



CSSF Thematic Review:  
Validation of Value-at-Risk  
models used by UCITS for  
global exposure calculation  
RESULTS

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## **CSSF Thematic Review: Validation of Value-at-Risk models used by UCITS for global exposure calculation**

### **1. Context**

Article 42(1) of the Law of 17 December 2010 relating to undertakings for collective investment (“Law of 17 December 2010”) requires that UCITS management companies employ a risk management process which enables them to monitor and measure at any time the risk of the positions and their contribution to the overall risk profile of the portfolio of a UCITS.

In accordance with Article 42(3) of the Law of 17 December 2010, a UCITS shall ensure that its global exposure relating to derivative instruments does not exceed the total net value of its portfolio.

Article 46 of the CSSF Regulation 10-4, adopted pursuant to Article 42(1) of the Law of 17 December 2010, requires that UCITS management companies calculate the global exposure by using the commitment approach, the Value-at-Risk approach (“VaR”) or other advanced risk measurement methodologies as may be appropriate.

The CESR Guidelines on Risk Measurement and the Calculation of Global Exposure and Counterparty Risk for UCITS (ref.: CESR/10-788; dated 28 July 2010, “the CESR Guidelines 10-788”) accompany and clarify, in accordance with CSSF Circular 11/512, the CSSF Regulation 10-4 in respect of risk management as well as the calculation of global exposure and counterparty risk.

Paragraph 2 of Box 1 of the CESR Guidelines 10-788 sets forth that a UCITS may consider appropriate for the calculation of the global exposure only those methodologies on which CESR has published Level 3 Guidelines.

Paragraph 1 of Box 14 of the CESR Guidelines 10-788 lays down that, when assessing the global exposure by means of a relative or absolute VaR approach, a UCITS should comply with the quantitative and qualitative minimum requirements as laid down in Boxes 15 to 22.

The CSSF launched a **thematic review into VaR models** used by UCITS for the calculation of global exposure and more specifically the **processes in place** at the level of the UCITS management companies (hereafter “IFMs”) concerning the **initial and ongoing validation of the VaR models**, as governed by paragraphs 3 and 4 concerning “Model validation” of Box 22 of the CESR Guidelines 10-788:

*“3. Following initial development, the model should undergo a validation by a party independent of the building process for ensuring that the model is conceptually sound and captures adequately all material risks. This validation process must also be carried out following any significant change to the model. A significant change could relate to the use of a new product by the UCITS, the need to improve the model following the back testing results, or a decision taken by the UCITS to change certain aspects of the model in a significant way.*

*4. The risk management function should perform ongoing validation of the VaR model (this includes, but is not limited to back testing as laid down in Box 18) in order to ensure the accuracy of the model’s calibration. The review should be documented. Where necessary, the model should be adjusted.” (emphasis added)*

The thematic review was carried out on the basis a representative sample of 20 Luxembourg IFM managing Luxembourg UCITS that use the VaR for the calculation of the global exposure.

The questionnaire used in that context covered various aspects, such as the organisational set-up of the validation, the aspects of the models covered by the validation, the tests performed, and the conclusions drawn by the IFMs from the validation exercise. In addition, the CSSF also based its observations on the VaR validation reports provided by the IFMs.

The main observations made by the CSSF, together with the related recommendations for improvement, are set out hereafter in Section 2.

**The CSSF hereby asks all IFMs using VaR models for the calculation of the global exposure to perform (i) by the end of the year 2023 a comprehensive assessment of their existing VaR model validation framework against these observations, and (ii) to take on that basis, in accordance with a given timeline, the necessary corrective measures (if applicable).**

## **2. Observations**

### **2.1 Governance around the VaR model validation**

#### **2.1.1 Independent validation**

Article 111(d) of the Law of 17 December 2010 requires from IFMs that, in the conduct of their business activities, they try to avoid conflicts of interest and, when they cannot be avoided, to ensure that the UCITS managed are fairly treated.

Paragraph 3 of Box 22 of the CESR Guidelines 10-788 states that the VaR model should undergo a validation by a party independent of the building process following initial development or any significant change to the model.

The related explanatory text in paragraph 72 further clarifies that such validation can be conducted, for example, by a relevant competent authority, by an internal or external auditor or by an external service provider independent of the building process.

