

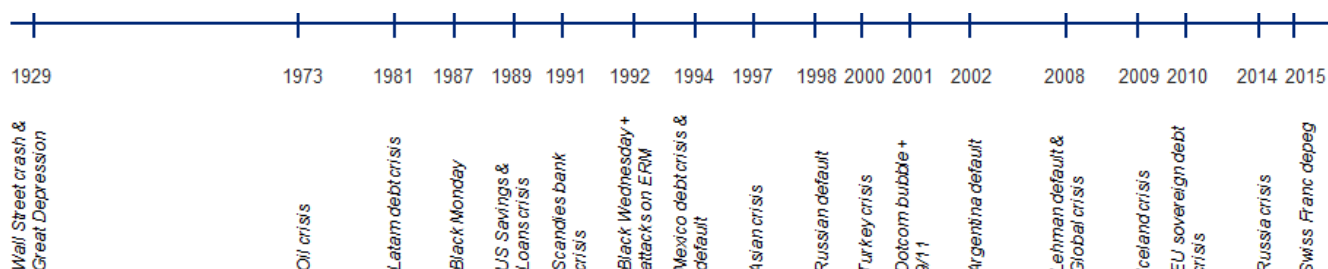


Date : February 1st, 2017

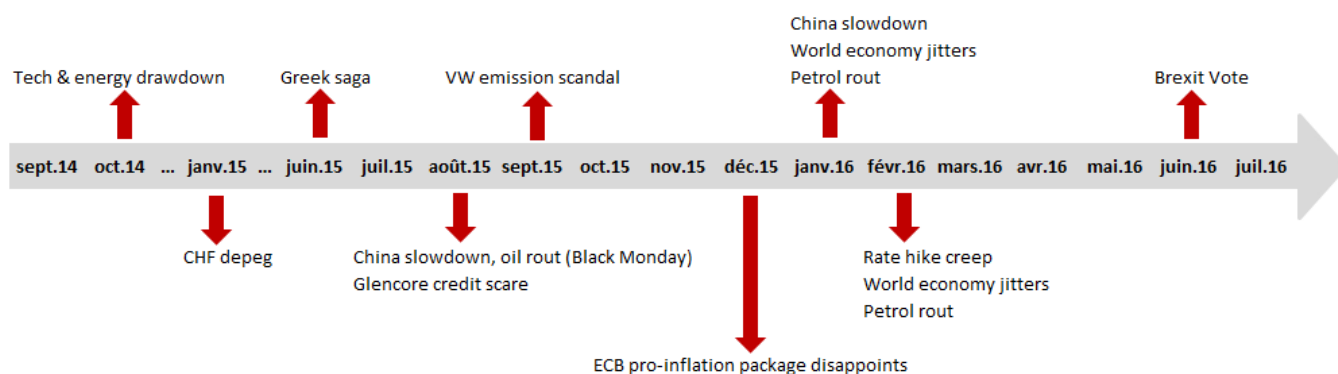
Subject : Practitioners' Forum on VaR Model Backtesting

SUMMARY

Industry participants have been faced with crisis at a quickening pace especially since early 2000's as is shown in the following timeline.



In addition to full blown crisis, during the last few years various episodes of market turbulence have also become more common as illustrated by the following graph.



During these episodes, backtests of VaR models often yielded underwhelming results: portfolios of various types, monitored with different models, experienced too many exceptions given their VaR confidence level.

In the context of RMP reviews, CSSF has provided feedback and touched upon the topic of backtesting exceptions. Soundness of such models are also addressed directly during on-site visits.

The heart of the questions is whether the models remain valid given a number of exceptions too high for comfort. We therefore decided to further investigate how the industry was coping or could cope with these questions.

A poll and discussions among practitioners throughout the industry revealed common ground on concerns about backtesting results, what areas to further investigate and how to go about these investigations. During the meeting held on 21st March 2016, participants shared their insights and experience.

WHAT DOES THE INDUSTRY SAY?

In order to get feedback from industry participants, the first initiative was to organize a practitioner forum where industry members could exchange and openly discuss such topics, their concerns and how they were trying to manage related issues. Initial feedbacks were that discussing and sharing experience about the steps taken to try and validate models in this challenging environment is an avenue worth exploring further, and that risk managers were willing to get involved in this process.

