



# Federal Register

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Wednesday,  
February 28, 2007

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## Part II

### Department of the Treasury

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Office of the Comptroller of the  
Currency  
Office of Thrift Supervision

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### Federal Reserve System

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### Federal Deposit Insurance Corporation

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**Proposed Supervisory Guidance for  
Internal Ratings-Based Systems for Credit  
Risk, Advanced Measurement Approaches  
for Operational Risk, and the Supervisory  
Review Process (Pillar 2) Related to Basel  
II Implementation; Notice**

**DEPARTMENT OF THE TREASURY****Office of the Comptroller of the Currency**

[Docket No. OCC-2007-0004]

**FEDERAL RESERVE SYSTEM**

[Docket No. OP-1277]

**FEDERAL DEPOSIT INSURANCE CORPORATION****DEPARTMENT OF THE TREASURY****Office of Thrift Supervision**

[No. 2007-06]

**Proposed Supervisory Guidance for Internal Ratings-Based Systems for Credit Risk, Advanced Measurement Approaches for Operational Risk, and the Supervisory Review Process (Pillar 2) Related to Basel II Implementation**

**AGENCIES:** Office of the Comptroller of the Currency, Treasury (OCC); Board of Governors of the Federal Reserve System (Board); Federal Deposit Insurance Corporation (FDIC); and Office of Thrift Supervision, Treasury (OTS) (collectively, the Agencies).

**ACTION:** Proposed supervisory guidance with request for public comment.

**SUMMARY:** The Agencies are publishing for comment three documents that set forth proposed supervisory guidance for implementing proposed revisions to the risk-based capital standards in the United States (New Advanced Capital Adequacy Framework or proposed framework). These proposed revisions, which would implement the "International Convergence of Capital Measurement and Capital Standards: A Revised Framework," published in June 2004 by the Basel Committee on Banking Supervision (Basel II), in the United States, were published in the **Federal Register** on September 25, 2006 as a notice of proposed rulemaking (NPR or proposed rule). The proposed framework outlined in the NPR would require some and permit other qualifying banks to calculate their regulatory risk-based capital requirements using an internal ratings-based (IRB) approach for credit risk and the advanced measurement approaches (AMA) for operational risk (together, the advanced approaches); it also provides guidelines for the supervisory review process (Pillar 2). The proposed supervisory guidance documents provide additional detail for the advanced approaches and the supervisory review process that should

help banks satisfy the qualification requirements in the NPR.

**DATES:** Comments on the three proposed supervisory guidance documents must be submitted on or before May 29, 2007.

**ADDRESSES:**

**OCC:** You must include OCC and Docket Number OCC-2007-0004 in your comment. You may submit comments by any of the following methods:

- Agency Web site: <http://www.occ.treas.gov>. Click on "Contact the OCC," scroll down and click on "Comments on Proposed Regulations."

- E-mail address: [regs.comments@occ.treas.gov](mailto:regs.comments@occ.treas.gov).

- Fax: (202) 874-4448.
- Mail: Office of the Comptroller of the Currency, 250 E Street, SW., Mail Stop 1-5, Washington, DC 20219.

- Hand Delivery/Courier: 250 E Street, SW., Attn: Public Information Room, Mail Stop 1-5, Washington, DC 20219.

**Instructions:** All submissions received must include the agency name (OCC) and docket number for this proposed notice. In general, OCC will enter all comments received into the docket without change, including any business or personal information that you provide.

You may review comments and other related materials by any of the following methods:

- **Viewing Comments Personally:** You may personally inspect and photocopy comments at the OCC's Public Information Room, 250 E Street, SW., Washington, DC. You can make an appointment to inspect comments by calling (202) 874-5043.

- **Viewing Comments Electronically:** You may request e-mail or CD-ROM copies of comments that the OCC has received by contacting the OCC's Public Information Room at:

[regs.comments@occ.treas.gov](mailto:regs.comments@occ.treas.gov).

- **Docket:** You may also request available background documents and project summaries using the methods described above.

**Board:** You may submit comments, identified by Docket No. OP-1277, by any of the following methods:

- Agency Web site: <http://www.federalreserve.gov>. Follow the instructions for submitting comments at <http://www.federalreserve.gov/generalinfo/foia/ProposedRegs.cfm>.

- **Federal eRulemaking Portal:** <http://www.regulations.gov>. Follow the instructions for submitting comments.

- E-mail: [regs.comments@federalreserve.gov](mailto:regs.comments@federalreserve.gov). Include the docket number in the subject line of the message.

- Fax: (202) 452-3819 or (202) 452-3102.

- Mail: Jennifer J. Johnson, Secretary, Board of Governors of the Federal Reserve System, 20th Street and Constitution Avenue, NW., Washington, DC 20551.

