Board of Governors of the Federal Reserve System

The Board Can Enhance the Effectiveness of Certain Aspects of Its Model Risk Management Processes for the SR/HC-SABR and BETR Models

OIG

Office of Inspector General
Board of Governors of the Federal Reserve System
Consumer Financial Protection Bureau

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Executive Summary, 2022-SR-B-016, December 7, 2022

The Board Can Enhance the Effectiveness of Certain Aspects of Its Model Risk Management Processes for the SR/HC-SABR and BETR Models

Findings

The Division of Supervision and Regulation (S&R) uses supervisory models, such as the Supervision and Regulation Statistical Assessment of Bank Risk (SR-SABR), Holding Company Statistical Assessment of Bank Risk (HC-SABR) (together, SR/HC-SABR), and Bank Exams Tailored to Risk (BETR) models, to advance risk-focused supervision of financial institutions. Supervisory model results help to inform decisions regarding supervisory programs and initiatives, the supervision of individual institutions, and the allocation of staff resources; therefore, it is important to ensure that the models S&R uses are sound and produce reasonable and reliable outputs.

Although S&R has taken steps to enhance model risk management for the SR/HC-SABR and BETR models, we found opportunities for S&R to further enhance certain aspects of its model risk management processes. Specifically, S&R can ensure timely review and validation of the SR/HC-SABR and BETR models. Many of the SR/HC-SABR and BETR models in use have not undergone Committee on Supervisory Model Oversight (COSMO) review and System Model Validation (SMV) group validation, in part because of COSMO's resource constraints. In addition, S&R can enhance model risk management by developing a comprehensive model inventory of top-tier supervisory models (TTSMs), including the SR/HC-SABR and BETR models, that aligns with the guidance outlined in Supervision and Regulation Letter 11-7: *Supervisory Guidance on Model Risk Management* (SR Letter 11-7). Further, S&R can benefit from developing a formal mechanism for tracking the findings and recommendations from COSMO reviews and SMV validations. A formal mechanism could help COSMO manage model risk and promote effective remediation of findings and recommendations.

Recommendations

Our report contains recommendations designed to enhance the effectiveness of the Board's model risk management processes for the SR/HC-SABR and BETR models. In its response to our draft report, the Board concurs with our recommendations and outlines actions that will be taken to address each recommendation. We will follow up to ensure that the recommendations are fully addressed.

Purpose

We conducted this evaluation to assess the effectiveness of the model risk management processes for the SR/HC-SABR and BETR models. This evaluation addressed governance and model validation activities for the SR/HC-SABR and BETR models for 2020 and 2021. Our scope did not include aspects of the model risk management framework related to model development.

Background

The use of models invariably presents *model risk*—the risk that decisionmaking may be influenced by incorrect or misapplied model outputs or reports. Because using models involves model risk, the Board issued SR Letter 11-7 to establish model risk management expectations for supervised institutions. SR Letter 11-7 includes expectations for (1) development, implementation, and use; (2) validation; and (3) governance, policies, and controls.

COSMO is an oversight body for TTSMs, including the SR/HC-SABR and BETR models, and conducts model review of TTSMs. After COSMO completes its review, the SMV group independently validates the TTSMs. COSMO's charter states that COSMO and its associated processes align, to the extent possible and appropriate, with the principles of sound model risk management practices articulated in SR Letter 11-7.

Office of Inspector General

Board of Governors of the Federal Reserve System
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Recommendations, 2022-SR-B-016, December 7, 2022

The Board Can Enhance the Effectiveness of Certain Aspects of Its Model Risk Management Processes for the SR/HC-SABR and BETR Models

Finding 1: S&R Can Enhance Model Risk Management by Ensuring Timely Review and Validation of the SR/HC-SABR and BETR Models

Number	Recommendation	Responsible office
1	Develop a plan for how COSMO and the SMV group intend to provide timely review and validation of the SR/HC-SABR and BETR models, including the expected time frames for completion along with a plan for ongoing validations. As part of this effort, assess the current level of staffing for COSMO and the SMV group to determine whether staffing is appropriate to efficiently and effectively conduct COSMO reviews and SMV validations consistent with guidance outlined in SR Letter 11-7.	Division of Supervision and Regulation
2	Develop formal procedures to ensure that limitations, including the status of models in use prior to receiving SMV validation, are documented and communicated to users, senior management, and other relevant parties.	Division of Supervision and Regulation
3	Develop expectations for internal communications to ensure that COSMO and SMV group officials and staff share necessary information on validation resource availability to ensure that models are validated in a timely manner.	Division of Supervision and Regulation

Finding 2: S&R Can Enhance Model Risk Management by Aligning Its Model Inventory With Guidance Outlined in SR Letter 11-7

Number	Recommendation	Responsible office
4	Develop policies and procedures for developing and maintaining a comprehensive model inventory of TTSMs, including all SR/HC-SABR and BETR models, to incorporate the following: a. the roles and responsibilities for maintaining the model inventory. b. the frequency with which the model inventory should be updated. c. the key elements that should be included in the model inventory. d. procedures for sharing the inventory with relevant parties.	Division of Supervision and Regulation
5	Enhance the model inventory of TTSMs, including all SR/HC-SABR and BETR models, to ensure it includes the key elements outlined in SR Letter 11-7.	Division of Supervision and Regulation

Finding 3: S&R Can Benefit From Developing a Formal Mechanism for Tracking the Findings and Recommendations From COSMO Reviews and SMV Validations

Number	Recommendation	Responsible office

6	Develop policies and procedures for tracking the findings and recommendations from COSMO reviews and SMV validations that
	    a. clarify roles and responsibilities for tracking findings and recommendations.
	    b. define how COSMO will provide tracking reports to senior management.
		Division of Supervision and Regulation

7	Develop a formal mechanism for tracking the findings and recommendations from COSMO reviews and SMV validations. Consider incorporating the following:
	    a. date and description of each finding and recommendation.
	    b. current status of each finding and recommendation along with the planned remediation time frame.
	    c. the name of the individual responsible for the remediation of the finding or recommendation.
		Division of Supervision and Regulation

Office of Inspector General
Board of Governors of the Federal Reserve System
Consumer Financial Protection Bureau

MEMORANDUM

DATE: December 7, 2022

TO: Michael S. Gibson
                Director, Division of Supervision and Regulation
                Board of Governors of the Federal Reserve System

FROM: Michael VanHuysen *[signature: Mike Van Huysen]*
                Associate Inspector General for Audits and Evaluations

SUBJECT: OIG Report 2022-SR-B-016: *The Board Can Enhance the Effectiveness of Certain Aspects of Its Model Risk Management Processes for the SR/HC-SABR and BETR Models*

We have completed our report on the subject evaluation. We conducted this evaluation to assess the effectiveness of the Board's model risk management processes for the Supervision and Regulation Statistical Assessment of Bank Risk, Holding Company Statistical Assessment of Bank Risk, and Bank Exams Tailored to Risk models.

