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SUBJECT: Applying the Requirement for Conservatism to the Parameters in the Advanced Approaches

Background

The primary objective of a bank's or a bank holding company's risk-parameter quantification process under the Federal Reserve Board's advanced approaches risk-based capital rule (rule)[1] is to produce "accurate, timely, and reliable" estimates of the risk parameters. The rule recognizes, in section 22(c)(3), that data limitations may affect the accuracy or reliability of risk-parameter estimates. Therefore, the rule also requires "... appropriately conservative risk-parameter estimates when the [bank] has limited relevant data, and any adjustments that are part of the quantification process must not result in a pattern of bias toward lower-risk-parameter estimates."[2] However, under the rule, conservatism is not a substitute for taking actions to address identified problems in risk-measurement processes or data.

This requirement was included in the rule to address situations where uncertainties around risk-parameter estimates make it difficult to confirm that the accuracy standard had been met. As stated in the preamble to the rule:

> "The choices of the particular assumptions and adjustments that determine the final estimate, within the defensible range, should reflect the uncertainty in the quantification process. More uncertainty in the process should be reflected in the assignment of final risk-parameter estimates that result in higher risk-based capital requirements relative to a quantification process with less uncertainty. … The degree of conservatism applied to adjust for uncertainty should be related to factors such as the relevance of the reference data to a bank's existing exposures, the robustness of the models, the precision of the statistical estimates, and the amount of judgment used throughout the process. A bank is not required to add a margin of conservatism at each step if doing so would produce an excessively conservative result. Instead, the overall margin of conservatism should adequately account

[1] Hereafter, "banking organization" refers to a bank and a bank holding company. Refer to 12 CFR part 208, appendix F (state member banks), and 12 CFR part 225, appendix G (bank holding companies).

[2] 12 CFR part 208, appendix F, section 22(c)(3), and 12 CFR part 225, appendix G, section 22(c)(3).

for all uncertainties and weaknesses in the quantification process. Improvements in the quantification process (including use of more complete data and better estimation techniques) may reduce the appropriate degree of conservatism over time."[3]

A similar concern is reflected in the Federal Reserve and Office of the Comptroller of the Currency *Supervisory Guidance on Model Risk Management* (April 4, 2011), which advises that "an understanding of model uncertainty and inaccuracy and a demonstration that the banking organization is accounting for them appropriately are important outcomes of effective model development, implementation, and use."[4] The guidance notes that "it can be prudent for banks to account for model uncertainty by explicitly adjusting model inputs or calculations to produce more severe or adverse model output in the interest of conservatism. Accounting for model uncertainty can also include judgmental conservative adjustments to model output, placing less emphasis on that model's output, or ensuring that the model is only used when supplemented by other models or approaches."

As to the specific incorporation of conservatism into the estimation process, the preamble to the rule (cited above) sets forth an overarching principle that conservatism need not be additive for all elements of uncertainty. However, to date, there has been insufficient attention to parameter uncertainty at some banking organizations. Some recognized data or process limitations have elicited conservative treatment, while others have gone unrecognized or have not been adequately evaluated or appropriately addressed.

By issuing this guidance, the Federal Reserve seeks to provide a more substantive articulation of how data limitations affecting risk-parameter estimation should be addressed through the appropriate application of conservative risk-parameter estimates. The guidance is intended to promote more extensive analysis of sources of uncertainty and more consistent methodological approaches for applying "appropriately conservative risk-parameter estimates" across banking organizations.[5]

General Implementation Guidance

The section 22(c)(3) requirement is fundamental to risk-parameter quantification and should be applied consistently through:

- Comprehensive identification and assessment of data or process limitations potentially affecting the accuracy and reliability of risk-parameter estimates, other than those arising from statistical uncertainty;
- Identification of portfolios with high variance around point estimates of risk parameters, resulting in less confidence in the accuracy of the parameter estimates (material degree of

[3] 72 *Fed. Reg.* 69314 (December 7, 2007).

