Office of the Comptroller of the Currency
Board of Governors of the Federal Reserve System
Federal Deposit Insurance Corporation
Office of Thrift Supervision

Summary Findings of the Fourth Quantitative Impact Study

Summary

On October 29, 2004, the Office of the Comptroller of the Currency, the Board of Governors of the Federal Reserve System, the Federal Deposit Insurance Corporation, and the Office of Thrift Supervision (the Agencies) initiated a quantitative impact study with the objective of gaining a better understanding of the potential effects of a Basel II-based regulatory capital regime on U.S. institutions. This paper summarizes the findings from this study, commonly referred to as the fourth quantitative impact study or QIS-4. It is important to note that QIS-4 was conducted on a best-efforts basis on the part of participating institutions using limited data and without the benefit of fully articulated final rules for U.S. implementation. In addition, the study focused on institutions' minimum risk-based capital requirements, without consideration of any effects that retention of the existing minimum leverage and Prompt Corrective Action[1] requirements would have on overall minimum regulatory capital requirements.[2] It is also important to note that the role of calibration of the supervisory risk functions was not addressed as part of the interagency analysis of the QIS-4 results. Hence this document does not address whether the Agencies' desire to avoid a material reduction in aggregate capital requirements would ultimately be achieved without some recalibration of the supervisory risk functions or changes to other aspects of the framework.

The results of the study indicated that aggregate minimum risk-based capital requirements[3] would fall 15.5 percent for the 26 institutions in the QIS-4 participant population when moving from the current Basel I-based framework to a Basel II-based framework.[4] The median

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[1] See 12 U.S.C. § 1831o.

[2] As announced in September 2005, under the proposed U.S. implementation of Basel II, institutions would be required to meet not only the new risk-based capital requirements, but also the existing U.S. leverage ratio requirements. Institutions also would remain subject to existing Prompt Corrective Action rules. See "Banking Agencies Announce Revised Plan for Implementation of Basel II Framework," September 30, 2005, Joint Release.

[3] This number refers to the effective minimum risk-based capital requirement. See the "QIS-4 Results" section of this paper for a description of how the effective minimum risk-based capital requirement is calculated.

[4] Since no final regulations implementing a Basel II-based framework have been issued in the United States, all QIS-4 results relating to Basel II are based on the description of such a framework contained in QIS-4 instructions. This description differs from the framework issued by the Basel Committee in June 2004 in several respects. For example, the QIS-4 articulation of a Basel II framework does not include a 1.06 scaling factor. The QIS-4 instructions are available at www.ffiec.gov/qis4/.

reduction in total effective minimum risk-based capital requirements was 26 percent and the median reduction in Tier 1 capital requirements was 31 percent. The results also showed material dispersion in minimum risk-based capital requirements across institutions and portfolios.

As indicated in an April 2005 press release[5], the Agencies were concerned about the magnitude of the drop in QIS-4 minimum risk-based capital requirements and the dispersion of those requirements and decided to undertake further analysis. This subsequent analytical work focused on identifying the extent to which the reduction and dispersion in minimum risk-based capital requirements reflected the risks facing institutions, differences in the state of institutions' data systems and their overall readiness to implement a Basel II framework, as well as aspects of the framework itself that might produce results that did not appropriately reflect underlying risks.

After analyzing QIS-4 results, the Agencies believe that a multitude of factors contributed to the observed drop and dispersion in capital requirements. The principal findings were the following.

- Interagency analysis was inconclusive on whether QIS-4 results represented an understatement or overstatement of the overall level of minimum risk-based capital that would be required under a fully implemented Basel II framework.
- The relatively benign economic environment prevalent when QIS-4 was conducted resulted in lower minimum risk-based capital requirements than would have been observed had QIS-4 been conducted during a more stressful economic period, since the Basel II framework is designed to be more sensitive to expected macroeconomic conditions than current U.S. rules.
- Much of the observed dispersion was caused by differences in the underlying source data and methodologies used by institutions to quantify their risks. These differences in quantification also likely affected the overall levels of minimum risk-based capital requirements observed in QIS-4 results. These differences were the result of two broad factors:
    o Institutions being at various stages of implementation of the Basel II framework; and,
    o Flexibility allowed within the framework governing the selection of risk inputs.
- Differences in portfolio composition and credit quality also contributed to the observed dispersion in QIS-4 capital requirements. However, analysis controlling for credit quality differences suggests that portfolio composition was not as important a contributor to dispersion as differences in data and methodologies used.

The remainder of this paper is divided into four sections. The first section provides background on, and context for, QIS-4. The second section presents the results of the QIS-4 exercise. The third section summarizes selected aspects of the Agencies' analysis in order to provide some perspectives and insights on QIS-4 results, and the final section presents concluding remarks.

Background

Over the past several years, the Agencies have conducted a number of quantitative impact studies, usually in conjunction with the Basel Committee on Banking Supervision (Basel

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[5] See "Banking Agencies To Perform Additional Analysis Before Issuing Notice of Proposed Rulemaking Related To Basel II", April 29, 2005, Joint Release.

Committee). The purpose of these studies was to gain a better understanding of the potential effects of proposed Basel II risk-based capital requirements. Each of these studies was based on the most current proposal of the Basel II framework in place when each study was conducted. In June 2004, the Basel Committee issued a new framework, which was used as the basis for QIS-4 instructions.[6]

The purpose of QIS-4 was to provide the Agencies with a better understanding of the potential effects of a Basel II-based regulatory capital regime on an industry, institution, and portfolio basis. It should be noted, however, that the Basel II capital regime, under its Pillar II specification, can require additional capital for an institution's market, concentration, and interest rate risks. Potential Pillar II capital requirements were not addressed in QIS-4. The Agencies also sought to use QIS-4 data to assist in the U.S. rulemaking process that would implement the Basel II framework.[7] Finally, the Agencies planned to use QIS-4 data to help evaluate the overall calibration of the Basel II framework on an international basis through consultations with the Basel Committee. Calibration of the individual risk weight functions, however, was beyond the scope of the QIS-4 exercise and the subsequent interagency analysis.