We provided you with a draft of our report for review and comment. In your response, you concur with our recommendations and outline actions that will be taken to address our recommendations. We have included your response as appendix B to our report.

We appreciate the cooperation that we received from Board and Reserve Bank staff during our evaluation. Please contact me if you would like to discuss this report or any related issues.

cc: Jennifer Burns
        Lisa Ryu
        Kevin Bertsch
        Jeff Gunther
        Ryan Lordos
        Jherylris Herron
        Ricardo A. Aguilera
        Cheryl Patterson

Contents

Introduction

Objective

Our objective for this evaluation was to assess the effectiveness of the model risk management processes for the Supervision and Regulation Statistical Assessment of Bank Risk (SR-SABR), Holding Company Statistical Assessment of Bank Risk (HC-SABR) (together, SR/HC-SABR), and Bank Exams Tailored to Risk (BETR) models. The scope of our evaluation included governance and model validation activities for the SR/HC-SABR and BETR models for 2020 and 2021. Our scope did not include aspects of the model risk management framework related to model development.

Background

The Division of Supervision and Regulation (S&R) uses supervisory models to advance the risk-focused supervision of financial institutions. Supervisory model results help to inform decisions regarding supervisory programs and initiatives, the supervision of individual institutions, and allocation of staff resources; therefore, it is important to ensure that the models and tools used by S&R are sound and produce reasonable and reliable outputs. The Board of Governors of the Federal Reserve System uses many types of supervisory models in support of its supervision activities, including top-tier supervisory models (TTSMs) that directly or indirectly affect supervisory processes or decisions in a material way.[1] Our evaluation focuses on two groups of TTSMs—SR/HC-SABR and BETR—which the Board uses to inform risk-based supervisory decisions for community banking organizations and regional banking organizations.[2]

SR/HC-SABR

SR-SABR and HC-SABR are a suite of early-warning models designed to monitor the financial performance of state member banks (SMBs) and bank and savings and loan holding companies (HCs), respectively, to identify high-risk institutions and institutions with emerging financial difficulties for enhanced supervisory attention.

The SR-SABR and HC-SABR models assign surveillance ratings to SMBs and HCs, respectively, and the ratings consist of the institution's most recent composite rating and a surveillance letter grade (A, B, C, D, or F). Grade A denotes an institution with strong financial and supervisory indicators relative to other institutions with the same composite rating, while an F indicates major weaknesses, poor financial results, or other signs of significant weakness.

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[1] Examples of TTSMs include models or tools used for (1) supervisory ratings or other formal ratings of institutions; (2) risk assessments of institutions or groups of institutions; (3) assessments of capital, liquidity, or other aspects of an institution's financial condition; (4) supervisory forecasts of aggregate banking conditions; (5) allocation or prioritization of supervisory resources; and (6) projections of local, regional, or national economic or financial conditions.

[2] The term *community banking organizations* refers to domestic institutions with less than $10 billion in total assets, and the term *regional banking organizations* refers to domestic institutions with total assets of at least $10 billion but less than $100 billion.

The composite rating and the surveillance grade help to indicate whether an institution should be added to the Watch List. S&R uses the Watch List to highlight institutions with emerging financial weaknesses. If substantial deterioration is evident or appears imminent, S&R and supervisory staff at the Federal Reserve Banks determine whether an examination, an inspection, or some other supervisory activity may be needed. The Watch List can also be used in SMB examinations and HC inspections to identify potentially deteriorating situations for the most extensive reviews.

BETR

BETR is a suite of models that combines model outputs with examiner judgment to classify the levels of risk at an SMB within individual risk stripes. The BETR suite of models is composed of models addressing individual risk stripes including investment securities, liquidity, credit, capital, earnings, interest rate risk, Bank Secrecy Act/Anti-Money Laundering, management, and operational risk. BETR's primary objective is to identify SMB activities that are low, moderate, or high risk and to apply a risk-based level of supervisory attention to the SMB activity within the examination work program. BETR's models gauge the potential for an SMB to experience adverse outcomes, such as highly unfavorable financial trends, significant performance shortfalls, severe losses, or supervisory rating downgrades over a 12- to 24-month time frame and under unfavorable market conditions.

S&R and supervisory staff at the Reserve Banks use the BETR models' outputs as data-driven starting points for their work in determining the scope of examinations and in allocating appropriate supervisory resources for SMBs in the community and regional banking organization supervisory portfolios.

Model Risk Management

Using models involves *model risk*, which is the potential for adverse consequences from decisions based on incorrect or misapplied model outputs or reports. In April 2011, the Board issued Supervision and Regulation Letter 11-7: *Supervisory Guidance on Model Risk Management* (SR Letter 11-7), to establish model risk management expectations and provide a framework for effective model risk management for the banking organizations under its supervision.

SR Letter 11-7 details key aspects of an effective model risk management framework, including robust model development, implementation, and use; effective validation; and sound governance.[3] Sound governance over the model risk management framework is fundamental to its effectiveness because it provides explicit support and structure to risk management functions. Effective model validation helps to ensure that models are sound and reduces model risk by identifying model errors, corrective actions, and appropriate use. In addition, ongoing validation helps to ensure that changes in markets, exposures, or activities do not create new limitations and helps to determine whether the model continues to perform as expected. SR Letter 11-7 notes that its application should be customized to be commensurate with a bank's risk exposure and the complexity of its model use.