To get the best out of such discussions, we drew up a straw poll that participants answered before meeting. The questions answered went along the following lines:

- Model used: name of provider (e.g. RiskMetrics, Barra, etc.)
- Type of model: historical, monte-carlo, parametric, etc.
- Type of portfolios with too many exceptions: equity (vanilla or with derivatives), fixed income (vanilla or with derivatives), derivative based.
- Origin of exceptions: market volatility shifts, mapping, data, low reactivity, etc.
- Additional analysis undertaken or measures set-up: independent validation, use of second model for challenging, analysis of breaks, statistical tests, etc.

Questionnaires were sent out to 24 asset managers, third party ManCos, consultants and independent directors. Of these, 21 answered. These answers provide a broad coverage:

10 VaR model providers. In alphabetical order:

1. Algorithmics,
2. APT,
3. Barra,
4. Gambit,
5. Much-Net,
6. Point,
7. RiskMetrics,
8. RMX,
9. SAS,
10. Statpro.

Various **types of model**:

1. Factor-based vs. full revaluation,
2. Historical vs. Monte Carlo vs. parametric.

9 respondent **nationalities**.

In alphabetical order:

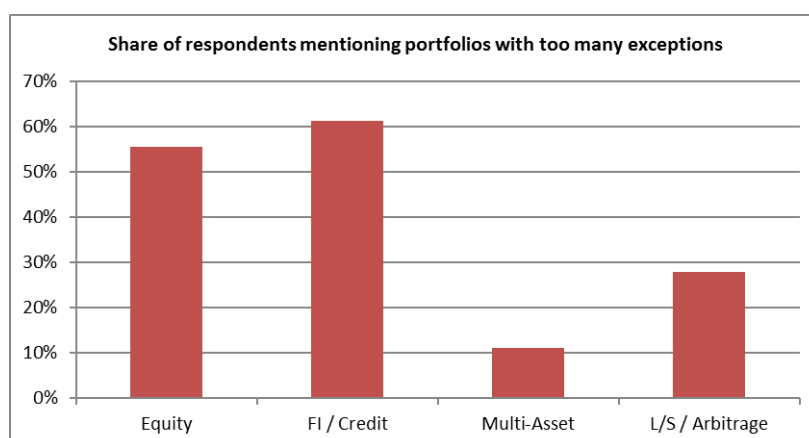
1. French,
2. German,
3. Italian,
4. Japanese,
5. Lux,
6. Nordic,
7. Swiss,
8. UK,
9. US.

From our poll, **model use and results** comes out as¹:

- 44% of respondents use factor-based models and 56% full revaluation models
- 39% of respondents use historical VaR, 50% use Monte Carlo and 44% use parametric VaR.
- 83% of respondents reported portfolios with more than 4 exceptions. Portfolios with too many exceptions:
 - ✓ Equity mentioned by 56% of respondents. These were both plain vanilla equity and portfolios using derivatives.

¹ Please note that, for most questions, sums don't add up to 100% as respondents could provide several answers e.g. use more than 1 model.

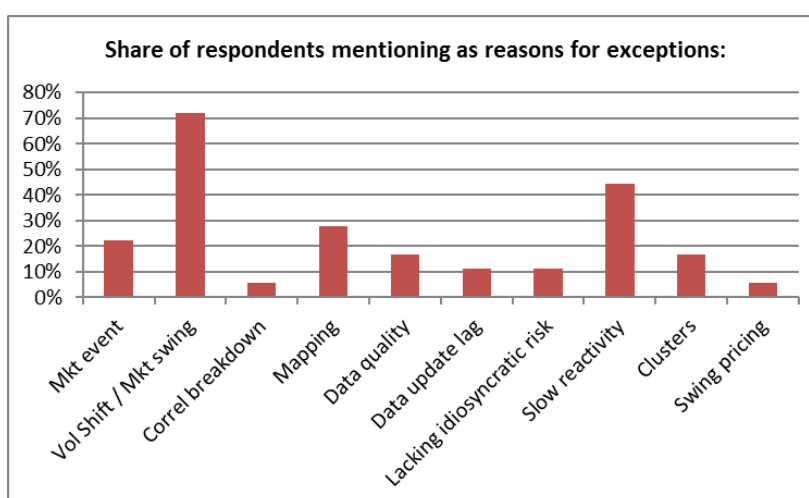
- ✓ Fixed Income and Credit mentioned by 61% of respondents. Emerging debt, high yield and convertible were often mentioned.
- ✓ Multi-Asset mentioned by 11% of respondents, with exceptions being often due to the equity part of the portfolios.
- ✓ L/S and arbitrage strategies mentioned by 28% of respondents.



