \sigma_{RTPL}}$$

The resulting correlation must be above 0.8 to be in the green zone as previously mentioned.

Kolmogorov Smirnov test

Recipe for Kolmogorov Smirnov test:

Ensure two vectors of equal size (not necessary for the statistical test but for the regulatory) containing the Hypotetical Profit and Loss (HPL) from the trading system and the Risk Theoretical Profit and Loss (RTPL) from the risk system.

Using daily PnL for the last 250 trading days.

Calculate the cumulative density function using the empirical distribution for both vectors.

Extract the max distance between these two distributions such that

$$D_{n,m} = \sup_x |F_{1,n}(x) - F_{2,m}(x)|,$$

where $F_{1,n}$ and $F_{2,m}$ are the [empirical distribution functions](#) of the first and the second sample respectively, and [sup](#) is the [supremum function](#).

The null hypothesis is rejected at level α if

$$D_{n,m} > c(\alpha) \sqrt{\frac{n+m}{nm}}.$$

and in general^[12] by

$$c(\alpha) = \sqrt{-\frac{1}{2} \ln \alpha}.$$

source: wikipedia

PnL attribution test metrics (page 93)

Check the calculated levels against the proposed rejection levels set by the regulatory framework. There are three possible outcomes;

Green zone when Spearman correlation is higher than 0.8 and KS test is less than 0.09.

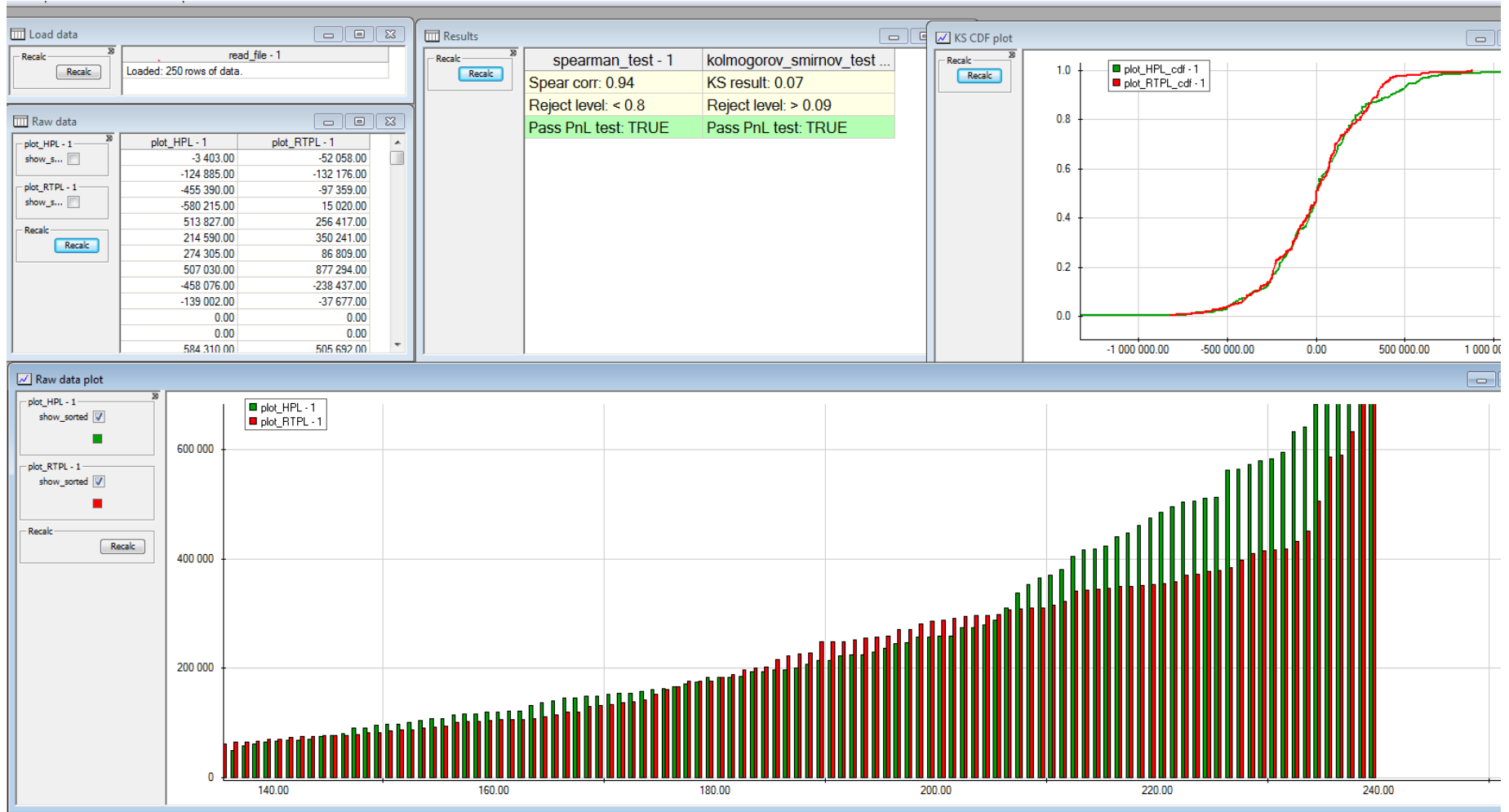
(for non-passing metrics see table 2 below)

PLA test thresholds

Table 2

Zone	Spearman correlation	KS test
Amber zone thresholds	0.80	0.09 (p-value = 0.264)
Red zone thresholds	0.70	0.12 (p-value = 0.055)

Review the metrics and check for anomalies



Visit our homepage for further info

and view the FRTB Kolmogorov Smirnov video at https://youtu.be/5mEx_0Jaz8s