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[3] As noted previously, the scope of our evaluation included governance and model validation activities but did not include model development activities.

Committee on Supervisory Model Oversight

S&R formed the Committee on Supervisory Model Oversight (COSMO) in 2019 to provide oversight of TTSMs, including SR/HC-SABR and BETR. COSMO is a subgroup of the System Risk Council[4] and is responsible for overseeing the TTSMs but not the stress testing models used for the Comprehensive Capital Analysis and Review (CCAR) and Dodd-Frank Act Supervisory Stress Test (DFAST), which have a separate governance structure.[5] The COSMO charter states that COSMO and its associated processes align, to the extent possible and appropriate, with the principles of sound model risk management practices articulated in SR Letter 11-7.

COSMO assists in guiding the development, implementation, and use of TTSMs; therefore, COSMO is not an independent validation group. COSMO members include officials and staff from S&R and select Reserve Banks. COSMO's responsibilities include developing and updating an inventory of TTSMs, periodically reporting to the System Risk Council on the status of TTSMs, reviewing material changes to existing TTSMs, reviewing new and existing TTSMs to confirm that they are sound for use in supervision and ready for validation, and recommending compensating controls to address any model deficiencies.

System Model Validation Group

S&R established the System Model Validation (SMV) group in 2016 to develop an independent validation program to ensure the quality of the supervisory stress testing models. The goal of the validation program is to identify and communicate model issues and limitations to model stakeholders. The Federal Reserve Bank of Minneapolis leads the SMV group, which consists of validators with expertise in quantitative disciplines, such as economics, statistics, and finance, or expertise in risk management, auditing, and accounting. The group also draws on experts from throughout the Federal Reserve System to assist on specific validations, as needed. COSMO members stated that after the committee's formation in 2019, they asked the SMV group to conduct validations of TTSMs, including the SR-SABR, HC-SABR, and BETR models, and the SMV group agreed to validate those TTSMs.[6]

Model Review and Validation Process

COSMO conducts a two-stage review of models. The first stage includes a policy review to assess the model from a broad sense to confirm that the model's general approach is appropriate before reviewing

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[4] The System Risk Council is responsible for identifying, evaluating, prioritizing, and reporting risk issues; developing recommendations for actions on identified risk issues, as appropriate; and assessing the effectiveness of risk identification tools. The System Risk Council is chaired by the officer over the Risk Identification and Analysis area in S&R, together with an officer from the Division of Consumer and Community Affairs.

[5] *CCAR* is an annual exercise undertaken by the Federal Reserve System to assess whether the largest HCs operating in the United States have sufficient capital to continue operating during times of economic and financial stress and whether they have robust, forward-looking capital-planning processes that account for their unique risks. *DFAST* is a forward-looking exercise conducted by the System and financial companies supervised by the System to help assess whether institutions have sufficient capital to absorb losses and support operations during adverse economic conditions.

[6] A COSMO member indicated that COSMO created an agreement with the SMV group to establish a preliminary process for validating COSMO's models. COSMO and the SMV group agreed to reevaluate the scope and timing of the validation work once the risk management program had a better understanding of the models needing review and the scope and timing of the validation work.
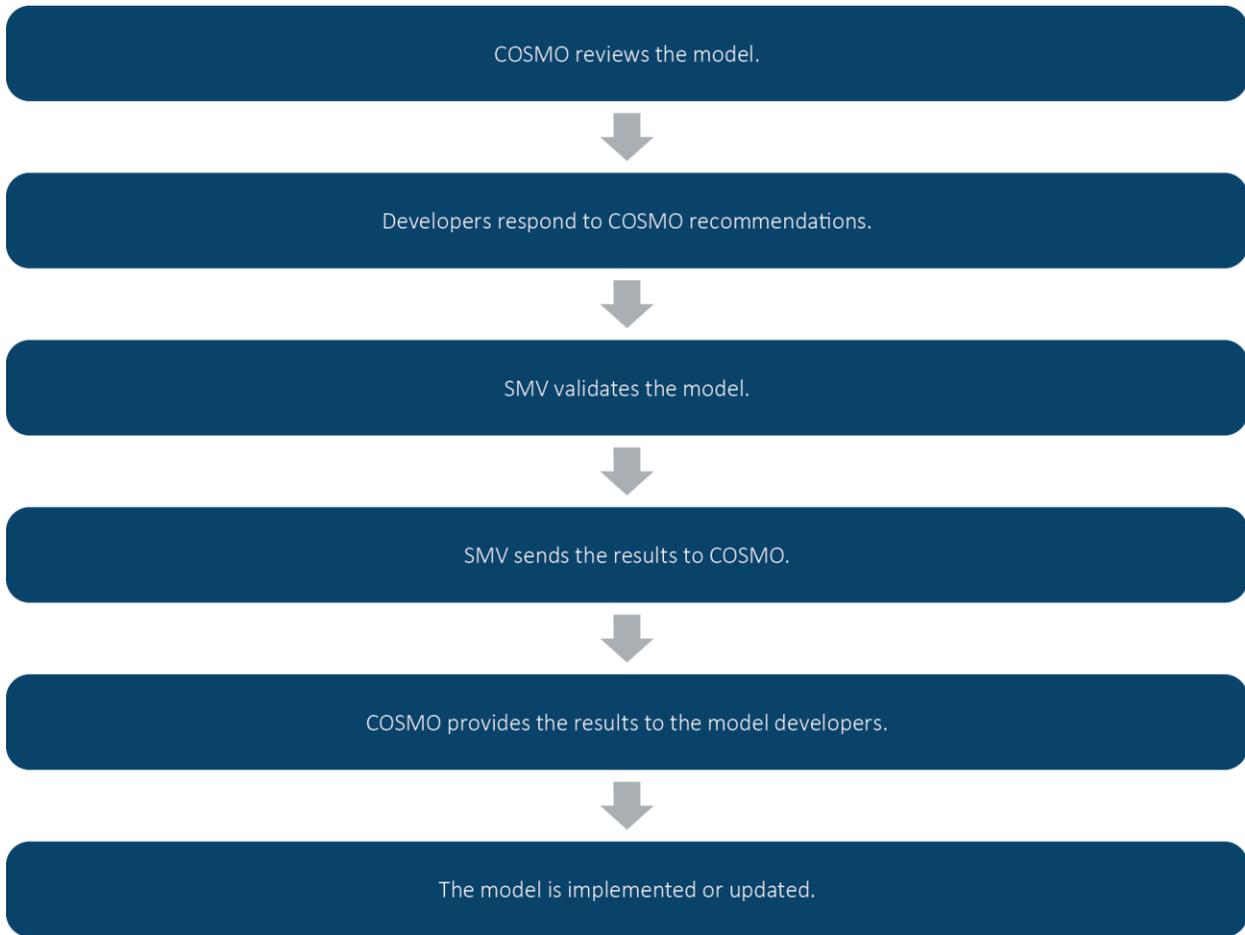
the model's technical elements.[7] The second stage includes a more detailed review of the model's design, specification, calibration, and performance, in addition to the steps for its implementation and performance monitoring. After completing its review, COSMO provides written feedback to model developers with one of three recommendations: (1) the model is generally fit for use, (2) the model could be used with compensating controls, or (3) the model should not be used because of significant concerns. COSMO also determines whether a model is ready for independent validation by the SMV group. A COSMO member indicated that in most cases, developers respond to COSMO recommendations before the SMV group validates the model.