The CSSF observed different approaches to perform the validation of the VaR model depending on the structural set-up of the IFMs. Based on its review, the CSSF observed that the validation was notably carried out by the following parties/entities:

- most of the time a third party (notably an advisory firm);

- in some cases, notably for IFMs belonging to a group, a specific unit/team of a group entity;
- in few cases the person responsible of the permanent risk management function of the IFM or the related risk management department.

The CSSF emphasises the importance that the validation of the VaR model is carried out by a unit independent from the unit in charge of the building process of the model.

The CSSF expects that in situations where a unit, which is part of the IFM or which is located within the same group, carries out the validation of the model, the IFM ensures that this unit is independent from the building process of the model (including design, implementation, maintenance and operation of the model) and that appropriate safeguards against conflicts of interest have been adopted in that respect. These safeguards have also to address the fact that the risk management function of the IFM is in any case involved in the specification and parameterisation of the VaR model.

### **2.1.2 UCITS coverage**

According to Article 45(2)(a) of the CSSF Regulation 10-4, it is the responsibility of the IFM to ensure that the risks of the UCITS under management are accurately measured.

Paragraph 1 of Box 17 of the CESR Guidelines 10-788 states that the UCITS is responsible for the choice of the appropriate model, and that the selection of the VaR model should ensure that such model is appropriate with regard to the investment strategy being pursued and the types and complexity of the financial instruments used.

The CSSF observed in some cases that IFMs relied entirely on a validation that was carried out by a third-party entity on behalf of an external risk solution provider and that the validation report produced in that context and available to the IFM was quite generic, without any specific consideration of the UCITS, with the related investment strategies and financial instruments, managed by the IFM.

The CSSF considers that a validation, as referred to above, does not provide for compliance with the above-mentioned regulatory requirements as the validation should explicitly and adequately cover all the UCITS managed by the IFM for which the VaR model is used for global exposure calculation, thereby considering the specific investment strategies, portfolio positions and related risks.

A good practice observed by the CSSF was that some IFMs completed the validation exercise performed by a third-party entity on behalf of an external risk solution provider by an additional independent validation covering specifically the above-mentioned points.

### **2.1.3 VaR validation report**

According to Article 45(2)(a) of the CSSF Regulation 10-4, it is the responsibility of the IFM to ensure that the risk management arrangements, processes and techniques of the UCITS under management are adequately documented.

The CSSF observed in some cases, where a third-party entity carried out the VaR model validation, that the IFM did not have access to the complete assessment and the related output report, but rather to a summary of the main findings of the validation exercise performed.

The CSSF reminds that the risk management function of the IFM shall have access to the detailed results and related report of the VaR validation work (including scope of analysis, assessments/reviews, tests) for allowing the function to take, on a fully knowledgeable basis, any necessary measures.

The complete validation report must be available at the premises of the IFM in Luxembourg and be available to the CSSF upon request.

## 2.2 Content of the VaR validation

Article 45(2)(a) of the CSSF Regulation 10-4 requires from IFMs to put in place for each UCITS they manage such risk measurement arrangements, processes and techniques that are necessary to ensure that the risks arising from all portfolio positions and their contribution to the overall risk profile are accurately measured on the basis of sound and reliable data and that these risk measurement arrangements, processes and techniques are adequately documented.

Paragraph 5 of Box 22 of the CESR Guidelines 10-788 further clarifies that an adequate documentation of the VaR model and the related processes and techniques has to cover, among others:

- a) the risks covered by the model;
- b) the model's methodology;
- c) the mathematical assumptions and foundations;
- d) the data used;
- e) the accuracy and completeness of the risk assessment;
- f) the methods used to validate the model;
- g) the back-testing process;
- h) the stress testing process;
- i) the validity range of the model; and
- j) the operational implementation.

On that basis, paragraph 5 of Box 22 of the CESR Guidelines 10-788 provides for the range of aspects that should be covered, at a minimum, in the context of an independent initial validation and the ongoing validation of the VaR model.

### 2.2.1 Initial validation of the VaR model

The initial validation of the VaR model must be performed prior to the first use of the model and it shall focus on all aspects and elements that have a material impact on the performance and the output of the VaR model. A validation exercise should also be performed in the context of a significant change of the model.

#### 2.2.1.1. Mathematical assumptions and foundations underlying the model

The CSSF observed in some cases that the validation consisted only of a high-level review of the mathematical assumptions/foundations of the model.