All public comments are available from the Board's Web site at <http://www.federalreserve.gov/generalinfo/foia/ProposedRegs.cfm> as submitted, unless modified for technical reasons. Accordingly, your comments will not be edited to remove any identifying or contact information. Public comments also may be viewed electronically or in paper form in Room MP-500 of the Board's Martin Building (20th and C Streets, NW.) between 9 a.m. and 5 p.m. on weekdays.

**FDIC:** You may submit comments by any of the following methods:

- Agency Web Site: <http://www.fdic.gov/regulations/laws/federal>. Follow instructions for submitting comments on the Agency Web Site.

- E-mail: [Comments@FDIC.gov](mailto:Comments@FDIC.gov). Include "Basel II Supervisory Guidance" in the subject line of the message.

- Mail: Robert E. Feldman, Executive Secretary, Attention: Comments, Federal Deposit Insurance Corporation, 550 17th Street, NW., Washington, DC 20429.

- Hand Delivery/Courier: Guard station at the rear of the 550 17th Street Building (located on F Street) on business days between 7 a.m. and 5 p.m. (EST).

- **Federal eRulemaking Portal:** <http://www.regulations.gov>. Follow the instructions for submitting comments.

**Public Inspection:** All comments received will be posted without change to <http://www.fdic.gov/regulations/laws/federal> including any personal information provided. Comments may be inspected and photocopied in the FDIC Public Information Center, 3501 North Fairfax Drive, Room E-1002, Arlington, VA 22226, between 9 a.m. and 5 p.m. (EST) on business days.

Paper copies of public comments may be ordered from the Public Information Center by telephone at (877) 275-3342 or (703) 562-2200.

**OTS:** You may submit comments, identified by No. 2007-06 by any of the following methods:

- **Federal eRulemaking Portal:** <http://www.regulations.gov>. Follow the instructions for submitting comments.

- E-mail: [regs.comments@ots.treas.gov](mailto:regs.comments@ots.treas.gov). Please include No. 2007-06 in the subject line of the message, and include your name and telephone number in the message.

- Fax: (202) 906-6518.

- *Mail:* Regulation Comments, Chief Counsel's Office, Office of Thrift Supervision, 1700 G Street, NW., Washington, DC 20552, Attention: No. 2007-06.

- *Hand Delivery/Courier:* Guard's Desk, East Lobby Entrance, 1700 G Street, NW., from 9 a.m. to 4 p.m. on business days, Attention: Regulation Comments, Chief Counsel's Office, Attention: No. 2007-06.

*Instructions:* All submissions received must include the agency name and document number. All comments received will be posted without change to <http://www.ots.treas.gov/pagehtml.cfm?catNumber=67&an=1>, including any personal information provided.

*Docket:* For access to the docket to read background documents or comments received, go to <http://www.ots.treas.gov/pagehtml.cfm?catNumber=67&an=1>. In addition, you may inspect comments at the Public Reading Room, 1700 G Street, NW., by appointment. To make an appointment for access, call (202) 906-5922, send an e-mail to [public.info@ots.treas.gov](mailto:public.info@ots.treas.gov), or send a facsimile transmission to (202) 906-7755. (Prior notice identifying the materials you will be requesting will assist us in serving you.) We schedule appointments on business days between 10 a.m. and 4 p.m. In most cases, appointments will be available the next business day following the date we receive a request.

**FOR FURTHER INFORMATION CONTACT:**

*Occ:* IRB guidance: Fred Finke, Senior Basel Policy Liaison (202-874-4468 or [fred.finke@occ.treas.gov](mailto:fred.finke@occ.treas.gov)); AMA guidance: Mark O'Dell, Deputy Comptroller for Operational Risk (202-874-4316 or [mark.odell@occ.treas.gov](mailto:mark.odell@occ.treas.gov)); or guidance on supervisory review: Akhtarur Siddique, Lead Expert (202-874-4665 or [akhtarur.siddique@occ.treas.gov](mailto:akhtarur.siddique@occ.treas.gov)); Office of the Comptroller of the Currency, 250 E Street, SW., Washington, DC 20219.

*Board:* IRB guidance: Sabeth Siddique, Assistant Director, Credit Risk Section (202-452-3861); AMA guidance: Stacy Coleman, Assistant Director, Operational Risk Section (202-452-2934) or Connie Horsley, Senior Supervisory Financial Analyst, Operational Risk Section (202-452-5239); or guidance on supervisory review: David Palmer, Senior Supervisory Financial Analyst, Credit Risk Section (202-452-2904); Board of Governors of the Federal Reserve System, 20th Street and Constitution Avenue, NW., Washington, DC 20551. Users of Telecommunication Device for Deaf (TTD) only, call (202) 263-4869.