According to an internal guidance document, once COSMO confirms that the model is ready for SMV validation, it notifies the SMV group. The SMV group then conducts an independent review of the model, which focuses on the conceptual soundness of modeling methodologies, code review, and model performance. Upon completing its review, the SMV group delivers COSMO a report containing findings and recommendations, which COSMO reviews and shares with the model developers.

The SMV group assesses the model's ability to meet its stated purpose but is not responsible for determining whether the model should be employed in supervision. COSMO is involved in determining how the SMV group's findings and recommendations should be incorporated into the model and, in consultation with other System supervisory groups and stakeholders, recommends whether a model fits its intended purpose and should be used within supervisory processes (figure 1).

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[7] The first stage review includes items such as the model's overall objective and purpose, whether it is a new or replacement model, the model's background and history, and the model's general structure and design. COSMO may decide to provide feedback to developers before moving to the second review stage.

Figure 1: Model Review and Validation Process

COSMO reviews the model.

⬇

Developers respond to COSMO recommendations.

⬇

SMV validates the model.

⬇

SMV sends the results to COSMO.

⬇

COSMO provides the results to the model developers.

⬇

The model is implemented or updated.

Source: Compiled by the OIG based on Board documents.

Finding 1: S&R Can Enhance Model Risk Management by Ensuring Timely Review and Validation of the SR/HC-SABR and BETR Models

Although S&R has taken steps to enhance model risk management for the SR/HC-SABR and BETR models, the majority of the SR/HC-SABR and BETR models in use have not undergone COSMO review and SMV validation. SR Letter 11-7 states that effective model validation helps to ensure that models are sound and that all model components should be subject to validation. COSMO is responsible for reviewing TTSMs to confirm they are ready for SMV validation and for providing assistance and support to the SMV group to allow it to conduct its independent validation work. We found that COSMO faces resource constraints, newly developed models requiring review, and a backlog of required reviews for models that were created and implemented prior to COSMO's 2019 formation, all of which have hindered its ability to complete model reviews. As a result, the SMV group has not validated the majority of the SR/HC-SABR and BETR models in use. In addition, we heard varying insights from interviewees regarding the SMV group's availability to validate the SR/HC-SABR and BETR models. By reviewing and validating the SR/HC-SABR and BETR models in a timely manner, S&R can help ensure that these models are performing as expected and reduce model risk.

S&R Has Taken Steps to Enhance the Board's Model Risk Management

COSMO was formed in December 2019 to ensure that models and tools used by supervisory staff are sound and produce reasonable output. COSMO created a charter that details its purpose and responsibilities. According to its charter, some of its responsibilities include (1) reviewing new and existing TTSMs to confirm that they are sound for use in supervision and ready for SMV validation and (2) assisting and supporting the SMV group in conducting its independent validation work. COSMO also developed the *COSMO Model Development, Implementation, and Documentation Standards Applicable to Non-CCAR/DFAST Supervisory Models* in August 2021 to help ensure that System staff implement sound model risk management practices.

Since its formation in December 2019, COSMO has reviewed six SR/HC-SABR and BETR models. SR Letter 11-7 states that ongoing monitoring and outcomes analysis are core elements of an effective validation

framework. To address these core elements, Board Surveillance[8] executes a quarterly monitoring program that includes outcomes analysis[9] and back-testing[10] for the SR/HC-SABR and BETR models.

The Majority of SR/HC-SABR and BETR Models in Production Have Not Undergone COSMO Review and Independent Validation

From December 2019, when COSMO was formed, to July 2022, only 2 of the 11 SR/HC-SABR and BETR models that are in use were both reviewed by COSMO and validated by the SMV group. One of these models was validated in December 2020 and has not subsequently undergone any ongoing validation. In addition, another 2 of the 11 SR/HC-SABR and BETR models in use were reviewed by COSMO but have not been validated by the SMV group. The remaining 7 SR/HC-SABR and BETR models, which were implemented prior to COSMO's formation in 2019, are in use and have yet to undergo COSMO review or SMV validation. An S&R official noted that COSMO is waiting for model developers to update these models before reviewing them.

Effective model validation helps to ensure that models are sound and identifies potential limitations and assumptions and assesses their possible effect. Ongoing monitoring can help ensure that models continue to work as intended. SR Letter 11-7 states that all model components should be subject to validation, and if it is not feasible to conduct necessary validation activities prior to model use, that fact should be documented and communicated in reports to users, senior management, and other relevant parties. Based on a review of the available documentation for the models that did not undergo validation activities prior to model use, it was not always clear whether this limitation was documented and communicated to users, senior management, and other relevant parties as outlined in SR Letter 11-7. In addition, Board interviewees acknowledged that COSMO does not have a formalized process for communicating these model limitations.