The Agencies received QIS-4 data from 26 institutions, 15 of which had also participated in QIS-3 (initiated in October of 2002). As with previous studies, QIS-4 was conducted on a best-efforts basis. No minimum threshold of compliance with the proposed framework was required to participate, and no supervisory oversight of the filings was performed. The Agencies are aware that some institutions had difficulty estimating certain parameters, and many institutions acknowledged that their systems were still under development in preparation for Basel II.

While previous studies, including QIS-3, were informative and valuable to the development of the Basel II framework, the Agencies recognized the limitations of the data collected from these studies and attempted to improve QIS-4 in several ways.

First, QIS-4 was a more tailored study than QIS-3. While QIS-3 and QIS-4 were constructed for use in several countries and were coordinated through the Basel Committee, the Agencies developed and tailored a version of QIS-4 specifically for U.S. institutions. As part of this process, instructions were developed that included specifications for items that were left to national discretion in the June 2004 Basel II framework. The U.S. version of QIS-4 also asked for less information than QIS-3 in that it only requested data on the advanced approaches (the advanced internal ratings-based approach for credit risk and the advanced measurement approaches for operational risk) proposed in the June 2004 Basel II framework since these are the only approaches proposed to be implemented in the United States. By not collecting information on the Standardized or Foundation IRB approaches, participating institutions were better able to focus resources on a limited data collection effort.

Second, the U.S. version of QIS-4 included a detailed questionnaire that participants were asked to complete. The Agencies intended for the questionnaire to provide additional qualitative

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[6] "International Convergence of Capital Measurement and Capital Standards: A Revised Framework," June 2004.
[7] In August of 2003, the Agencies issued an advance notice of proposed rulemaking on Basel II. The Agencies also noted in a September 30, 2005 press release that a notice of proposed rulemaking (NPR) on Basel II should be forthcoming.

information to supplement quantitative data collected and to provide contextual background to each institution's submission. In earlier studies, the Agencies had limited information with which to assess the relative strengths and weaknesses of each institution's data.

The Agencies also believe that QIS-4 data are of higher quality than previous QIS exercises because many institutions' data systems have improved as they have moved closer towards eventual adoption of a Basel II capital regime.

Given the factors noted above, the Agencies believe the QIS-4 data to be an improvement on QIS-3 data. More specifically, the Agencies believe that QIS-4 data represented the best available source of information at the time they were collected to assess the potential impact of a Basel II framework in the United States. However, the Agencies note that QIS-4 data still reflect material limitations that must be considered. Some of these limitations are discussed below, following a summary of QIS-4 results.

QIS-4 Results[8]

Many of the following tables and charts use two distinct measures for minimum risk-based capital requirements. These measures are particularly important when attempting to compare minimum risk-based capital requirements under a Basel II framework to those under the current U.S. risk-based capital framework. While previous QIS exercises used risk-weighted assets to compare Basel I and potential Basel II minimum risk-based capital requirements, changes to the Basel II framework since QIS-3 (that alter the numerators of the risk-based capital ratios) made this simple comparison of risk-weighted assets no longer sufficient. The numerators of the risk-based capital ratios would differ, reflecting, under Basel II, (a) direct deductions of certain additional exposure types from Tier 1 or total capital, and (b) a new approach for determining the amount of reserves eligible for inclusion in Tier 1 and Tier 2 capital based on the amount of reserves in relation to the bank's total expected credit losses (EL).

One measure used by the Agencies to assess minimum risk-based capital requirements is "minimum required risk-based capital" (MRC). MRC equals the sum of EL – and other items that must be deducted from capital – and unexpected losses (UL). In other words, MRC can be thought of as the total amount of regulatory capital and reserves that an institution must maintain in order to meet its minimum risk-based capital requirement. For example, the MRC for a drawn corporate loan under a Basel II framework would include the EL and UL capital requirements for the loan (where, in effect, the UL risk-weighted assets were multiplied by 8 percent to arrive at a dollar capital amount). Under current U.S. rules, the MRC for a drawn corporate loan would be the risk-weighted assets assigned to the loan multiplied by 8 percent.

The second measure, "effective minimum required risk-based capital" (EMRC) takes into account the effects of eligible reserves. EMRC is equal to MRC adjusted for the amount of eligible reserves. Thus, EMRC can be thought of as the total amount of regulatory capital excluding reserves needed to meet the 8 percent total minimum risk-based capital requirement.
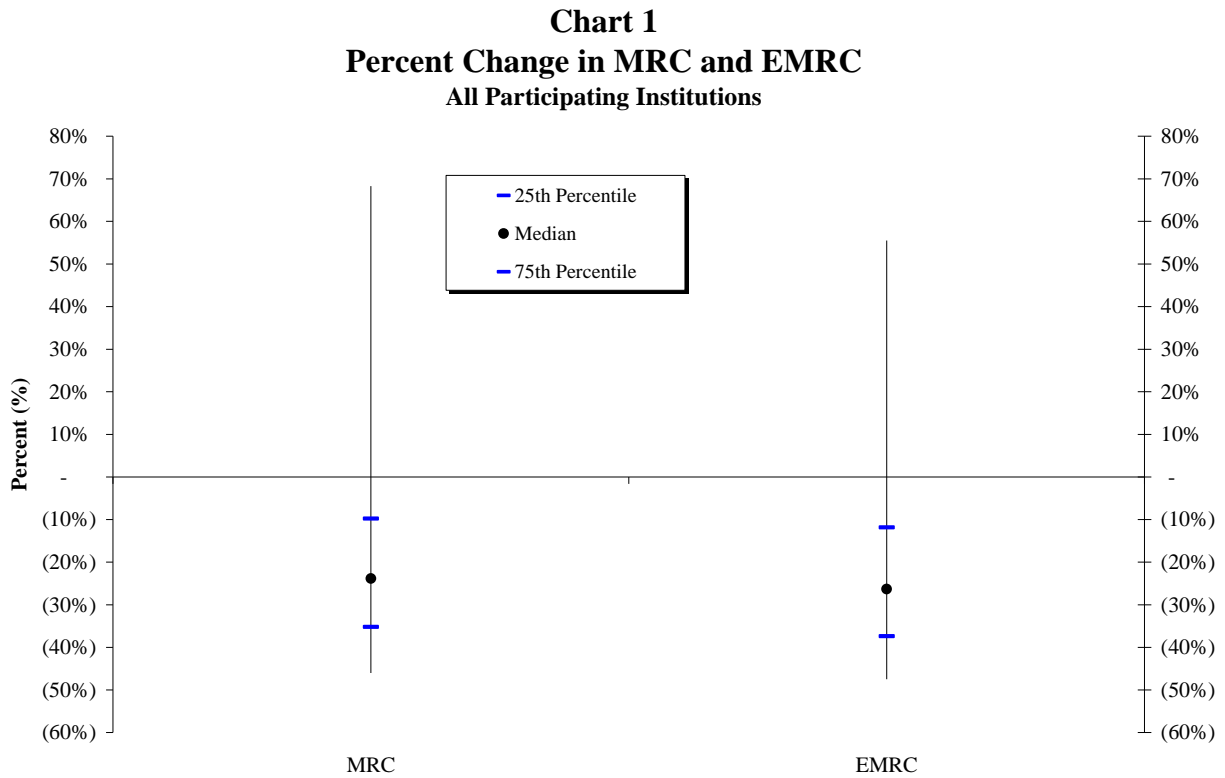
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[8] As noted earlier, the QIS-4 results reflect the application of a 1.0 scaling factor rather than the 1.06 scaling factor presented in the June 2004 Basel II framework.