*FDIC:* IRB guidance: Pete Hirsch, Chief, Large Bank Supervision (202-898-6751 or [phirsch@fdic.gov](mailto:phirsch@fdic.gov)), Curtis Wong, Senior Examination Specialist, Planning and Program Development Section (202-898-7327 or [cwong@fdic.gov](mailto:cwong@fdic.gov)); AMA guidance: Mark S. Schmidt, Regional Director (678-916-2189 or [maschmidt@fdic.gov](mailto:maschmidt@fdic.gov)), Alfred Seivold, Senior Examination Specialist, Large Bank Supervision (415-808-8248 or [aseivold@fdic.gov](mailto:aseivold@fdic.gov)); or guidance on supervisory review: Bobby Bean, Chief, Capital Markets Policy Section (202-898-3575 or [bbean@fdic.gov](mailto:bbean@fdic.gov)), Gloria Ikosi, Senior Quantitative Risk Analyst, Capital Markets Policy Section (202-898-3997 or [gikosi@fdic.gov](mailto:gikosi@fdic.gov)); Federal Deposit Insurance Corporation, 550 17th Street, NW., Washington, DC 20429.

*OTS:* IRB guidance: David Tate, Manager, Examination Quality Review (202-906-5717); AMA guidance: Eric Hirschhorn, Senior Financial Economist, Credit Policy (202-906-7350); or guidance on supervisory review: Sonja White, Senior Project Manager, Capital Policy (202-906-7857); Office of Thrift Supervision, 1700 G Street, NW., Washington, DC 20552.

**SUPPLEMENTARY INFORMATION:** The Agencies issued an NPR on September 25, 2006,<sup>1</sup> which seeks comment on the New Advanced Capital Adequacy Framework that revises the existing general risk-based capital standards as applied to large, internationally active U.S. banks.<sup>2</sup> The public comment period on the NPR closes on March 26, 2007.<sup>3</sup> The proposed framework would implement Basel II in the United States.

As described in the NPR, Basel II sets forth a three-pillar framework encompassing regulatory risk-based capital requirements (Pillar 1); supervisory review of capital adequacy (Pillar 2); and market discipline through enhanced public disclosures (Pillar 3). The proposed framework outlined in the NPR for Pillar 1 would require some and permit other qualifying banks to calculate their regulatory risk-based capital requirements using the IRB approach for credit risk and the AMA for operational risk.<sup>4</sup> The NPR also

requires a process for the supervisory review of capital adequacy under Pillar 2, and outlines requirements for enhanced public disclosures under Pillar 3.<sup>5</sup> The NPR describes the qualification process and provides qualification requirements for obtaining supervisory approval for use of the advanced approaches.<sup>6</sup> The qualification requirements are written broadly to accommodate the many ways a bank may design and implement robust credit and operational risk measurement and management systems, and to permit industry practice to evolve.

The proposed supervisory guidance documents are companion guidance to the September 2006 NPR and, as such, are designed to be consistent with the proposed rule and do not address any public comments since the NPR was issued. They provide additional detail that should help banks satisfy the qualification requirements in the NPR. However, the publication of these guidance documents for comment does not imply that the outcome of the NPR has already been determined. As part of the regulatory rulemaking process, the proposed guidance documents are subject to change as needed based on, among other things, the public comments on the guidance and the Agencies' decisions regarding any final rule.

The Agencies believe that the proposed supervisory guidance documents are necessary to supplement the proposed framework with standards to promote safety and soundness and encourage comparability across banks. A bank's primary Federal supervisor will review the bank's framework relative to the qualification requirements in the NPR to determine whether the bank may apply the advanced approaches and has complied with the proposed rule in determining its regulatory capital requirements.

In August 2003, the Agencies issued an advance notice of proposed rulemaking (ANPR), which described the proposed revisions to the existing risk-based capital framework in general terms and sought public comment.<sup>7</sup> The content of the ANPR was based, in large part, on the April 2003 version of the Basel II framework.<sup>8</sup> Contemporaneously with the ANPR, the Agencies also issued for public

approaches are proposed for implementation in the United States.

<sup>5</sup> Supervisory expectations pertaining to a bank's public disclosures are not part of this notice.

<sup>6</sup> See part III, section 22 of the NPR.

<sup>7</sup> See 68 FR 45900 (Aug. 4, 2003).

<sup>8</sup> See The New Basel Capital Accord (April 2003) (available at <http://www.bis.org>).

<sup>1</sup> See 71 FR 55830 (Sept. 25, 2006).

<sup>2</sup> For simplicity, and unless otherwise noted, the term "banks" is used here to refer to banks, savings associations, and bank holding companies. The terms "bank holding company" and "BHC" refer only to bank holding companies regulated by the Board and do not include savings and loan holding companies regulated by the OTS. For a detailed description of the institutions covered by this notice, refer to part I, section 1, of the NPR.

<sup>3</sup> See 71 FR 77518 (Dec. 26, 2006).