COSMO Faces Resource Constraints and Interviewees Shared Varying Insights Regarding Resource Availability for Validation Activities

Interviewees noted that COSMO's ability to complete its model reviews is hindered by a backlog of models it is working through that were created prior to the committee's existence and by resource constraints, as all COSMO members are volunteers and have other primary responsibilities. In addition,

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[8] Board Surveillance consists of the Surveillance—Financial Trends section and the Surveillance—Metric Systems section. Board Surveillance uses data science methods and techniques to extract key findings from the numerical and textual data available to supervisory staff. The resulting insights center on emerging risks at supervised institutions, both individually and as an industry. By providing supervisory staff with this type of information, Surveillance promotes and enables data-informed supervisory programs and initiatives. Financial Trends focuses on algorithm development and industry analysis, and Metric Systems builds automated production and delivery systems.

[9] *Outcomes analysis* involves comparing model outputs to corresponding actual outcomes.

[10] *Back-testing* is a form of outcomes analysis that involves comparing actual outcomes with model forecasts during a sample time period not used in model development at a frequency that matches the model's forecast horizon or performance window.

Board officials noted that the COVID-19 pandemic occupied a considerable amount of COSMO's time in 2020. One of the officials added that this was because COSMO had to assess the potential effect of the pandemic on the models. Given that COSMO must first confirm that the models are ready for independent validation, the SMV group cannot conduct validations for the SR/HC-SABR and BETR models until they have undergone COSMO review.

In addition, interviewees shared varying insights about the SMV group's availability to conduct SR/HC-SABR and BETR model validation activities. As noted above, the SMV group was formed in 2016 to validate the CCAR and DFAST models. In 2019, the SMV group agreed to also validate TTSMs, including the SR/HC-SABR and BETR models. COSMO members indicated that the SMV group has prioritized validating the stress testing models and does not always have time to complete validations for all the SR/HC-SABR and BETR models. SMV leadership and staff acknowledged that validating the stress testing models takes priority over other TTSMs, but stated that the SMV group has staff available to validate the TTSMs, including SR/HC-SABR and BETR.

Ensuring Timely Model Validation Could Help Mitigate Model Risk

By reviewing and validating the SR/HC-SABR and BETR models in a timely manner, S&R can help ensure that these models are performing as expected and reduce model risk by identifying potential errors and corrective actions. If it is not feasible to conduct necessary validation activities prior to model use, formally communicating such limitations to users and management can help to ensure that potential risks are known and appropriately mitigated by compensating controls. In addition, ongoing validation can help S&R assess whether the SR/HC-SABR and BETR models continue to perform as expected and identify potential improvements to the models. Further, enhanced communication between COSMO and the SMV group regarding resource availability can help S&R ensure that COSMO's and the SMV group's resources can be used efficiently.

Recommendations

We recommend that the director of S&R

1. Develop a plan for how COSMO and the SMV group intend to provide timely review and validation of the SR/HC-SABR and BETR models, including the expected time frames for completion along with a plan for ongoing validations. As part of this effort, assess the current level of staffing for COSMO and the SMV group to determine whether staffing is appropriate to efficiently and effectively conduct COSMO reviews and SMV validations consistent with guidance outlined in SR Letter 11-7.

2. Develop formal procedures to ensure that limitations, including the status of models in use prior to receiving SMV validation, are documented and communicated to users, senior management, and other relevant parties.

3. Develop expectations for internal communications to ensure that COSMO and SMV group officials and staff share necessary information on validation resource availability to ensure that models are validated in a timely manner.

Management Response

In its response to our draft report, S&R concurs with our recommendations.

Specifically, in response to recommendation 1, S&R states that COSMO and the SMV group have begun a discussion to develop options to improve the timeliness of COSMO reviews and SMV validations. S&R intends to develop the recommended plan in the first quarter of 2023.

In response to recommendation 2, S&R states that COSMO plans to recommend compensating controls for models currently in use but not yet reviewed and validated. In addition, the status of such models and compensating controls will be clearly communicated and a summary of compensating controls across all models will be reported to key stakeholders. S&R intends to develop the recommended procedures in the second quarter of 2023.

In response to recommendation 3, S&R states that COSMO plans to enhance its processes for communicating to the SMV group, modelers, and key stakeholders. In addition, communications on the status of the models will be tailored to the specific audience. S&R intends to develop the recommended expectations in the first quarter of 2023.

OIG Comment

The actions described by S&R appear to be responsive to our recommendations. We will follow up to ensure that the recommendations are fully addressed.

Finding 2: S&R Can Enhance Model Risk Management by Aligning Its Model Inventory With Guidance Outlined in SR Letter 11-7

COSMO maintains two model inventories, and they do not contain several expected data fields outlined in SR Letter 11-7. In addition, one of the model inventories is incomplete, having not been updated since October 2020. We learned that there are no formal policies or procedures for maintaining model inventories of TTSMs, including the SR/HC-SABR and BETR models. While the COSMO charter states that COSMO is responsible for developing and updating the model inventory, it does not provide procedures or designate a specific role for maintaining the inventory. A comprehensive model inventory could enhance model risk management for the SR/HC-SABR and BETR models and assist in scheduling validation activities.

COSMO Model Inventories Do Not Align With SR Letter 11-7

We found that COSMO maintains two model inventories. One inventory, which was provided in response to our document request, included only the SR/HC-SABR and BETR models. A second inventory, posted on COSMO's intranet site, included an inventory of TTSMs.

Based on our review, neither inventory aligns with guidance in SR Letter 11-7. For example, the inventories do not indicate whether the models are functioning properly, list exceptions to policy, identify when the model was last updated, or include the dates of planned validation activities. We also found that the inventory of TTSMs did not include any of the BETR models and had not been updated since October 2020. An interviewee noted that COSMO members compiled the inventory of TTSMs from different sources based on COSMO members' involvement in certain model activities. Further, interviewees indicated that neither model inventory was widely shared with relevant parties.