In some other cases, the validation did not cover the theoretical foundations, with the IFM explaining that the model was developed by a specialised service provider with a proven track record and benefiting from the support of academic research. In these cases, the IFM considered that the technical documentation made available by the service provider for the VaR model was sufficient and that further validation work would not be necessary.

The CSSF reminds, for the cases described here above, that the VaR model validation does not comply with the regulatory requirements. Indeed, it does not allow to ensure that the model is conceptually sound and captures adequately all material risks, in particular also with regard to the specific context of usage of the VaR model by the IFM for the UCITS managed.

As a result, a validation exercise should include a review of the theoretical foundations of the model (including also related limitations) for ensuring the accuracy of the model and its appropriateness for the UCITS managed by the IFM.

#### 2.2.1.2. Review of the specific assumptions and approximations of the model

The CSSF observed in some cases that the validation did not sufficiently address the accuracy of the assumptions and approximations that were used in the context of the VaR model.

The CSSF reminds that the model assumptions and approximations used in the context of the model are an integral part of the VaR model and should, therefore, be part of the validation process.

For example, a validation exercise should cover the following aspects (if applicable):

- The assumptions used by the model (e.g., the value of the decay factor, the shape of the return distribution, the threshold value for Peak-over-Threshold approaches when modeling extreme values, etc.).
- The methodology used by some IFMs to scale VaR figures to different time horizons.

The CSSF observed that the use of the square-root of time rule for scaling a 1-day VaR to a 20-days VaR was not challenged when the conditions set in paragraph 4 of Box 15 of the CESR Guidelines 10-788 (*"The rescaling can only be done under the assumption of a normal distribution with an identical and independent distribution of the risk factor returns"*) were not met as a result of the modeling approach underlying the model.

- The length of the observation time window underlying VaR models.
- The number of scenarios generated in simulation-based models. The statistical randomness associated with simulation-based models should be assessed since different numbers of simulations may result in different levels of accuracy or reliability of the model.

### 2.2.1.3. Completeness of the VaR calculation

Box 10 and Box 17 of the CESR Guidelines 10-788 require that the VaR model should provide for "completeness" and should assess the risks with a high level of accuracy, thereby specifying amongst others that *"All the positions of the UCITS portfolio should be included in the VaR calculation"*.

In addition, paragraph 2 of Box 17 of the CESR Guidelines 10-788 requires that the model should *"adequately capture all the material market risks associated with portfolio positions"*.

The CSSF observed in some cases that the validation did not fully address the "completeness" requirement as, for instance, the validation did not include the review of the following:



- whether all types of financial instruments were covered in an appropriate manner by the model; and
- whether the proxies used by the model for certain financial instruments (e.g. structured financial instruments or derivative instruments) that were not explicitly supported and covered by the model are based on an adequate quantitative analysis, supported by regular reviews and adequate procedures, for ensuring that they provide on an ongoing basis for an adequate quantification of the risks of these instruments.

The CSSF expects that the validation provides for an adequate completeness review and includes, in particular, an assessment of the validity range of the model towards the portfolio positions held by the UCITS.

Such a review should also cover the positions/financial instruments held by the UCITS handled through proxies/approximations by the model in order to ensure their adequate coverage by the VaR model providing for accurate risk measures.

#### 2.2.1.4. Operational implementation of the VaR model by the IFM and related aspects

The CSSF observed in some cases that the validation did only focus on the mathematical assumptions and foundations of the model as well as the related model outputs. For example, some validations, typically produced by a third-party entity on behalf of an external risk solution provider, only covered the technical specifications of the VaR model, without reviewing its concrete implementation and use by the IFM (e.g. the daily calculation process of the VaR by the IFM, comprehensive coverage of all portfolio positions of UCITS, data used for feeding the VaR model).

As a result, the validation did not cover aspects such as the data used, the accuracy and completeness of the risk assessment, the validity range of the model and the operational implementation.

The CSSF expects that all aspects and elements of the model that have a material impact on its performance and output are reviewed in the context of the independent VaR model validation.

On that basis, the validation exercise should also cover aspects including, but not limited to, the data used for the risk calculations, the operational implementation of the model at the level of the IFM (e.g. daily calculation of the VaR with related operational processes, coverage of all the portfolio positions of the UCITS) or error/exception handling process.

#### 2.2.1.5. Model change management process

Paragraph 3 of Box 22 of the CESR Guidelines 10-788 requires that a validation exercise should be carried out following any significant change to the model.