<sup>4</sup> While Basel II provides several approaches for calculating regulatory risk-based capital requirements under Pillar 1, only the advanced

comment two proposed supervisory guidance documents relating to the proposed framework.<sup>9</sup> The first proposed 2003 guidance document described supervisory views on the credit risk measurement and management systems that should be implemented by banks that adopt the IRB approach for computing risk-based capital requirements for corporate credit risk exposures. The second proposed 2003 guidance document provided supervisory views on the operational risk measurement and management systems that should be implemented by banks that adopt the AMA for computing risk-based capital requirements for operational risk, including their operational risk management, data elements, and quantification processes. In October 2004, the Agencies also issued for public comment proposed supervisory guidance on IRB systems for retail credit risk exposures.<sup>10</sup>

The first guidance document presented in this notice sets forth proposed supervisory guidance on IRB systems for credit risk covering the wholesale and retail exposure categories, as well as guidance on the equity and securitization exposure categories (IRB Guidance). Under the IRB framework, banks would use internal estimates of certain risk components as key inputs in the determination of their regulatory risk-based capital requirement for credit risk. As mentioned above, the Agencies previously published proposed supervisory guidance on a bank's IRB systems for corporate and retail exposures in 2003 and 2004, respectively. Since the release of those documents, the Agencies have continued to refine the proposals based on insights gained from public comment and the collective efforts of the interagency IRB working groups. The IRB Guidance updates and consolidates the previously proposed supervisory guidance on corporate and retail exposures. It also provides new guidance on systems a bank may need to differentiate the risk of other credit exposure types, such as equity and securitization exposures, as well as to recognize the benefits of financial collateral in mitigating counterparty credit risk in certain transactions or to use the double default treatment for certain wholesale exposures.

The IRB Guidance is structured somewhat differently from the proposed supervisory guidance issued in 2003

and 2004. Those guidance documents contained four chapters covering corporate ratings and retail segmentation systems, quantification, data management and maintenance, and controls, with discussion of validation and stress testing contained within the rating and segmentation and quantification chapters. The structure of the IRB Guidance generally follows the key components of a bank's advanced systems for credit risk outlined in the NPR. Chapter 1 provides guidance on governance of a bank's overall advanced systems for credit risk. Chapters 2 through 5 cover the components of a bank's IRB systems for wholesale and retail exposures. Chapters 6 and 7 provide guidance on data management and maintenance and the control and validation framework. Chapter 8 provides guidance on stress testing. Chapters 9 through 11 provide guidance on the other systems a bank may need to differentiate risk in certain transactions subject to counterparty credit risk, equity exposures, and securitization exposures.

The IRB Guidance supplements the NPR and provides additional context and detail to help banks meet the qualification requirements in the NPR relevant to a bank's systems and processes for credit risk. Thus, the guidance should be read alongside the NPR to obtain a full perspective of the underlying requirements in the proposed rule. The guidance does not contain additional proposed requirements that are not in the NPR. Chapters 5, 9, 10, and 11, are being issued for the first time and supplement the detailed discussion of those topics in the NPR. Similar to the previously proposed corporate and retail guidance, the IRB Guidance contains supervisory standards (designated with an "S") that highlight important elements of a bank's advanced systems for credit risk. The supervisory standards contained in the previously proposed corporate and retail guidance documents have been consolidated and updated and new supervisory standards are proposed.

The second guidance document in this notice sets forth proposed supervisory guidance on the AMA for operational risk (AMA Guidance), updating the proposed AMA Guidance published in 2003. Since the issuance of that proposed AMA Guidance, the Agencies have revised the guidance to clarify issues and simplify, wherever possible, supervisory standards. The revisions are based on insights gained from public comment and the collective efforts of the interagency AMA working group. Under the AMA framework, a bank would rely on internal estimates of

its operational risk exposure to generate its regulatory risk-based capital requirement for operational risk. The AMA Guidance provides additional context and detail to help a bank meet the qualification requirements outlined in the NPR relevant to operational risk.

Some of the specific revisions to the AMA Guidance include: (1) Clarifying the roles of a bank's board of directors and management in developing and overseeing the implementation of the bank's AMA framework; (2) expanding standard 5 to address the integration of the bank's operational risk management, data and assessment, and quantification processes into the bank's existing risk management decision-making processes; (3) expanding and clarifying operational risk quantification standards both to reflect the evolution of industry practices, as well as to address supervisory concerns; (4) clarifying supervisory expectations regarding the use of scenario analysis, the key elements used to support operational risk management and measurement, and eligible operational risk offsets (see standards 20, 24, and 26, respectively); (5) adding standard 25 that discusses how frequently a bank must recalculate its estimate of operational risk exposure and its risk-based capital requirement for operational risk; (6) adding standard 27 that a bank must employ a unit of measure that is appropriate for its range of business activities and the variety of operational loss events to which it is exposed; (7) expanding the discussion on dependence modeling in standard 28; and (8) adding a section that discusses a bank's use, in certain limited circumstances, of an alternative quantification system to estimate its operational risk exposure.