According to SR Letter 11-7, a comprehensive set of information should be maintained for models in use, under development for implementation, or recently retired. The inventory should describe the purpose and products for which the model is designed, the actual or expected use, and any restrictions. SR Letter 11-7 also lists attributes that would be helpful to include, such as

- whether the model is functioning properly
- the types and sources of inputs used
- when the model was last updated
- a time frame during which the model is expected to remain valid
- a list of exceptions to policy

- a list of planned validation activities
- the names of individuals responsible for various aspects of model development and validation

SR Letter 11-7 further notes that a specific party should also be charged with maintaining an enterprise inventory of all models, which should assist in evaluating model risk in the aggregate.

A Comprehensive Model Inventory Could Strengthen Model Risk Management

The COSMO charter states that COSMO is responsible for developing and updating an inventory of TTSMs, including the SR/HC-SABR and BETR models; however, it does not designate a specific role as having the responsibility to maintain the model inventory of TTSMs, including the SR/HC-SABR and BETR models. By designating a specific person or position to maintain and distribute the inventory, S&R could ensure accountability and promote consistency. In addition, by establishing policies and procedures for maintaining the model inventory, S&R could (1) clarify roles and responsibilities, (2) set clear expectations for maintaining the inventory, and (3) ensure that the inventory contains the elements outlined in SR Letter 11-7. COSMO members acknowledged that their inventory should be updated and consolidated, and added that this task is on their priority list.

An interviewee indicated that a comprehensive model inventory could also help facilitate the scheduling of SMV validations to ensure that validations are completed in a timely manner. A comprehensive inventory could also help communicate the status of TTSMs, including model limitations, to model users and senior management.

Recommendations

We recommend that the director of S&R

4. Develop policies and procedures for developing and maintaining a comprehensive model inventory of TTSMs, including all SR/HC-SABR and BETR models, to incorporate the following:

   a. the roles and responsibilities for maintaining the model inventory.

   b. the frequency with which the model inventory should be updated.

   c. the key elements that should be included in the model inventory.

   d. procedures for sharing the inventory with relevant parties.

5. Enhance the model inventory of TTSMs, including all SR/HC-SABR and BETR models, to ensure it includes the key elements outlined in SR Letter 11-7.

Management Response

In its response to our draft report, S&R concurs with our recommendations.

Specifically, in response to recommendation 4, S&R states that COSMO plans to consolidate the model inventories under its purview into one. COSMO plans to review its definition of TTSMs and make adjustments to reflect differences in use cases and risk levels. S&R states that COSMO will update its operating procedures to confirm the roles, responsibilities, communication protocols, and frequency for updating the COSMO model inventory. S&R intends to develop the recommended policies and procedures in the first quarter of 2023.

In response to recommendation 5, S&R states that by the first quarter of 2023, COSMO plans to consolidate and update its existing model inventories, with appropriate metadata for each model.

OIG Comment

The actions described by S&R appear to be responsive to our recommendations. We will follow up to ensure that the recommendations are fully addressed.

Finding 3: S&R Can Benefit From Developing a Formal Mechanism for Tracking the Findings and Recommendations From COSMO Reviews and SMV Validations

COSMO informally tracks findings and recommendations from completed COSMO reviews and SMV validations through meeting minutes and its intranet site but does not have a formal mechanism for tracking these findings and recommendations. As more models undergo model review and validation, such informal tracking could become more difficult. While SR Letter 11-7 does not provide specific guidance on how to track findings and recommendations, we identified guidance issued by another federal financial regulator that may be useful. Federal Housing Finance Agency Advisory Bulletin 2013-07: *Model Risk Management Guidance* (FHFA AB: 2013-07) states that the proper tracking and remediation of model validation findings is essential to managing model risk. We attribute the lack of formal tracking to the absence of COSMO procedures requiring that findings and recommendations from COSMO reviews and SMV validations be tracked. A formal process for tracking the findings and recommendations from COSMO reviews and SMV validations could help COSMO manage model risk and help promote the effective remediation of findings and recommendations.

COSMO Informally Tracks Model Review and Validation Findings and Recommendations

COSMO does not have a designated individual or a formal mechanism for tracking the findings and recommendations from completed COSMO reviews and SMV validations. COSMO members indicated that COSMO informally tracks findings and recommendations: One interviewee mentioned that COSMO documents findings and recommendations through COSMO's meeting minutes, and another interviewee mentioned that COSMO tracks findings and recommendations through COSMO's intranet site. Although we were able to determine the status of these findings and recommendations by reviewing validation reports and the COSMO meeting minutes and by searching through documents on COSMO's intranet site, the process was inefficient. As more models undergo model review and validation and as the volume of findings and recommendations increases, the informal tracking of findings and recommendations will likely become more difficult and inefficient.

While SR Letter 11-7 does not provide specific guidance on how to track findings and recommendations, we identified guidance issued by another federal financial regulator that highlights the importance of tracking findings and recommendations. FHFA AB: 2013-07 states that properly tracking and remediating model validation findings is essential to managing model risk. It also states that model risk managers should provide regular tracking reports to senior management and recommends prioritizing model risk remediation to ensure timely resolution.

A Formal Mechanism for Tracking Findings and Recommendations Could Help Mitigate Model Risk

A COSMO member indicated that COSMO does not have formal procedures to track findings and recommendations from COSMO reviews and SMV validations. They also stated that a formal mechanism for tracking COSMO review and SMV validation findings and recommendations could enhance the Board's model risk management practices for the SR/HC-SABR and BETR models. The interviewee acknowledged that COSMO's current tracking practices could be refined and that COSMO is currently looking to establish a mechanism for tracking these findings and recommendations. The interviewee also noted that having a master list of findings and recommendations from COSMO reviews and SMV validations could also help identify common risk factors among models that are causing multiple findings and recommendations, which is a practice that the Board asks supervised institutions to do.

As more models undergo review and validation, a formal mechanism to track all of COSMO's and SMV's findings and recommendations in one location could help promote the efficient and effective remediation of findings and recommendations. A formal mechanism could also help COSMO to communicate the status of findings, recommendations, and remediation efforts more efficiently to senior management, model developers, and the SMV group.