In the Agencies' analysis, MRC was often used to examine changes in minimum risk-based capital requirements when moving from the current rules to a Basel II framework for individual portfolios, such as an institution's mortgage or wholesale portfolio. This is because the effect of reserves could not be assessed at the portfolio level, since reserves were not attributable to the specific portfolios defined in QIS-4. When looking at an institution as a whole, the effects of reserves can be incorporated, and so EMRC is generally used.

Industry-wide results

QIS-4 data showed that aggregate EMRC on a dollar-weighted basis[9] for the 26 institutions that participated in the study would be 15.5 percent lower under a Basel II framework than under the current U.S. rules. MRC would be 12.5 percent lower. The median reduction in EMRC among the 26 participating institutions was 26 percent.

Chart 1 shows the distribution across participating institutions of the percent changes in MRC and EMRC in moving from the current rules to a Basel II framework. The vertical lines identify the total distribution, from minimum to maximum, of the 26 participating institutions. The 25th and 75th percentiles and the median percent changes are also identified.

Chart 1
Percent Change in MRC and EMRC
All Participating Institutions

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[9] Each institution's contribution to the aggregate is equal to the dollar amount of its EMRC.

QIS-4 results also suggested that minimum Tier 1 risk-based capital requirements under a Basel II-based framework would be lower for many institutions than they are under current U.S. rules. Minimum Tier 1 capital requirements declined by 22 percent in aggregate. Half the organizations reported reductions in minimum Tier 1 capital requirements of over 31 percent. Note that the minimum required capital calculations undertaken in QIS-4 do not take into account the impact of the minimum leverage ratio requirement. Were such results produced under an up-and-running risk-based capital regime, the existing PCA leverage requirements could become a more important constraint than they are currently.

Industry-wide portfolio effects

Table A shows the changes in MRC by portfolio, aggregated across all QIS-4 participants. Entries in parentheses denote negative numbers. The term "portfolio" is used here to identify discrete segments of capital requirements. For example, operational risk is listed as a separate line item in this table, which means that all risk-based capital requirements associated with operational risk have been captured within this line item. It is important to note that operational risk has been segregated in this way when considering the changes in MRC for the various credit portfolios. For most institutions, at least some portion of the operational risk charge would be associated with various credit-related activities. However, Table A makes no attempt to allocate operational risk to the various portfolios, as any such allocation would require arbitrary assumptions. There are no percentage change numbers for operational risk because it is not separated out as a specific charge under current rules.

Table A
QIS-4 Results: Changes in Minimum Required Capital

Portfolio	Column 1: % Change in Portfolio MRC	Column 2: % Point Contrib. to MRC Change	Column 3: Median % Change in Port. MRC	Column 4: Weighted Median % Change in Port. MRC	Column 5: Share of Basel I MRC	Column 6: Share of Basel II MRC
Wholesale Credit	**(24.6%)**	**(10.9%)**	**(24.5%)**	**(21.6%)**	**44.3%**	**38.2%**
Corporate, Bank, Sovereign	(21.9%)	(7.4%)	(29.7%)	(13.5%)	33.9%	30.3%
Small Business	(26.6%)	(1.2%)	(27.1%)	(24.8%)	4.6%	3.9%
High Volatility CRE	(33.4%)	(0.6%)	(23.2%)	(42.4%)	1.8%	1.3%
Income Producing RE	(41.4%)	(1.7%)	(52.5%)	(52.4%)	4.0%	2.7%
Retail Credit	**(25.6%)**	**(7.8%)**	**(49.8%)**	**(28.7%)**	**30.6%**	**26.0%**
Home Equity (HELOC)	(74.3%)	(4.6%)	(78.6%)	(76.8%)	6.1%	1.8%
Residential Mortgage	(61.4%)	(6.8%)	(72.7%)	(64.4%)	11.1%	4.9%
Credit Card (QRE)	66.0%	4.0%	62.8%	72.2%	6.1%	11.6%
Other Consumer	(6.5%)	(0.4%)	(35.2%)	(18.3%)	6.0%	6.4%
Retail Business Exposures	(5.8%)	(0.1%)	(29.2%)	11.6%	1.2%	1.3%
Equity	6.6%	0.1%	(24.4%)	9.6%	1.3%	1.6%
Other assets	(11.7%)	(1.2%)	(3.2%)	(11.6%)	10.0%	10.1%
Securitization	(17.9%)	(1.4%)	(39.7%)	(45.8%)	8.1%	7.6%
Operational Risk		**9.2%**			**0.0%**	**10.5%**
Trading Book	0.0%	0.0%	0.0%		5.2%	5.9%
Change in MRC	**(12.5%)**	**(12.5%)**	**(23.8%)**	**(17.1%)**	**100.0%**	**100.0%**
Change in Effective MRC	**(15.5%)**		**(26.3%)**	**(21.7%)**		

Notes to the table: The first two columns of the table show the *dollar-weighted* average percentage change in MRC by portfolio and the percentage point contribution of each portfolio to the overall average percentage change (of 12.5%). The third column shows the *unweighted* median percentage change in MRC by portfolio. The fourth column shows the *weighted* median percentage change in MRC by portfolio, weighting by total exposures at the portfolio level. The next two columns show the share each portfolio contributes to MRC, under the current framework (Basel I, in column 5), and the QIS-4 interpretation of Basel II as defined in the QIS-4 instructions (column 6). Entries in parentheses denote negative numbers. There are no percentage change numbers for operational risk because it is not separated out as a specific charge under Basel I.