The Agencies recognize that a bank required to adopt an AMA framework may have developed an implementation plan using the proposed supervisory standards in the 2003 proposed AMA Guidance to assess its status in meeting the requirements proposed in the ANPR and to determine additional work needed to comply with those requirements. The table below maps the current proposed supervisory standards to those in the 2003 proposed AMA Guidance.

**COMPARISON OF CURRENT PROPOSED AMA SUPERVISORY STANDARDS TO THE 2003 PROPOSED AMA SUPERVISORY STANDARDS**

Current Proposed Standard Number	2003 Proposed Standard Number
1 .....	1

<sup>9</sup> See 68 FR 45949 (Aug. 4, 2003).

<sup>10</sup> See 69 FR 62748 (Oct. 27, 2004), and 70 FR 423 (Jan. 4, 2005) (correction).

COMPARISON OF CURRENT PROPOSED AMA SUPERVISORY STANDARDS TO THE 2003 PROPOSED AMA SUPERVISORY STANDARDS—Continued

Current Proposed Standard Number	2003 Proposed Standard Number
2	8
3	11
4	2
5	3
6	4
7	5
8	6
9	7
10	9, 10
11	12
12	13, 14
13	15
14	16
15	17
16	18
17	19
18	20
19	21
20	24
21	22
22	23
23	25
24	27
25	New
26	28
27	New
28	29
29	30
30	26
31	31
32	32, 33

The third document sets forth proposed supervisory guidance on the supervisory review process (Pillar 2) in the New Advanced Capital Adequacy Framework. The process of supervisory review described in this proposed guidance document reflects a continuation of the longstanding approach employed by the Agencies in their supervision of banks. However, new methods for calculating regulatory risk-based capital requirements—such as those in the proposed framework—and development of improved risk monitoring and management tools within the industry often bring changes in the relative emphasis placed on the various aspects of supervisory review. This proposed guidance document highlights aspects of existing supervisory review that are being augmented or more clearly defined to support the proposed framework. Under the framework, in determining the extent to which banks should hold capital in excess of regulatory minimums, supervisors would consider the combined implications of a bank's compliance with qualification requirements for regulatory risk-based capital standards, the quality and results

of its internal capital adequacy assessment process (ICAAP), and supervisory assessment of its risk management processes, control structure, and other relevant information relating to its risk profile and capital position. The ICAAP (while not mandating the determination of economic capital) should, to the extent possible, identify and measure material risks, which may include (but should not necessarily be limited to) credit risk, market risk, operational risk, interest rate risk, and liquidity risk, and account for concentrations within and among risk types.

The Agencies solicit comment on all aspects of the supervisory guidance documents. In addition, the Agencies believe an important goal for any regulatory capital system is to achieve a measure of consistency in the capital requirements assigned to exposures with similar risk profiles held by different banks. The Agencies seek comment on the extent to which this proposed supervisory guidance will promote that objective.

**Paperwork Reduction Act**

*A. Request for Comment on Proposed Information Collection*

In accordance with the requirements of the Paperwork Reduction Act of 1995, the Agencies may not conduct or sponsor, and the respondent is not required to respond to, an information collection unless it displays a currently valid Office of Management and Budget (OMB) control number. The Agencies are requesting comment on a proposed information collection. The Agencies are also giving notice that the proposed collection of information has been submitted to OMB for review and approval.

Comments are invited on:

- (a) Whether the collection of information is necessary for the proper performance of the Agencies' functions, including whether the information has practical utility;
- (b) The accuracy of the estimates of the burden of the information collection, including the validity of the methodology and assumptions used;
- (c) Ways to enhance the quality, utility, and clarity of the information to be collected;
- (d) Ways to minimize the burden of the information collection on respondents, including through the use of automated collection techniques or other forms of information technology; and
- (e) Estimates of capital or start up costs and costs of operation, maintenance, and purchase of services to provide information.

Comments should be addressed to:

*OCC:* Communications Division, Office of the Comptroller of the Currency, Public Information Room, Mail stop 1–5, Attention: 1557–NEW, 250 E Street, SW., Washington, DC 20219. In addition, comments may be sent by fax to (202) 874–4448, or by electronic mail to [regs.comments@occ.treas.gov](mailto:regs.comments@occ.treas.gov). You can inspect and photocopy the comments at the OCC's Public Information Room, 250 E Street, SW., Washington, DC 20219. You can make an appointment to inspect the comments by calling (202) 874–5043.

*Board:* You may submit comments, identified by FR 4199, by any of the following methods:

- *Agency Web Site:* <http://www.federalreserve.gov>. Follow the instructions for submitting comments at <http://www.federalreserve.gov/generalinfo/foia/ProposedRegs.cfm>.
- *Federal eRulemaking Portal:* <http://www.regulations.gov>. Follow the instructions for submitting comments.
- *E-mail:* [regs.comments@federalreserve.gov](mailto:regs.comments@federalreserve.gov).
- *Fax:* (202) 452–3819 or (202) 452–3102.