Recommendations

We recommend that the director of S&R

6. Develop policies and procedures for tracking the findings and recommendations from COSMO reviews and SMV validations that

    a. clarify roles and responsibilities for tracking findings and recommendations.

    b. define how COSMO will provide tracking reports to senior management.

7. Develop a formal mechanism for tracking the findings and recommendations from COSMO reviews and SMV validations. Consider incorporating the following:

    a. date and description of each finding and recommendation.

    b. current status of each finding and recommendation along with the planned remediation time frame.

    c. the name of the individual responsible for the remediation of the finding or recommendation.

Management Response

In its response to our draft report, S&R concurs with our recommendations.

Specifically, in response to recommendation 6, S&R states that COSMO plans to enhance the tracking and communication of COSMO recommendations and SMV findings by updating its operating procedures to clarify roles and responsibilities. COSMO also plans to enhance its formal monitoring and tracking of models under its purview and develop standardized templates for tracking reports provided to S&R senior

management and other key stakeholders. S&R notes that it intends to develop the recommended policies and procedures in the first quarter of 2023.

In response to recommendation 7, S&R states that COSMO plans to operationalize the formal and systemic monitoring and tracking of models under its purview. COSMO also plans to provide regular reports to the System Risk Council and other key stakeholders on the results of monitoring and tracking, which will include information about recommendations and findings. S&R intends to implement the recommended mechanism in the second quarter of 2023.

OIG Comment

The actions described by S&R appear to be responsive to our recommendations. We will follow up to ensure that the recommendations are fully addressed.

Appendix A: Scope and Methodology

We initiated this evaluation to assess the effectiveness of the model risk management processes for the SR/HC-SABR and BETR models. Our scope included governance and model validation activities for the SR/HC-SABR and BETR models for 2020 and 2021. Our scope did not include COSMO reviews or SMV validations of other supervisory models, nor the development phase of the model risk management framework.

To accomplish our objective, we reviewed SR Letter 11-7, FHFA AB: 2013-07, and other relevant policies and procedures, including internal Board policies related to model risk management.

We reviewed documentation associated with governance and model validation activities for the SR/HC-SABR and BETR models. For example, we reviewed the COSMO charter, *COSMO Model Development, Implementation, and Documentation Standards Applicable to Non-CCAR and DFAST Supervisory Models*, and guidance related to model review and validation. We also reviewed COSMO operational documentation, meeting minutes, and model inventories. We reviewed documentation pertaining to validation, ongoing monitoring, and outcomes analysis of the SR/HC-SABR and BETR models during the scope of our review.

We also reviewed COSMO review reports from 2020 to 2021 to identify recommendations contained in the reports and reviewed documentation in COSMO meeting minutes and on COSMO's intranet to assess COSMO's practices for tracking findings and recommendations.

We conducted interviews with Board and Reserve Bank officials and staff involved in model risk management activities for the SR/HC-SABR and BETR models, including COSMO members, S&R leadership, and System Risk Council leadership. We also interviewed SMV group leadership and staff involved in the model validation activities.

We conducted our evaluation from July 2021 through September 2022. We performed our evaluation in accordance with the *Quality Standards for Inspection and Evaluation* issued by the Council of the Inspectors General on Integrity and Efficiency in December 2020.

Appendix B: Management Response

BOARD OF GOVERNORS OF THE FEDERAL RESERVE SYSTEM
WASHINGTON, D. C. 20551

DIVISION OF
SUPERVISION AND REGULATION

November 17, 2022

Michael VanHuysen
Associate Inspector General for Audits and Evaluations
Office of Inspector General

Board of Governors of the Federal Reserve System
20th Street and Constitution Avenue N.W.
Washington, DC 20551

Dear Mr. VanHuysen:

Thank you for the report, *The Board Can Enhance the Effectiveness of Certain Aspects of Its Model Risk Management Processes for the SR/HC-SABR and BETR Models.* We appreciate the efforts of the Office of Inspector General in assessing the oversight of these models and find the report's recommendations helpful.

The report covers models generally used by the Division of Supervision and Regulation (S&R) to help identify risks and promote the efficient allocation of supervisory resources across community and regional banking organizations. Bank Exams Tailored to Risk (BETR) models classify the levels of risk present in banks' activities, helping supervisory staff tier bank examinations according to risk. The two early warning models—Supervision and Regulation Statistical Assessment of Bank Risk (SR-SABR) and Holding Company Statistical Assessment of Bank Risk (HC-SABR)—flag for heightened supervisory attention emerging financial weaknesses at state member banks and holding companies, respectively.

S&R supports strong model risk management (MRM) practices. For MRM, S&R employs a risk-based approach and calibrates its MRM practices to the materiality and risk posed by a particular supervisory model.

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As usage of the BETR and SR/HC-SABR models has increased, S&R has enhanced its governance structure over these models. This has included establishing the Committee on Supervisory Model Oversight (COSMO) in December 2019; developing new, more extensive supervisory model development and documentation standards in August 2021; and arranging for independent model validation by the System Model Validation (SMV) group.

As S&R continues to enhance this governance structure, and as MRM for these models matures, S&R intends to implement the report's recommendations. The S&R response to each recommendation is shown below, along with a target completion date. To capture and track all the recommendations together, COSMO intends to develop an overarching project plan that will include a gap analysis, remediation steps, milestones, and communication with stakeholders; the plan will include each recommendation listed below, with coordinated deadlines, and indicate how COSMO and the SMV group will incorporate responses to the recommendations into their processes.

<u>Finding 1: S&R Can Enhance Model Risk Management by Ensuring Timely Review and Validation of the SR/HC-SABR and BETR Models</u>

Recommendation 1: Develop a plan for how COSMO and the SMV group intend to provide timely review and validation of the SR/HC-SABR and BETR models, including the expected time frames for completion along with a plan for ongoing validations. As part of this effort, assess the current level of staffing for COSMO and the SMV group to determine whether staffing is appropriate to efficiently and effectively conduct COSMO reviews and SMV validations consistent with guidance outlined in SR Letter 11-7.