Column 1 shows the dollar-weighted[10] average percentage change in MRC by portfolio. Some of the largest changes in MRC occur for mortgages – both home equity lines of credit (HELOCs) and all other residential mortgages – and for qualifying revolving exposures (QREs), which mostly consist of credit card exposures. However, it is important to consider the relative size of portfolios as well as the percentage change when attempting to understand the drivers of the 12.5 percent aggregate decrease in MRC. Columns 5 and 6 show the share each portfolio contributes to MRC, under the current framework (Column 5) and the QIS-4 interpretation of Basel II as defined in the QIS-4 instructions (Column 6).

Column 2 shows the percentage point contribution of each portfolio to the overall average percentage change (of 12.5%). From this column, we can see that operational risk, Corporate-Bank-Sovereign, HELOCs, Residential Mortgages, and QREs were key drivers of the aggregate change in MRC.[11]

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[10] Each institution's contribution to the aggregate is equal to the dollar amount of its MRC.

[11] Data on corporate, bank, and sovereign exposures were collected on an aggregate basis, and are referred to as the "Corporate-Bank-Sovereign" portfolio. The remaining wholesale portfolios are Small and Medium Enterprises

Column 3 shows that risk-based capital requirements declined by more than 26 percent in half the institutions in the study. Most portfolios showed double-digit declines in minimum risk-based capital requirements for over half the banking organizations, with the exception of credit cards. It should be noted that Column 3 gives every participating institution equal weight. Column 4 shows the analogous weighted median change, using total exposures as weights.

<u>Distribution of minimum risk-based capital requirements and parameter estimates</u>

Charts 2 through 6 and Tables B and C provide information on the distribution, by portfolio, across participating institutions of MRC, risk weights, and several parameter estimates. These charts and tables provide some insight into the dispersion in QIS-4 results.[12]

It should be noted that these tables and charts give every participating institution equal weight; therefore, an institution with an extremely small amount of exposures in a particular portfolio is included in the distribution, as are institutions with relatively large amounts of exposures.[13] This tends to increase the dispersion seen in these tables and charts since some institutions appear to have provided extremely rough estimates for portfolios that were small or immaterial.

Chart 2 shows the percent change in MRC by portfolio across institutions when moving from the current Basel I-based framework to a Basel II-based framework. One example of why care should be taken in interpreting these charts is the dispersion in QREs shown by the extended line in Chart 2. While QREs show even greater dispersion than many other portfolios, the dispersion among institutions with material QRE portfolios was not nearly as large as indicated in these charts. In contrast, the dispersion in mortgage parameters was significant among institutions with material mortgage exposures.

(SME), High Volatility Commercial Real Estate (HVCRE), and Income Producing Real Estate (IPRE). The "Residential Mortgages" portfolio refers to data collected on all residential mortgages other than HELOCs. For a detailed description of each of the portfolios included in Table A, see the QIS-4 instructions.

[12] The vertical axes in charts 2, 3, 4, and 6 were truncated in order to better illustrate the variation across portfolios.

[13] Institutions with no exposures in a particular portfolio have been excluded.