The following **reasons for exceptions** were the most often mentioned:

1. Most cited were volatility shifts and market swings (72% of respondents).
2. Slow model reactivity (44% of respondents). In a similar category, the fact that model data is not updated daily (often monthly) was mentioned by 11% of participants, and clusters of exceptions by 17%.

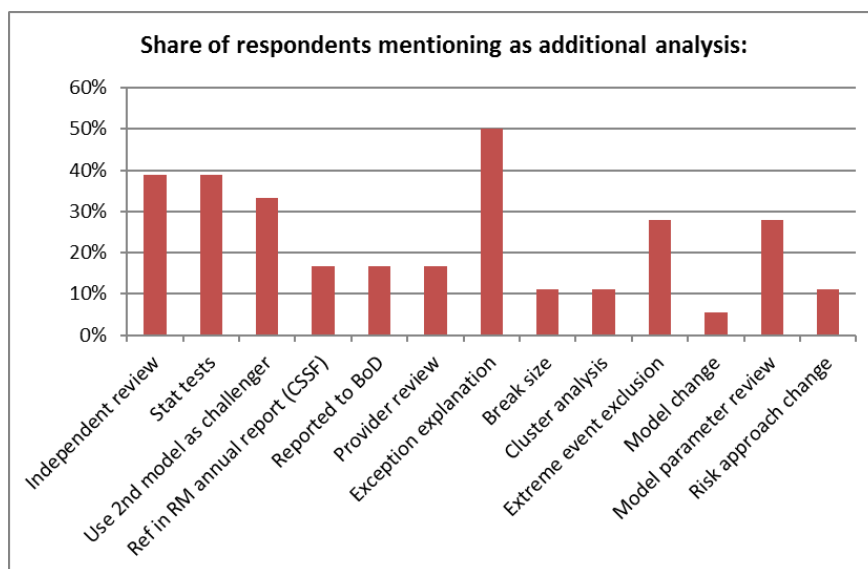
Mapping issues were mentioned by 28% of participants. To this, we can add the lack of idiosyncratic risk in the models (11%) and data quality (often mapping to a USD generic curve / 17%).



When looking at the **additional analysis work or measures**, the most mentioned ones are:

1. Review and explanation of exceptions: 50% of respondents.
2. Statistical tests aiming to qualify the number of exceptions:
 - Kupiec & Christoffersen: 39% of respondents.
 - Exclude extreme events: 28% of respondents.
 - Cluster/contagion analysis: 11% of respondents.
 - Consider size of the break: 11% of respondents.

3. Independent review and validation of model: 39% of respondents. 17% of respondents also went back to their providers for further validation.
4. Use a 2nd model as challenging (whether from a different provider, or historical vs. MC simulation, or long term vs. short term): 33%.
5. Review of model parameters (decay factor, lookback period, etc.) and fine-tuning them outright or correcting them when volatility spikes is explored by 28% of respondents. To this, we can add that 6% are considering changing model (e.g. go from historical simulation to MC).
6. Reporting to CSSF and/or BoD: 17% each.
7. Changing the risk approach (from absolute to relative VaR or to commitment) is considered by 11% of respondents.



The forum held on 21st March 2016 allowed practitioners to discuss these items and bring forward additional areas they had been investigating or were looking to investigate when testing models in this difficult environment. These included (non-exhaustive):

These areas of concern and investigation highlighted may be grouped in the following broad categories.

- What is the impact of model assumptions (market data consistency and the absence of intraday trading)?
- How to adjust model parameters (reference period, model reactivity, etc.)?
- How to handle clusters of exceptions?
- How to look at market swings and exceptional events?
- Should multiple models be used (per asset class, in parallel, etc.)

ALRiM has been collaborating with other trade associations with an aim to publish a series of papers on backtesting related topics.