- *Mail:* Jennifer J. Johnson, Secretary, Board of Governors of the Federal Reserve System, 20th Street and Constitution Avenue, NW., Washington, DC 20551.

All public comments are available from the Board's Web site at <http://www.federalreserve.gov/generalinfo/foia/ProposedRegs.cfm> as submitted, except as necessary for technical reasons. Accordingly, your comments will not be edited to remove any identifying or contact information. Public comments may also be viewed electronically or in paper form in Room MP–500 of the Board's Martin Building (20th and C Streets, NW.) between 9 a.m. and 5 p.m. on weekdays.

*FDIC:* You may submit comments by any of the following methods:

- *Agency Web Site:* <http://www.fdic.gov/regulations/laws/federal>. Follow instructions for submitting comments on the Agency Web Site.
- *E-mail:* [Comments@FDIC.gov](mailto:Comments@FDIC.gov).

Include "Basel II Supervisory Guidance" in the subject line of the message.

- *Mail:* Robert E. Feldman, Executive Secretary, Attention: Comments, Federal Deposit Insurance Corporation, 550 17th Street, NW., Washington, DC 20429.

- *Hand Delivery/Courier:* Guard station at the rear of the 550 17th Street Building (located on F Street) on business days between 7 a.m. and 5 p.m. (EST).

• *Federal eRulemaking Portal:* <http://www.regulations.gov>. Follow the instructions for submitting comments.

*Public Inspection:* All comments received will be posted without change to <http://www.fdic.gov/regulations/laws/federal> including any personal information provided. Comments may be inspected and photocopied in the FDIC Public Information Center, 3501 North Fairfax Drive, Room E-1002, Arlington, VA 22226, between 9 a.m. and 5 p.m. (EST) on business days. Paper copies of public comments may be ordered from the Public Information Center by telephone at (877) 275-3342 or (703) 562-2200.

A copy of the comments may also be submitted to the OMB desk officer for the Agencies: By mail to U.S. Office of Management and Budget, 725 17th Street, NW., #10235, Washington, DC 20503 or by facsimile to 202-395-6974, Attention: Federal Banking Agency Desk Officer.

*OTS: Information Collection Comments, Chief Counsel's Office, Office of Thrift Supervision, 1700 G Street, NW., Washington, DC 20552; send a facsimile transmission to (202) 906-6518; or send an e-mail to [infocollection.comments@ots.treas.gov](mailto:infocollection.comments@ots.treas.gov). OTS will post comments and the related index on the OTS Internet site at <http://www.ots.treas.gov>. In addition, interested persons may inspect the comments at the Public Reading Room, 1700 G Street, NW., by appointment. To make an appointment, call (202) 906-5922, send an e-mail to [public.info@ots.treas.gov](mailto:public.info@ots.treas.gov), or send a facsimile transmission to (202) 906-7755.*

#### *B. Proposed Information Collection*

*Title of Information Collection:* Proposed Basel II Interagency Supervisory Guidance for IRB, AMA, and the Supervisory Review Process.  
*Frequency of Response:* Event-generated.

*Affected Public:*

*OCC:* National banks.

*Board:* State member banks, bank holding companies, affiliates and certain non-bank subsidiaries of bank holding companies, commercial lending companies owned or controlled by foreign banks, and Edge and agreement corporations.

*FDIC:* Insured nonmember banks and certain subsidiaries of these entities.

*OTS:* Savings associations and certain of their subsidiaries.

*Abstract:* The notice sets forth three proposed supervisory guidance documents for implementing proposed revisions to the risk-based capital standards in the United States (New

Advanced Capital Adequacy Framework). The proposed guidance documents concern (1) the internal ratings-based systems for credit risk (IRB), (2) the advanced measurement approaches for operational risk (AMA), and (3) the supervisory review process (Pillar II).

The Agencies believe that the documentation, prior approvals, and disclosures included in the proposed IRB and AMA guidance are directly related to the information collection requirements found in the Basel II notice of proposed rulemaking (NPR) published in the **Federal Register** on September 25, 2006 (71 FR 55830). More specifically, the information collection aspects of the proposed IRB and AMA guidance tie to the following sections of the NPR: 21, 22, 44, 53, and 71. The Agencies believe that the burden estimates developed for the NPR adequately cover the additional specificity contained in the proposed IRB and AMA guidance.

For the proposed Pillar II portion of the guidance, the Agencies believe that paragraphs 25, 31, 35, 37, and 42 impose new information collection requirements that were beyond the scope of the burden estimates developed for the NPR. The agencies burden estimates for these additional information collection requirements are summarized below. Note that the estimated number of respondents listed below include both institutions for which the Basel II risk-based capital requirements are mandatory and institutions that may be considering opting-in to Basel II (despite the lack of any formal commitment by most of these latter institutions).

