The SS1/23 ask

Implications of the model risk management norms for algorithmic trading and AI/ML

Point of View | July 2023

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Executive summary

The Prudential Regulation Authority (PRA) had set out its expectations for model-risk management (MRM) at banks through a consultation paper (CP6/22) published last year.

The paper specifically mentioned the risks associated with artificial intelligence (AI)/ machine learning (ML) models and the need to bring such models within the MRM scope.

The PRA received 11 written responses on AI/ML models in addition to responses around algorithmic trading, particularly dynamic recalibration. The responses indicated keen interest among firms on the topics of AI/ML and algorithmic trading, especially with respect to managing risks associated with them.

The PRA provided feedback on the responses through a policy statement (PS6/23) and recently published its final policy supervisory statement 1/23 (SS1/23), laying down model-risk management principles for banks.

In this report, we present our point of view on the impact of SS1/23 on algorithmic trading and AI/ML.

We endeavour to articulate the key requirements for each of the five principles of MRM SS1/23 for algorithmic trading and AI/ML with a view to support the initial gap analysis and the subsequent self-assessment firms need to carry out in line with the PRA's guidance.

We also reflect on some of the discussion points from previous forums and round tables in the section '*Key considerations for initial self-assessment*'.

Finally, we seek to highlight some of our expertise in model risk and how we can help firms given our experience in implementing similar regulations such as SR11-7.

Mapping the contours of the new regulation

This report is focused on the application of SS1/23 to algorithmic trading and AI/ML based models. AI/ML could be used independently or could be used as a component of other models, where it could amplify existing risks.

In the following pages, we take a close look at key expectations of the regulator and present our views on the requirements of SS1/23 with an aim to support initial gap analysis and self-assessment for successful implementation of the proposal by May 17, 2024.

Summary of the PRA's expectations

1. Model identification and model-risk classification

Firms should have a definition of models, a model inventory, and a risk-based tiering approach to models

2. Governance

Firms' senior management should promote the MRM culture at all levels, starting from the top. They should set clear model-risk appetite, approve MRM policy, and appoint an accountable individual for implementation of the MRM framework.

3. Model development, implementation, and use

Firms should be able to demonstrate a robust model-development process with defined standards for the entire model life cycle, i.e., model development, implementation, and use.

4. Independent model validation

Firms should be able to demonstrate a validation process that provides an ongoing, independent, and effective challenge to model development and use.

5. Model-risk mitigants

Firms should have procedures for the use of model-risk mitigations and procedures for the independent review of post-model adjustments.

Model identification and model-risk classification

Incorporating AI/ML and algorithmic models in model identification and model-risk classification constituents

Model definition

SS1/23 clearly sets out the scope of the MRM framework through model definition. The scope will not only include algorithms within the MiFID II scope, i.e., Investment and Execution Decision maker (EDM/IDM), but will include quantitative methods, systems, or approaches that support these algorithms. These could be pricing models used by algorithms and credit-risk models used to calculate the client limits and so on.

Hence, firms need to establish a clear definition for models. Trading algorithms and supporting quantitative methods, systems, or approaches that satisfy this definition should be brought within the scope. Firms should also consider applying the MRM framework to decision-based rules or algorithms that are not classified as a model but have a material bearing on business decisions.

Model inventory

To effectively implement the MRM framework, firms are expected to maintain a complete and accurate set of information related to model risk as a part of a single model inventory. This inventory could be used to identify aggerate model risk by identifying all direct and indirect model interdependencies. This is particularly important for algorithmic trading, as the rise of AI/ ML means algorithmic trading could be the consumer of data from AI/ML models that do not actually sit within the algorithmic trading infrastructure.

Care should be taken not to duplicate the effort, particularly SME time, as most firms already have an algo inventory and documentation to support it. This also applies to AI/ML models.

Model tiering

Tiering of models within the inventory is essential to define materiality. This has multiple uses, including defining a risk-based approach for periodic revalidation of models.

Key considerations for initial self-assessment.

Model definition

- Whether there is a firm-wide definition of models
- Whether work has been carried out within the algorithmic trading team to determine the scope of MRM considering the SS1/23 definition of models
- Whether the firm has taken an approach where all algos are classed as models and are approved centrally through the (say) New Product Approval (NPA) process
- Whether the Model Risk Team is considering the use of AI/ML models that may exacerbate existing algorithmic trading risk

Model inventory

- Whether there is a linkage between algo inventory and model Inventory in the organization?
- Whether the firm maintains a list of all the AI/ML models that have been deemed model risk relevant, and whether inter-dependencies have been worked out

Model tiering

- Whether the firm is considering algo materiality as an input to model tiering

Governance

Enhancing MRM governance to include algorithms and AI/ML

Responsibilities of Board of Directors

There needs to be a clear division of responsibility in relation to model risk. Business teams, algo owners and algorithmic risk management (first line of defence or 1LoD) teams should work with the model-risk team for approvals. They need to adhere to the model risk appetite set for the firm. The risk appetite should include measures for the design and operational effectiveness of the MRM framework, identifying models, and approving their use for decision-making and guidelines on acceptable performance.