Chart 2
Portfolio Percent Change in MRC
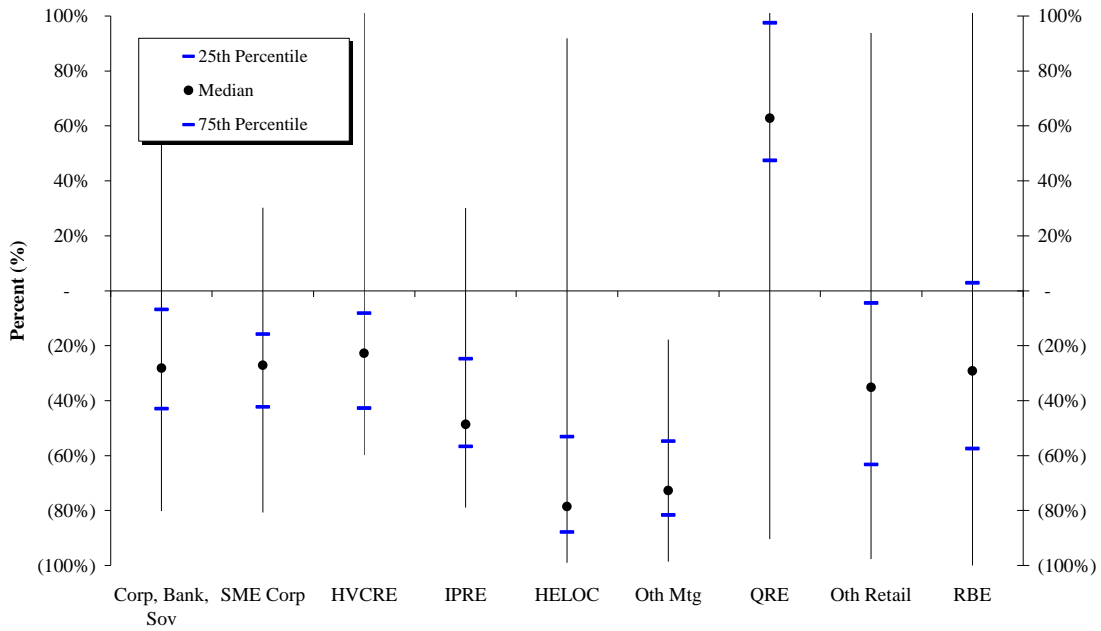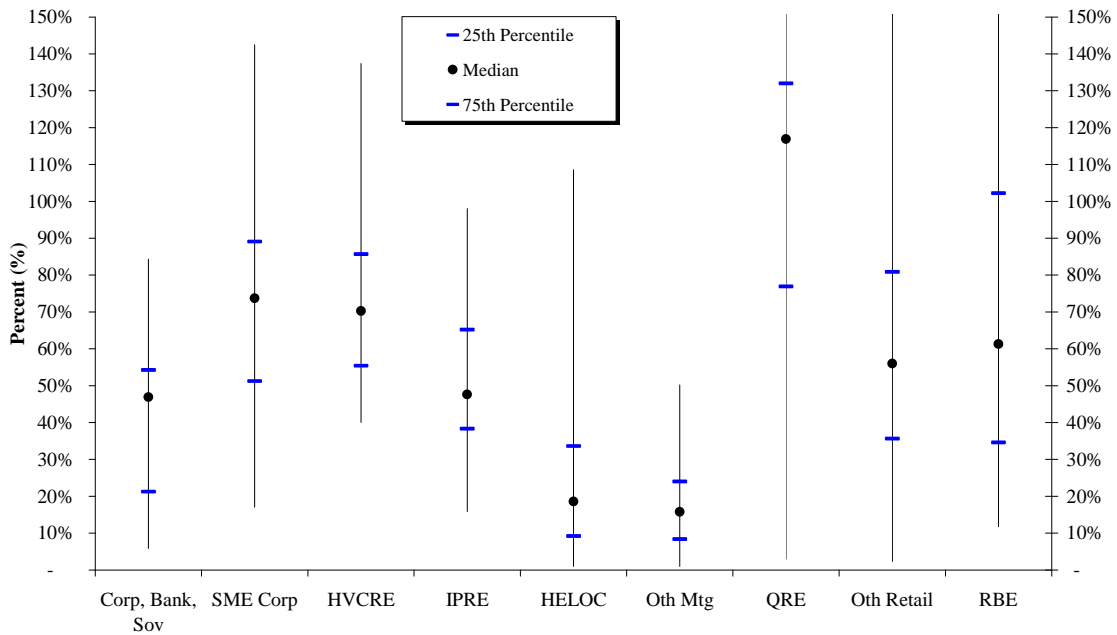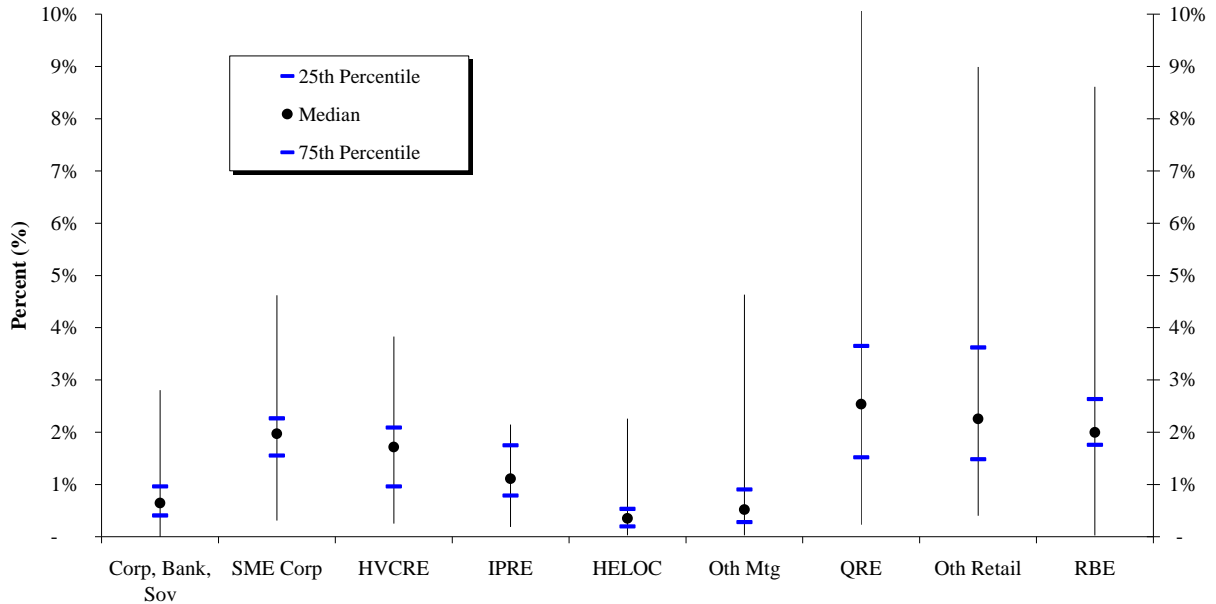**All Participating Institutions**

Chart 3 shows the Basel II weighted-average risk weights by portfolio across institutions, where the risk weight is defined as the sum of the EL and UL risk-weighted assets divided by the amount of drawn exposures.

Chart 3
UL + EL Average Risk Weight (drawn exposures)
All Participating Institutions

Charts 4, 5, and 6 show that the dispersion was also evident in many of the parameter inputs including probability of default (PD), loss given default (LGD), and imputed credit conversion factors (CCFs) which reflect the proportion of off-balance sheet exposures converted into exposure-at-default (EAD) amounts. Chart 4 shows the weighted-average PD across institutions for each portfolio, while Chart 5 shows the weighted-average LGD across institutions for each portfolio. Chart 6 shows the weighted-average CCF across institutions for each portfolio.

Chart 4
Average PDs (nondefaulted*)
All Participating Institutions

*Drawn, undrawn, repo-style transactions, OTC derivatives, PFGs, and other off-balance sheet items