*Estimated Burden:*

#### *OCC*

*Number of Respondents:* 52.

*Estimated Burden per Respondent:* 140 hours.

*Total Estimated Annual Burden:* 7,280 hours.

#### *Board*

*Number of Respondents:* 15.

*Estimated Burden per Respondent:* 420 hours.

*Total Estimated Annual Burden:* 6,300 hours.

#### *FDIC*

*Number of Respondents:* 19.

*Estimated Burden per Respondent:* 420 hours.

*Total Estimated Annual Burden:* 7,980 hours.

#### *OTS*

*Number of Respondents:* 4.

*Estimated Burden per Respondent:* 420 hours.

*Total Estimated Annual Burden:* 1,680 hours.

*The proposed supervisory guidance documents follow:*

### **Proposed Supervisory Guidance on Internal Ratings-Based Systems for Credit Risk**

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### Introduction

#### I. Purpose

1. This proposed guidance (“guidance”), published jointly by the U.S. Federal banking agencies<sup>1</sup> provides supervisory guidance for U.S. banks, thrifts, and bank holding companies (“banks”) that adopt the Advanced Internal Ratings-Based Approach (“IRB” or “IRB framework”) for calculating minimum regulatory risk-based capital (“risk-based capital”) requirements for credit risk under the Basel II capital regulation.

2. This guidance supplements the notice of proposed rulemaking (“NPR” or “proposed rule”) published in the **Federal Register** on September 25,

<sup>1</sup> The Federal banking agencies are: The Board of Governors of the Federal Reserve System; the Federal Deposit Insurance Corporation; the Office of the Comptroller of the Currency; and the Office of Thrift Supervision; and will collectively be referred to as “the Agencies,” “supervisors,” or “regulators” in this guidance.

2006.<sup>2</sup> The NPR proposes a regulatory framework within which all banks subject to the proposed rule must develop their IRB systems. The NPR contains qualification requirements that each bank subject to the proposed rule must meet to the satisfaction of its primary Federal supervisor before using its IRB systems to calculate risk-based capital requirements. As stated in the preamble to the NPR, the qualification requirements for these systems are written in broad terms to accommodate the many ways a bank may design and implement a robust internal risk measurement and management system and to permit industry practice to evolve. As a supplement to the NPR, this guidance provides supervisory standards and additional detail on credit risk measurement and management systems that will assist banks in satisfying the requirements in the NPR.

#### II. Scope of Guidance

3. The focus of this guidance is on wholesale, retail, equity, and securitization exposures. A bank subject to the IRB framework for credit risk in the NPR is required to have systems for determining risk-based capital requirements for its wholesale and retail exposures. The wholesale category includes corporate exposures (for example, exposures to companies and banks, as well as commercial real estate exposures and other types of specialized lending), sovereign exposures, and other non-retail exposures. The retail category includes residential mortgage exposures, qualifying revolving exposures (QRE), and other retail exposures.

4. A bank may also need systems to differentiate the risk of other exposure types, such as equity and securitization exposures, as well as to recognize the benefits of financial collateral in mitigating counterparty credit risk in certain transactions or to use double default treatment for certain wholesale exposures.

5. In aggregation, the IRB systems and other systems for differentiating credit risk are defined in the NPR and in this guidance as a bank’s “advanced systems.” This guidance covers advanced systems for all of a bank’s credit-related exposure types. A bank’s advanced systems also include its systems for determining risk-based capital requirements for its operational risk exposures under the proposed Advanced Measurement Approaches (“AMA”) framework, which is the subject of a separate supervisory

<sup>2</sup> 71 FR 55830 (Sept. 25, 2006).

guidance document. Certain banks subject to the proposed rule may also be required to calculate risk-based capital requirements for their market risk exposures.

6. As described in separate guidance relating to supervisory review (Pillar 2), in addition to meeting qualification requirements for regulatory risk-based capital standards, a bank must have a rigorous process for assessing its overall capital adequacy in relation to its risk profile and a comprehensive strategy for maintaining an appropriate level of capital. This process (while not mandating the determination of economic capital) should, to the extent possible, identify and measure material risks, which may include (but should not necessarily be limited to) credit risk, market risk, operational risk, interest rate risk, and liquidity risk, and account for concentrations within and among risk types. One of the main objectives of the internal capital adequacy assessment process is to identify the extent to which banks need to hold capital above regulatory minimums, in order to address risks not adequately captured by minimum regulatory capital requirements.