SMF accountability for model risk management framework

An accountable SMF should be empowered to have overall oversight to ensure the effectiveness of the MRM framework. SMF's responsibilities may include operationalising the MRM framework and ensuring compliance.

Policies and procedures

Policy and procedures of the MRM framework should be applicable to algorithms and use of AI/ML to support those algorithms or models in general.

Roles and responsibilities

Given the wide nature of MRM framework, clearly defined and documented roles and responsibilities are key to its operational effectiveness.

Internal audit

Internal audit should independently access the effectiveness of MRM framework and compliance with internal policies.

Third-party models and products

Firms should ensure there is sufficient information available to assess the compliance of third-party models and components.

Key considerations for initial self-assessment

Overall governance

- Whether the model risk senior management has adequate awareness of the use of
  a. Trading algorithms across the firm
  b. AI/ML in algorithms or in general across the firm
- Algo development usually follows agile development model. Given this, whether the impact of additional governance on algorithmic trading been assessed

Documentation

- Whether the governance model (i.e., SMF roles and responsibility) been adequately documented

Model development, implementation, and use

Incorporating the PRA's guidance on model development, implementation, and use in AI/ML and algorithmic development life cycle

Model purpose and design

To satisfy the requirement of the MRM framework, the model risk team should issue a design template that can be used by the model development team to provide the intended purpose and design objectives**.**

The use of data

The data remains the key focus area, particularly due to the extensive use of AI/ML within models. Firms should clearly demonstrate the steps in place to address key issues such as data bias.

Model-development testing

Firms need to ensure that all AI/ML or algo-development processes adhere to the minimum model development and testing criteria defined by the Model Risk team.

Model adjustments and expert judgement

Firms should be able to able to demonstrate the appropriate use of expert judgement (where applicable), say, by understanding the limitation of an AI/ML model.

Model development documentation

Firms should have comprehensive and up-to-date documentation covering (for example), the use of data, performance testing and limitations.

Supporting systems

Firms should be able to demonstrate that algorithms and AI/ML models have been implemented in an environment, in line with the stated purpose and testing, and are subject to rigorous change-management process.

Key considerations for initial self-assessment

Model purpose and design

Whether the MRM risk team defines minimum criteria for model development, which are incorporated in algorithmic development lifecycle and AI/ML model development

Model development documentation

Whether the documentation covers

    a. Overall algorithmic or AI/ML development process, including purpose & design, test data and performance testing.

    b. Any model adjustment and expert judgement applied to algorithmic or AI/ML models**.**

Supporting systems

Whether the formal change-management process covers

    a. A clear definition on what constitutes a material change to an algorithm or an AI/ML model, and the required process for any material change approval.

    b. Impact analysis of environmental changes, including any change in the environment AI/ML models or algorithms work in, such as structure of input data and configuration.

    c. Documentation of all types of regulatory impact, even when they may not relate to any IT or process change.

Independent model validation

Tuning the model validation process to factor AI/ML-specific model risks

The independent validation functions

Firms should be able to demonstrate the independence of the validation function to ensure it provides an objective, unbiased and critical opinion. As proposed under the second principle, this team should have sufficient organisational standing to provide effective challenge.

Independent review

Firms should be able to demonstrate that the independent team is competent, its findings are well documented, and are governed though the proper governance forms.

Process verification

The verification process should be carried out to confirm that all the components are operating effectively and have been implemented as intended.

Model performance monitoring

Firms should be able to demonstrate that model KPIs have been defined in line with the MRM framework. These KPIs, in turn, should be used to assess model performance.

Performance monitoring is especially challenging for self-learning AI/ML models. Hence, firms should be able to demonstrate that these models are working within their defined risk appetite through performance monitoring.

Periodic revalidation

Firms should conduct regular independent revalidation to determine if the models have been operating as intended and if previous validation findings were still valid.

Key considerations for initial self-assessment

Independent validation function

How the firm can demonstrate that the validation team

- Is independent
- Has the required skillset to perform testing without help from the development team?
- Has the required skillset to handle algorithmic and AI/ML models?

Process verification

- Whether sufficient documentation is available to support the verification process
- Whether the verification team has access to essential infrastructure such as markets/venues for algo verification i.e., to validate if algo or AI models can cause market disruptions

Model performance monitoring

- Whether firms have performance monitoring tools that can be used by the validation team to generate required management information
- Whether there is adequate management information and reporting on in-scope models for performance monitoring

Periodic revalidation

- Whether the firm has the required resources and skillsets to perform periodic re-validation

Model risk mitigants

Tuning MRM's model risk mitigant constituents to factor AI/ML or algorithm-specific model risks

Process for applying post-model adjustments

Firms should have a consistent enterprise-wide process and guidelines on application of post model adjustments (PMA). The process should be well documented. Since the MRM framework is likely to include algorithms and AI/ML models (i.e., multiple model types), PMAs should be governed by proper governance channels to ensure they are applied in line with the firm's policy and procedures. Any variation in PMA application across model types should be approved by MRM governance and all such approvals should be documented.