Response: S&R agrees with this recommendation. The BETR and SR/HC-SABR models are important inputs to risk-focused supervision. However, they are designed and used as data-driven starting points for risk identification. Supervisory staff combine the models with other information, and exercise supervisory judgment, before reaching supervisory conclusions. S&R calibrates the resources devoted to COSMO reviews and SMV validations of the BETR and SR/HC-SABR models accordingly. With this in mind, COSMO and the SMV group have begun a discussion to develop options to improve the timeliness of COSMO reviews and SMV validations. S&R intends to develop the recommended plan in the first quarter of 2023.

Recommendation 2: Develop formal procedures to ensure that limitations, including the status of models in use prior to receiving SMV validation, are documented and communicated to users, senior management, and other relevant parties.

Response: S&R agrees with this recommendation. COSMO plans to recommend compensating controls for models currently in use but not yet reviewed and validated.

The status of such models and compensating controls will be clearly communicated to the users of model output, and a summary of compensating controls across all models will be reported to key stakeholders, including the System Risk Council and S&R senior management. S&R intends to develop the recommended procedures in the second quarter of 2023, but in the meantime will ensure that all users of model output are informed of model limitations.

Recommendation 3: Develop expectations for internal communications to ensure that COSMO and SMV group officials and staff share necessary information on validation resource availability to ensure that models are validated in a timely manner.

Response: S&R agrees with this recommendation. COSMO plans to enhance its processes for communicating to the SMV group, modelers, and key stakeholders, including the System Risk Council and S&R senior management. Such communication will contain information, tailored to the specific audience, on the status of models either under development or in the review and validation process. S&R intends to develop the recommended expectations in the first quarter of 2023.

Finding 2: S&R Can Enhance Model Risk Management by Aligning Its Model Inventory With Guidance Outlined in SR Letter 11-7

Recommendation 4: Develop policies and procedures for developing and maintaining a comprehensive model inventory of TTSMs, including all SR/HC-SABR and BETR models, to incorporate the following:
    a. the roles and responsibilities for maintaining the model inventory.
    b. the frequency with which the model inventory should be updated.
    c. the key elements that should be included in the model inventory.
    d. procedures for sharing the inventory with relevant parties.

Response: S&R agrees with this recommendation. COSMO plans to enhance the current inventories for the models under its purview, consolidating them into one. As part of this effort, COSMO plans to stratify models by materiality and risk, to help tailor the application of MRM practices appropriately. COSMO plans to review its definition of top-tier supervisory models (TTSMs) and make adjustments to reflect differences in use cases and risk levels. COSMO will also update its current operating procedures to confirm the roles and responsibilities, communication protocols, and frequency for updating the COSMO model inventory. S&R intends to develop the recommended policies and procedures in the first quarter of 2023.

Recommendation 5: Enhance the model inventory of TTSMs, including all SR/HC-SABR and BETR models, to ensure it includes the key elements outlined in SR Letter 11-7.

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Response: S&R agrees with this recommendation. As noted, COSMO plans to update and consolidate its existing model inventories into one inventory, with appropriate metadata for each model. The information is intended generally to include:
- the model's reliability;
- types and sources of inputs;
- date of last update;
- any policy exceptions;
- expected timeframe of model validity;
- key model limitations and uncertainties;
- model review and validation status and plan;
- any review recommendations or validation findings;
- responses to recommendations and findings;
- application of compensating controls; and
- names of individuals responsible for different model tasks.

S&R intends to update the COSMO model inventory in the first quarter of 2023.

Finding 3: S&R Can Benefit From Developing a Formal Mechanism for Tracking the Findings and Recommendations From COSMO Reviews and SMV Validations

Recommendation 6: Develop policies and procedures for tracking the findings and recommendations from COSMO reviews and SMV validations that
   a. clarify roles and responsibilities for tracking findings and recommendations.
   b. define how COSMO will provide tracking reports to senior management.

Response: S&R agrees with this recommendation. COSMO plans to enhance the tracking and communication of COSMO recommendations and SMV findings by updating its operating procedures to clarify roles and responsibilities. COSMO also plans to enhance its formal monitoring and tracking of models under its purview. COSMO's operating procedures will also include discussion of when compensating controls should be applied in response to recommendations, findings, or other identified issues. Further, COSMO plans to develop standardized templates for tracking reports provided to S&R senior management and other key stakeholders. S&R intends to develop the recommended policies and procedures in the first quarter of 2023, but in the meantime will continue to monitor and track model performance and findings using its current processes.

Recommendation 7: Develop a formal mechanism for tracking the findings and recommendations from COSMO reviews and SMV validations. Consider incorporating the following:
   a. date and description of each finding and recommendation.
   b. current status of each finding and recommendation along with the planned remediation time frame.

    c.   name of individual responsible for the remediation of the finding or recommendation.

Response: S&R agrees with this recommendation. COSMO plans to operationalize the formal and systematic monitoring and tracking of models under its purview. Details may include the date and description of each recommendation and finding; the planned remediation timeframe; remediation status; individuals responsible for remediation; and any compensating controls applied in response to identified model issues. COSMO plans to provide regular reports to the System Risk Council and other key stakeholders on the results of monitoring and tracking, to include information about recommendations and findings, other identified issues, modeler responses, and any compensating controls. S&R intends to implement the recommended mechanism in the second quarter of 2023, but in the meantime will continue to monitor and track model performance and findings using its current processes.

Michael Gibson (signed)
Director

Abbreviations

BETR	Bank Exams Tailored to Risk
CCAR	Comprehensive Capital Analysis and Review
COSMO	Committee on Supervisory Model Oversight
DFAST	Dodd-Frank Act Supervisory Stress Test
FHFA AB: 2013-07	Federal Housing Finance Agency Advisory Bulletin 2013-07: *Model Risk Management Guidance*
HC	holding company
HC-SABR	Holding Company Statistical Assessment of Bank Risk
S&R	Division of Supervision and Regulation
SMB	state member bank
SMV	System Model Validation
SR Letter 11-7	Supervision and Regulation Letter 11-7: *Supervisory Guidance on Model Risk Management*
SR/HC-SABR	SR-SABR and HC-SABR
SR-SABR	Supervision and Regulation Statistical Assessment of Bank Risk
TTSM	top-tier supervisory model

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