Chart 5
Average LGDs (nondefaulted*)
All Participating Institutions

*Drawn, undrawn, repo-style transactions, OTC derivatives, PFGs, and other off-balance sheet items
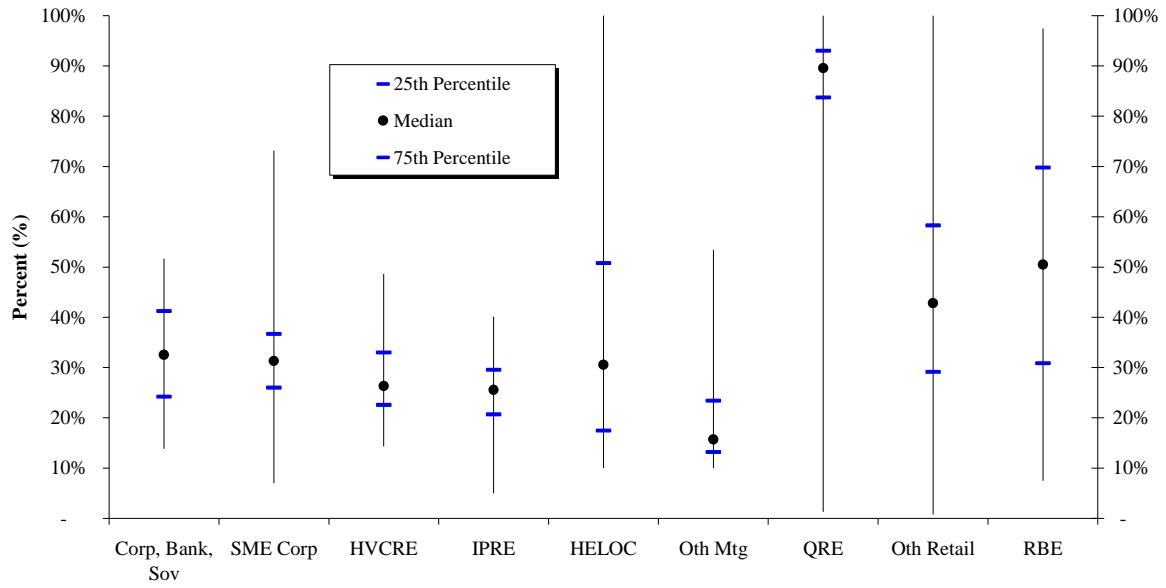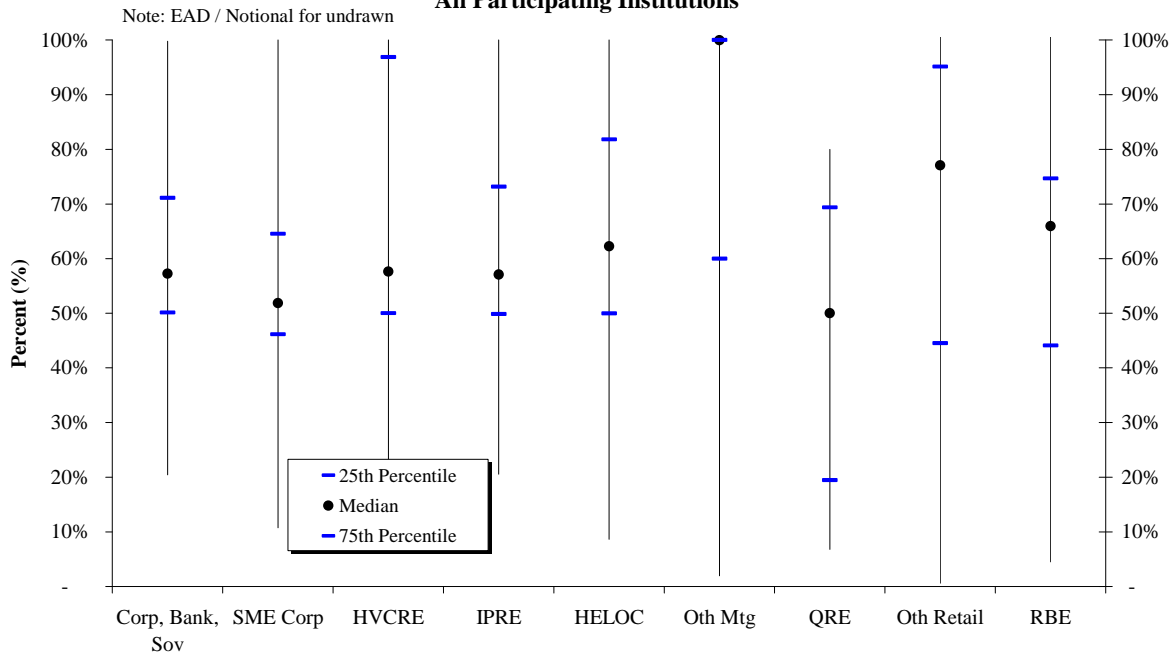
Chart 6
CCFs on Undrawn Lines
All Participating Institutions

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Tables B and C show key EAD-weighted average parameter estimates for wholesale (Table B) and retail (Table C) portfolios. The tables also show the median, 25th, and 75th percentiles for these parameters. The rows titled "PD, drawn" and "LGD, drawn" use PDs and LGDs for drawn exposures only, and do not include any undrawn exposures. Similarly, the "Risk Weight (EL + UL drawn)" reflects the risk-weighted assets associated with drawn exposures only, divided by the amount of drawn exposures.

Table B
Key Parameters for AIRB (Wholesale)

	All Banks Wtd. Avg.	25th Pctile	Median	75th Pctile
Corp., Bank, Sov.				
PD, all exposures	0.63%	0.41%	0.64%	0.96%
PD, drawn	1.00%	0.44%	0.82%	1.23%
LGD, drawn	31.6%	21.7%	30.2%	39.4%
EAD-CCF	59.8%	50.1%	57.3%	71.1%
Risk Weight (EL+UL drawn)	47.3%	21.3%	46.9%	54.2%
SME Corporate				
PD, all exposures	1.92%	1.55%	1.97%	2.27%
PD, drawn	2.06%	1.73%	2.15%	2.50%
LGD, drawn	32.9%	26.2%	31.7%	38.3%
EAD-CCF	50.3%	46.2%	51.9%	64.5%
Risk Weight (EL+UL drawn)	76.4%	51.2%	73.8%	89.1%
HVCRE				
PD, all exposures	1.41%	0.96%	1.72%	2.09%
PD, drawn	1.48%	0.95%	1.68%	2.18%
LGD, drawn	26.0%	23.0%	26.4%	33.4%
EAD-CCF	60.4%	50.0%	57.6%	96.9%
Risk Weight (EL+UL drawn)	63.8%	55.4%	70.3%	85.7%
IPRE				
PD, all exposures	1.40%	0.79%	1.11%	1.75%
PD, drawn	1.31%	0.77%	1.13%	1.77%
LGD, drawn	24.5%	20.2%	25.7%	29.5%
EAD-CCF	57.9%	49.9%	57.1%	73.2%
Risk Weight (EL+UL drawn)	56.8%	38.3%	47.6%	65.2%

Notes: Over non-zero exposures.
All weighted averages are computed using dollar amount of EAD as weights.