The documentation should include justification of the PMA, criteria for its continued application and triggers for removal i.e., exit criteria.

The PMA should be periodically revalidated, and the revalidation process should include reasoning for the application of PMA, any data inputs or/and outputs, and root cause analysis.

Restrictions on model use:

Firms should be able to demonstrate that there are clear policies and procedures in place to restrict the use of algorithms or AI/ML when a significant deficiency and/or errors have been identified during the validation process, or if performance monitoring shows a significant breach.

Any deficiency or errors leading to a remediation exercise should be adequately documented and tracked through the MRM governance forum.

Exceptions and escalations

The exception and escalation process should be well defined. Model tiering within the inventory should include materiality and hence could potentially be used as an input for the exception and escalation process.

Key considerations for initial self-assessment.

Process for applying post-model adjustments

- Whether the risk team monitors post-model adjustments applied to algorithmic or AI/ML models

Restrictions on model use

- Whether annual validation considers any existing breach for a given AI/ML model

- Whether the firm can demonstrate the audit trail of all in-scope models for the past 12 months, including details of the exception and escalation process

- Whether the MRM framework contains a defined policy and procedures for restrictions on the use of algorithms or AI/ML models when the validation process has identified a significant breach

- Whether the policy and procedures are adequately governed through MRM governance forums

Exceptions and escalations

- Whether there is a defined exception process that considers materiality of algorithmic and AI/ML models

Implementing SS1/23

Key considerations for implementation of the MRM framework

Proportionality

The practical application of the five principles by the firm should be consistent with the size of the firm, the extent of model use, and model complexity as well as the business activity of the firm.

Firms should also look at the business justification of the MRM framework.

For example, bringing all the AI/ML models within the MRM framework might be beneficial for the firm irrespective of SS1/23 principles. While defining materiality and including them in a single inventory may be challenging to start with, it can help provide senior management oversight by consolidating all the relevant model risks in one place.

SMF accountability for the MRM framework

Active senior management involvement is key for maintaining a robust and effective MRM framework. It is important to allocate overall MRM responsibility to an appropriate person in the firm.

Financial reporting and external auditors:

PRA expects the models involved in financial reporting to be part of the scope. It also expects effectiveness of MRM for financial reporting to be made available to audit committees.

> ## Next steps
>
> **Gap analysis**
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> - Whether the firm has performed initial gap analysis for the MRM framework with respect to SS1/23, especially with reference to algorithmic trading activity
>
> - Whether initial gap analysis covers AI/ML models, especially when AI/ML model outputs are consumed by other models, and hence AI/ML may amplify existing model risk
>
> - How prepared the firm is for the implementation deadline of May 17, 2024. Whether it has considered the following aspects:
>
>   – Documentation
>
>   – Overall governance structure and the role of SMF
>
>   – Resource availability for gap analysis
>
>   – Skillset within the MRM team, especially related to algorithms and AI/ML
>
>   – Availability of SMEs to support gap analysis

Conclusion

As evident from the article, the five overarching principles are likely to have an impact of how algorithmic and AI/ML model risks are managed. We conclude by summarising some of the key challenges.

Our view of PRA's expectations		The key challenges	What CRISIL brings to the table
Model identification and model risk classification	Firms should identify trading algorithms and AI/ML models (or components that may amplify model risk) that need to be classified as models and added to the model inventory.	Assessment of existing algorithmic and AI/ML models to determine if they are in MRM scope	Track record of working with 1LoD to create model inventory and supporting documentation Proven methodology for model tiering
Governance	The MRM function should ensure that effective risk management practises are in place for the firm's algorithmic trading and AI/ML activities.	Review of algorithmic and AI/ML governance models to determine compliance with SS1/23	Expertise in implementing an effective model governance framework in line with the firm's model risk management policy
Model development, implementation, and use	Firm-wide algorithmic and AI/ML development process will have to adhere to model risk principles.	Potential additional documentation and workflow tool requirements to support SS1/23 compliance	Extensive expertise in documentation of various models and creation of workflow and MI tools
Independent model validation	Firms should be able to provide ongoing, independent, and effective challenge to algorithmic and AI/ML model development and use.	Potential skill and resource requirements within the validation team	Strong track record and extensive experience in helping clients across the model validation landscape, especially regarding SR11-7 guidelines
Model risk mitigants	Firms should have procedures for the use of model risk mitigations and independent review of PMAs.	Benchmarking of model risk mitigations and procedures with industry peers	Good understanding of industry best practices in model risk mitigations and exception and escalation procedures

> **By leveraging its offshore/nearshore model, CRISIL can deliver projects and potentially generate over 30% cost efficiencies for MRM SS1/23 implementation, including initial self-assessment, implementation, and periodic validation**

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