In this respect, the CSSF expects IFMs to define and document a change management process (through at least a policy or procedure) with regard to the VaR model, in order (i) to determine the conditions under which a change of the VaR model would trigger a model validation and (ii) to define the scope and content of the validation to be conducted in such case.

### 2.2.2 Ongoing validation of the VaR model

The use of the VaR model for the purpose of the global exposure calculation should be subject to an ongoing validation for assessing the performance of the model, which includes, but is not limited to back testing. The ongoing validation should also assess the potential sources of model risks as identified during the initial model validation, whenever appropriate.

### 2.2.2.1. Back-testing

In its [Annual Report 2014](#), Chapter VII, section 4.7.2. the CSSF has drawn the attention of IFMs to the back-testing programme requirements described in Box 18 of CESR Guidelines 10-788 which constitute, in accordance with paragraph 4 of Box 22 of these guidelines, a minimum framework, which should be supplemented by other validation techniques.

The CSSF observed in some cases that the testing performed in the context of the ongoing validation exercise was only limited to back-testing and that the analysis of the back-testing results was limited to simply counting the number of “overshootings”.

The CSSF expects notably that the back-testing programme implemented by the IFMs allows for a proper analysis of the cause of any “overshoot”, also specifying the conditions under which an in-depth review or validation of the VaR model could be triggered. Additional analyses that could be performed in that context relate, for instance, to the number of overshootings observed over several confidence intervals, the overshooting concentration or their amplitude, or the abnormally low number of overshootings.

In accordance with the CESR Guidelines 10-788, the CSSF also expects that the ongoing model validation includes an appropriate testing programme, being not limited to back-testing, for assessing on an ongoing basis the adequate performance of the VaR model.

To illustrate, the back-testing could be complemented, for instance, by tests of the hypotheses and assumptions used in the model, stress-tests of the model output under extreme market conditions, ad hoc tests of the model under specific market conditions. IFMs should consider the specificities, validity conditions and limitations of the model when designing the testing programme.

If the ongoing validation reveals vulnerabilities/issues, then the IFMs should perform an in-depth review of the accuracy of the model and take, if necessary, corrective measures.



#### 2.2.2.2. Back-testing methodologies

In some cases, the CSSF observed that the methodologies underlying the back-testing programme were not adequately reviewed by the IFM.

The explanatory text set out under Box 18 of the CESR Guidelines 10-788 lays down that the back-testing programme should be performed on the basis of either the effective changes (“dirty” back-testing) or the hypothetical changes (“clean” back-testing). It further specifies that back-testing is ideally performed by means of a “clean” approach.

More particularly, a “dirty back-testing” approach may indeed prove inaccurate or inappropriate if the realised performance of the fund deviates significantly from its hypothetical performance, assuming unchanged positions. This is, for instance, the case in front of UCITS with higher intra-day activity where a significant portion of their performance is generated by the intra-day changes in portfolio positions.

Therefore, the CSSF expects that IFMs review the accuracy of the back-testing approach, as it is central to the assessment of model performance.

#### 2.2.2.3. Stress-testing

Box 19 of the CESR Guidelines 10-788 states that an adequate stress testing programme should be conducted for each UCITS using the VaR approach to calculate the global exposure. Among other goals, stress-testing serves as a complement to a VaR calculation by providing insight into risks underlying a portfolio under extreme changes in markets and other environmental factors which would affect the UCITS and which would not be considered by the VaR.

The explanatory text under Box 7 “Management of model risk concerning the risk measurement framework” of the CESR Guidelines on Risk Management principles for UCITS (ref.: CESR/09-178, dated February 2009) lays down the following:

*“41. Stress tests are usually meant to capture the possibility of rare and severe losses which could occur during market shocks, and which are unlikely to be measured by the models as they tend to follow structural breaks in the functional relationships between market variables (sudden shifts of crucial model parameters).*

*42. Stress tests should cover all quantifiable risks which affect, to a material degree, the value of the UCITS, with particular attention given to those risks which are not represented with sufficient accuracy by the risk models used. (...)”*

The CSSF expects that the ongoing validation of the VaR model takes into account the complementary nature of VaR and stress-testing. For example, the IFM should design a stress-testing programme that considers extreme scenarios that the VaR figures may not reflect fully. Conversely, IFMs should also analyse situations where VaR figures are inconsistent with the stress test results.



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