[4] *See* SR letter 11-7, "Supervisory Guidance on Model Risk Management." http://www.federalreserve.gov/bankinforeg/srletters/sr1107.htm

[5] This guidance is limited to the application of conservatism in the context of data limitations affecting risk-parameter estimates. It does not address the rule's so-called "principle of conservatism," which addresses different concerns. *See* 12 CFR part 208, appendix F, section 1(d), and 12 CFR part 225, appendix G, section 1(d).

statistical uncertainty), such as may be the case where drivers of loss are not well understood or difficult to capture quantitatively;

- Analysis of the effect of specific data or process limitations that the banking organization or examiners have identified as contributing to material uncertainty around an estimate or potentially producing a materially biased estimate;
- Implementation of conservative adjustments, as appropriate; and
- Constructive efforts to reduce data and process limitations through improvements to data collection and data management processes.

Note that this guidance does not distinguish among different types of parameter uncertainty attributable to specific underlying sources.[6] Rather, this guidance addresses parameter uncertainty generally and expectations for conservative adjustments when such uncertainty is material in relation to point estimates of risk parameters. While not all sources of uncertainty require an adjustment under the rule, supervisors expect banking organizations to have a robust process for identifying all sources of uncertainty and to apply demonstrably conservative adjustments when parameters are not shown to be accurate within defensible tolerances.

In general, conservatism should be applied as a temporary measure while actions are taken to develop more adequate data and empirical support. Accuracy and reliability remain the primary goal of the risk-parameter segmentation and quantification process.

Framework for Identifying Data Limitations

While the nature of data limitations requiring conservative adjustments may vary widely across banking organizations and portfolios, commonly encountered types of data limitations include, but are not limited to:

- Lack of relevant historical reference data for particular business lines or exposure types or for acquired portfolios;
- Low default portfolios;
- Missing data on key risk drivers or segmentation variables, for example, missing information on whether a loan is secured and the amount of collateral;
- Lack of data on one or more components of loss-given-default, such as workout costs, accrued but unpaid interest and fees, and recovery discount factors;
- Unresolved defaults (censoring of loss given default (LGD) data); and

[6] In principle, any parameter uncertainty can be attributable to data limitations of one form or another; with sufficiently large amounts of accurate and relevant reference data, parameter uncertainty generally would be minimal.

- Risk-parameter calibrations involving mapping from external or historical data sets that bear limited resemblance to the banking organization's current portfolio, for which the differences can be only imperfectly controlled.[7]

In some cases, the impacts of data limitations may be obscured by assumptions applied in response to the limitations. For example, modelers sometimes use average recovery or loss timing curves to extrapolate future recoveries or losses for unresolved defaults. The original source of uncertainty is then reflected in uncertainty around these timing relationships. Reliance on extrapolations, imputations, or assumptions to obtain risk-parameter estimates in the face of data limitations does not eliminate the need to assess materiality of the limitations and to consider whether conservative adjustments are needed.

Supervisory Expectations of Banking Organization Practices

Banking organizations should conduct a robust assessment of all uncertainty associated with risk-parameter estimates, and explicitly adjust the parameters with an appropriate degree of conservatism where needed to address material uncertainty. This assessment should include:

- Identification of material instances of statistical uncertainty;
- A comprehensive listing of other sources of uncertainty in the parameter quantification processes, including gaps and limitations in reference data or in underlying processes that potentially impact the accuracy of the risk-parameter estimates (for example, rating and segmentation systems), and an assessment of materiality of each limitation or gap;
- An assessment of the degree to which each material limitation, gap, or assumption creates a potential for downward bias in the risk-parameter estimate; and
- Qualitative and quantitative assessment (perhaps incorporating expert judgment) of the impact of material limitations, gaps, and assumptions on the uncertainty of individual risk-parameter estimates, including sensitivity analysis of key assumptions. Rigorous statistical or quantitative measures are generally preferred; however, examiners should evaluate the analytical methods used in the context of feasibility of alternative approaches.