Table C
Key Parameters for AIRB (Retail)

	All Banks Wtd. Avg.	25th Pctile	Median	75th Pctile
HELOC				
PD, all exposures	0.33%	0.20%	0.35%	0.53%
PD, drawn	0.41%	0.24%	0.39%	0.67%
LGD, drawn	40.8%	17.4%	30.5%	51.1%
EAD-CCF	66.7%	50.0%	62.3%	81.8%
Risk Weight (EL+UL drawn)	19.0%	9.2%	18.6%	33.6%
Other Mortgage				
PD, all exposures	1.37%	0.28%	0.52%	0.90%
PD, drawn	1.39%	0.29%	0.52%	0.91%
LGD, drawn	17.7%	13.2%	15.8%	23.4%
EAD-CCF	51.2%	60.0%	100.0%	100.0%
Risk Weight (EL+UL drawn)	21.6%	8.4%	15.8%	24.0%
QRE				
PD, all exposures	3.02%	1.52%	2.54%	3.65%
PD, drawn	4.53%	2.06%	3.65%	4.79%
LGD, drawn	91.7%	82.8%	89.1%	93.0%
EAD-CCF	22.2%	19.5%	50.0%	69.4%
Risk Weight (EL+UL drawn)	126.8%	76.9%	116.9%	132.0%
Other Retail				
PD, all exposures	4.29%	1.48%	2.26%	3.62%
PD, drawn	3.93%	1.54%	2.25%	3.62%
LGD, drawn	47.4%	29.1%	42.7%	58.3%
EAD-CCF	25.4%	44.5%	77.0%	95.1%
Risk Weight (EL+UL drawn)	85.1%	35.6%	56.0%	80.8%
Retail Business Exposures				
PD, all exposures	3.02%	1.76%	2.00%	2.63%
PD, drawn	3.23%	2.03%	2.47%	3.77%
LGD, drawn	43.7%	29.9%	47.4%	68.5%
EAD-CCF	41.6%	44.1%	65.9%	74.7%
Risk Weight (EL+UL drawn)	69.7%	34.6%	61.3%	102.2%

Notes: Over non-zero exposures.
All weighted averages are computed using dollar amount of EAD as weights.

Explaining QIS-4 Results

QIS-4 compared with QIS-3

The dispersion across institutions and within portfolios observed in QIS-4 also existed in QIS-3 data. However, the overall drop in EMRC (15.5 percent) and MRC (12.5 percent) in QIS-4 was larger than the drop in minimum risk-based capital requirements for U.S. participants observed in QIS-3 (6 percent).

Many factors contributed to the differences in the overall drop observed in QIS-3 compared with QIS-4. As noted earlier, there is good reason to believe that the QIS-3 data are less reliable than the data from QIS-4, making comparisons difficult. In addition, significant changes to the framework occurred between the two studies. Also, under QIS-3, no institutions used the advanced measurement approach (AMA) to assess minimum risk-based capital requirements for operational risk, whereas several used AMA techniques in QIS-4.[14] Research has also shown that institutions that participated in QIS-4, but that did not participate in QIS-3, generally had lower historical chargeoffs than the average QIS-3 participant, which would cause the drop in minimum risk-based capital requirements to be larger in QIS-4 than in QIS-3.

Finally, QIS-4 was conducted during relatively benign macroeconomic conditions (2004) compared to QIS-3, which was conducted during a period of greater economic stress (2002). Given the sensitivity of a Basel II framework to economic conditions, we would expect a larger drop in QIS-4 than observed in QIS-3 due to this factor. This point is discussed in more detail below, along with other factors that affected the overall level of minimum risk-based capital requirements implied by QIS-4.

Factors affecting overall capital levels

Overall minimum risk-based capital requirements for credit risk under Basel II will be determined by the risk parameters (PDs, LGDs, exposures, and maturities) institutions input into the supervisory formulas. Hence by definition, the Basel II minimum risk-based capital charge is determined in part by the calibration of these formulas – by how much capital the formulas require for given combinations of risk inputs, especially for the ranges of risk inputs that are expected to be most typical.

Taking the Basel II formulas as given, the primary drivers of overall capital will be factors that most strongly influence the distribution of risk inputs. These would include regulatory and supervisory approaches to the determination of acceptable risk quantification methodologies and, notably, variations in the economic environment.

The effect of changes in economic conditions on minimum risk-based capital requirements under Basel II is expected to be material. Both Agency analysis and analysis conducted by a subset of QIS-4 participating institutions suggests that for certain wholesale and retail portfolios, minimum risk-based capital requirements under the QIS-4 interpretation of the Basel II framework could

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[14] As a result, the QIS-3 results reflected an average standardized operational risk capital requirement of 11.3% versus the QIS-4 AMA average of 9.2%.

rise or fall by 20 percent or more (peak-to-trough) over economic cycles such as those experienced by the United States in recent years.

While the Basel II framework requires use of long run, one-year average parameter estimates, the internal ratings used to estimate those parameters are still sensitive to economic conditions. For example, a corporate credit that might be internally rated a 5 in a benign economic environment might be downgraded to a rating of 7 in an economic downturn, resulting in a higher PD assignment to that exposure.

The sensitivity of overall minimum risk-based capital requirements to economic conditions will depend on the correlation between different portfolios. For example, if wholesale exposures are experiencing a downturn at the same time as the mortgage market, the swing in overall minimum risk-based capital requirements could be expected to be larger than if only one of those product types were experiencing adverse market conditions.

While the greater sensitivity of the Basel II framework to economic conditions combined with the relatively benign economic environment prevalent during the period in which QIS-4 data were collected help to explain why the Basel II framework is estimated to result in a lower minimum risk-based capital requirement than the current rules, several other important factors must also be considered. These factors relate to the limitations of the data quality in QIS-4. The major factors can be broken into two categories: those that might have contributed to an understatement of minimum risk-based capital requirements and those that might have contributed to an overstatement.

The major factors that might have caused minimum risk-based capital requirements reported in QIS-4 to be understated include (1) the limited use of downturn LGDs, (2) limited incorporation of economic loss in LGD estimates, and (3) failure of the data series used to estimate parameters to cover a full range of economic conditions.

The Basel II framework requires LGDs to reflect economic losses, not just accounting losses, and to be "stressed" to reflect higher LGDs during periods of higher losses. It also requires parameters to be estimated on at least 5 to 7 years of data that include an economic downturn environment.

In QIS-4, only a handful of institutions incorporated downturn conditions into their LGD estimates, and only for certain portfolios. Even fewer institutions incorporated economic losses such as workout costs into their LGD estimates. Some institutions used accounting losses alone to estimate LGDs. Furthermore, many institutions had limited time series of data upon which to estimate parameter inputs. In many cases, these time series were shorter than 5 to 7 years, and even where the data series were longer, they often did not cover a full range of economic conditions.

The major factors that might have caused minimum risk-based capital requirements in QIS-4 to be overstated include (1) the lack of incorporation of credit risk mitigation, and (2) the use of parameter estimates that may have been more conservative than what the rules governing the framework might ultimately require.

Analysis has shown that few institutions had the systems in place to identify comprehensively those exposures that would be eligible for lower minimum risk-based capital requirements as a result of credit risk mitigation. Consequently, in QIS-4 submissions such exposures would have been reported as if they did not benefit from any collateral or credit protection. The Agencies expect that as we move closer to implementation, systems will capture the information necessary to permit the assignment of lower risk weights to these exposures.

Follow-up discussions with institutions also indicated that when a few institutions lacked data to adequately estimate parameters, they sometimes attempted to choose a conservative estimate, potentially creating an upward bias in QIS-4 results.

Thus, while in some respects better data and better compliance could result in higher minimum risk-based capital requirements compared to those estimated in QIS-4, the correction of an upward bias in risk parameter estimates would have a countervailing effect. It is difficult to quantify the magnitude of each of the factors discussed above, and therefore the net effect on overall minimum risk-based capital requirements is also difficult to assess. As a result, it is not clear whether QIS-4 results tended to overstate or understate the overall level of minimum risk-based capital requirements under a Basel II framework. The Agencies expect that as further progress toward implementation is made, additional clarity will be possible as to the specific effects of Basel II on U.S. institutions.

Differences in IRB quantification contributed to dispersion

The factors affecting the overall level of minimum risk-based capital requirements among QIS-4 respondents also contributed to dispersion in those requirements, both at the institution level and at the portfolio level. For example, the fact that some institutions used downturn LGDs while others did not contributed to the observed dispersion in QIS-4 results. These differences in IRB quantification across institutions reflect different levels of rigor used to estimate parameter inputs. Even within an institution, the reliability of parameter estimates varied from portfolio to portfolio.

As noted earlier, QIS-4 was conducted on a best-efforts basis, and this lack of compliance should not be viewed as a lack of readiness on the part of institutions to adopt a Basel II framework. Rather, it is a reflection of the stage in the rulemaking and implementation process at which QIS-4 was conducted. The Agencies believe that many of these shortcomings observed in QIS-4 will be resolved as institutions adopting a Basel II framework continue to build their data collection systems and to develop more robust methodologies for estimating parameter inputs. However, the Agencies found it difficult to quantify how much dispersion was the result of different stages of Basel II implementation and how much related to other factors.

Variations in practices permissible within the Basel II framework also contributed to the observed dispersion in minimum risk-based capital requirements. Analysis suggests that flexibility permitted under the framework with respect to the choice of reference data (e.g., internal versus external data or the specific time period of reference data used) could materially affect the minimum required risk-based capital assigned to exposures. In addition, internal

ratings can be more or less sensitive to economic conditions while still being in compliance with the framework, and these differences in sensitivity lead to differences in parameter estimates and minimum risk-based capital requirements. For institutions that did incorporate economic losses and downturn adjustments in LGDs, different methodologies and approaches of incorporation also contributed to dispersion. For example, institutions chose different discount rates to incorporate economic losses into LGDs and chose different approaches, data sets, and time periods to incorporate downturn conditions into LGDs.

<u>The role of portfolio composition in dispersion</u>

In addition to the factors already discussed, differences in portfolio composition also contributed to the observed dispersion in QIS-4 minimum risk-based capital requirements. Portfolio composition refers to both differences between institutions in broad asset categories (e.g., those with higher concentrations of credit cards versus residential mortgages) as well as differences in credit quality within portfolios (e.g., low credit risk mortgages versus higher credit risk mortgages). However, analysis suggests that portfolio composition was not as important a contributor to dispersion as the factors discussed above (e.g., differences in parameter estimation and quantification, sensitivity to the economic cycle, etc.). This conclusion was based on comparing different institutions' parameter estimates for similar credits, as we now discuss.

An analysis of corporate credits was conducted by collecting additional information from a subset of QIS-4 participants on the risk parameters that they assigned to a set of shared national credits (SNCs) – large credits for which an agent bank sells participations. This analysis revealed that the minimum risk-based capital requirements attributed by institutions to the same credits varied significantly, and certain institutions tended to produce consistently lower capital charges than others.

A similar analysis was conducted for residential mortgage loans. Several institutions were asked to provide risk parameters for specific mortgage products with specific risk characteristics (e.g., 720 credit score, 80 LTV, 5/1 ARM, seasoned at least 3 years). To examine differences in overall portfolio risk, institutions were also asked to segment their entire mortgage portfolio in a credit score/LTV matrix by product line and age. As was the case with SNC exposures, even when controlling for differences in the above risk characteristics, there were still material differences observed in the risk-based capital assigned across institutions.

For both the SNC analysis and the mortgage analysis, all of the factors discussed previously likely contributed to the observed dispersion in the minimum risk-based capital requirements across institutions.

Conclusions

Analysis suggests that a multitude of factors contributed to the overall drop and dispersion in minimum risk-based capital requirements observed in QIS-4. After reviewing QIS-4 results and analysis, the Agencies announced in September 2005 a plan to implement the proposed framework in the United States along an extended timeline and with additional safeguards. The

Agencies recognize that the results described above would raise concerns if they were being produced by an up and running system of capital regulation. However, as emphasized at the outset, these results were provided on a best efforts basis and without benefit of either a definitive set of proposals or meaningful supervisory validation of institutions' systems. Experience during the multi-year transition period to Basel II that the Agencies have outlined will provide both a better basis to assess the quantitative implications of and make adjustments to this framework, or make other changes to minimum risk-based regulatory capital requirements, as appropriate.