Banking organizations should provide documentation that develops or explains the specific conservative adjustments adopted by the organization to compensate for uncertainties or potential biases in their risk-parameter quantification process. Banking organizations are not expected to support such adjustments with the same amount of developmental evidence or level of validation that would be applied to risk-parameter estimation, where the focus is accuracy and reliability. However, a conservative adjustment should be demonstrably reasonable given the uncertainties being addressed.

Following its assessment, a banking organization should develop a plan to reduce limitations and gaps within a reasonable remediation timeline, depending on feasibility of database development, the degree of uncertainty of risk-parameter estimates, and total exposure

[7] According to the preamble to the rule, "an important element of mapping is making adjustments for differences between reference data sets and the bank's exposures."

amount.[8] While conservative adjustments should be appropriate regardless of the remediation timeline, examiners' evaluation of the adequacy of the overall risk-measurement practices, including conservatism in the process, should consider remediation plans and execution. In addition, a banking organization's internal validation process should explicitly review the banking organization's implementation of section 22(c)(3), including the adequacy of efforts to identify, evaluate, and address data limitations through conservative adjustments or other means, and the findings should be fully documented.

Note that the comprehensive review and assessment of assumptions, limitations, and gaps, is applicable to all material aspects of banking organizations' advanced systems. The rule requires a banking organization to adequately document all material aspects of its advanced systems, irrespective of the organization's evaluations of appropriate conservatism.[9] Quantitative approaches to assessing uncertainty and potential bias vary, and (as noted in SR letter 11-7) could entail an assessment of the potential impact of factors that are unobservable or not fully incorporated in the data or model; the development of a confidence interval around a statistical model's point estimate; a sensitivity analysis producing a range of outputs rather than a simple point estimate; or a rigorous benchmarking analysis.

Consideration of Conservatism across Parameters and Portfolios

While the rule emphasizes the need for accurate and reliable risk-parameter estimates in determining minimum regulatory capital, it does not recognize, for risk-measurement purposes, the concepts of cross-parameter diversification (for example, correlations in risk factors impacting the probability of default (PD), LGD, or exposure at default (EAD) estimates), inter-portfolio diversification (for example, for given risk parameters, correlated loss rates across different types of loans), or inter-risk diversification (for example, that losses across risk dimensions may be less than perfectly correlated). Consistent with this approach, demonstrated conservatism in one risk area at the parameter or portfolio level should not compensate for lack of conservatism in a separate risk area.

Within a portfolio, evaluation of the conservatism built into parameter estimation should, ordinarily, treat each parameter in isolation. While the preamble to the rule discourages an additive approach to dealing with conservatism, this caution should generally be interpreted as applying to individual risk-parameter estimates.[10] Further, since banking organizations and examiners typically measure, validate, and evaluate parameters on a standalone basis, consistency and logic imply that conservative adjustments should also be considered on that basis.

While the guiding principle is to treat each parameter separately, there can be instances when an adjustment applied to one parameter suffices to address uncertainty across multiple parameters for a given portfolio. For instance, when uncertainty across risk parameters arises from a common source (such as with low default portfolios), it may be appropriately addressed

[8] For example, it may be infeasible or of limited usefulness to attempt to overcome data limitations for runoff or acquired portfolios that have little data, or for extremely low default portfolios.

[9] 12 CFR part 208, appendix F, section 22(k), and 12 CFR part 225, appendix G, section 22(k).

[10] *See* note 3 supra.

via an adjustment to one of the risk parameters. Likewise, an individual parameter adjustment could suffice given robust demonstration that uncertainty in one risk parameter will offset uncertainty in other parameters when calculating risk weighted assets.[11] In such cases, the justification for applying only the single adjustment should be documented and will be subject to additional supervisory scrutiny.

[11] It may not be advisable to treat risk parameters independently in cases when errors in PD and LGD are logically or empirically demonstrated to be negatively correlated; for example, when a banking organization's historical reference data is not entirely consistent with the rule's definition of default in a way that logically implies offsetting effects on measurement error in PD and LGD.