7. A primary objective of the IRB framework is to make the risk-based capital requirements more sensitive to credit risk. In general, the IRB framework incorporates recent developments in risk management and banking supervision. Under this framework, banks use their own internal risk rating and segmentation systems, as well as their quantification processes, to generate estimates of risk parameters that are inputs to the calculation of the risk-based capital requirements. Data that support accurate and reliable credit risk measurements, as well as rigorous management oversight and controls, including continuous monitoring and validation, are crucial to the prudent application of the IRB framework.

8. This guidance, which is written for supervisors and bankers, describes the important elements and characteristics of a bank's advanced systems for credit risk. Toward this end, this guidance designates certain of those elements as supervisory standards denoted by the prefix "S." These supervisory standards generally implement or clarify the requirements in the NPR and, whenever possible, are principle-based to provide banks with flexibility in implementing the framework. However, when prudential concerns or the need for standardization outweigh the benefits of flexibility, the supervisory standards are specified in greater detail. Furthermore, nothing in this guidance should be interpreted as weakening, modifying, or

superseding the safety and soundness principles articulated in the Agencies' existing statutes, regulations, or guidance. The standards are contained within each chapter with a full compilation of the standards provided in Attachment B.

9. Supervisors will consider this guidance in evaluating banks' advanced systems for credit risk. This guidance assumes that readers are familiar with the proposed framework for calculating risk-based capital requirements for credit risk articulated in the NPR.

10. The conceptual framework outlined in this guidance is not intended to dictate the precise manner by which banks should meet the qualification and other requirements in the NPR. Supervisors will determine compliance with the qualification requirements by evaluating, on an individual bank basis, the extent to which banks meet the substance and spirit of those requirements as they relate to each of the components of a bank's advanced systems for credit risk. However, evaluating each qualification requirement individually is not sufficient to determine a bank's overall compliance. The components of a bank's advanced systems for credit risk should complement and reinforce one another to ensure the accuracy of risk measurements. As part of the supervisory review of a bank's advanced systems, supervisors will analyze the extent to which a bank's advanced systems incorporate the substance and spirit of the standards outlined in this guidance.

11. The structure of this guidance generally follows the key components of the advanced systems for credit risk. Chapter 1 provides guidance on governance of a bank's overall advanced systems. Chapters 2 through 7 cover the components of a bank's IRB systems for wholesale and retail exposures. Chapter 8 provides guidance on stress testing. Chapters 9 through 11 provide guidance on the other systems a bank may need to differentiate risk for certain transactions subject to counterparty credit risk, equity exposures, and securitization exposures and supplements the detailed discussion of these exposure types in the NPR. The data standards and control framework provided in Chapters 6 and 7, respectively, of this guidance generally apply to these other systems as well.

12. To aid the reader, the applicable NPR qualification requirements are listed at the front of each chapter, as well as listed together in Attachment A. Also, certain NPR requirements, such as definitions, are either repeated in this guidance or paraphrased to provide

context. However, readers must look to the NPR for the exact proposed rule requirements.

13. What follows is a brief description of each chapter:

#### *Chapter 1: Advanced Systems for Credit Risk*

The chapter provides a discussion of the governance and system and process requirements for a bank's advanced systems for credit risk. It also outlines the key components of a bank's advanced systems for credit risk.

#### *Chapter 2: Wholesale Risk Rating Systems*

A key component of an IRB system for wholesale exposures is the risk rating system. This chapter describes the design and operation of wholesale risk rating systems. Banks should use the principles outlined in this chapter when designing and operating wholesale risk rating systems.

#### *Chapter 3: Retail Segmentation Systems*

A key component of an IRB system for retail credit exposures is the segmentation system, which groups retail exposures into segments according to risk characteristics. This segmentation is the retail portfolio analogue of assigning ratings to exposures in wholesale portfolios. This chapter describes the design and operation of an IRB segmentation system. The retail framework provides banks with substantial flexibility to use the retail segmentation that is most appropriate for their activities.

#### *Chapter 4: Quantification*

Another key component of an IRB system is a quantification process that assigns numerical values to the key risk parameters that are used as inputs to the IRB risk-based capital formulas. This chapter provides guidance on the quantification process for wholesale and retail exposures. These risk parameters are probability of default ("PD"), expected loss given default ("ELGD"), loss given default ("LGD"), and exposure at default ("EAD"), and for wholesale exposures only, the effective remaining maturity ("M"). The quantification of these risk parameters should be the result of a disciplined process as described in this chapter. The chapter also includes specific examples for both wholesale rating systems and retail segmentation systems in the two appendices.

#### *Chapter 5: Wholesale Credit Risk Protection*

This chapter supplements the detailed discussion of credit risk mitigation in



the NPR by providing guidance on how banks may recognize contractual arrangements for exposure-level credit protection (eligible guarantees and eligible credit derivatives) that transfer risk to one or more third parties. Each of these forms of credit protection must meet certain specific standards of eligibility, as articulated in the NPR, for recognition of the associated risk mitigation.

#### *Chapter 6: Data Management and Maintenance*

A bank must have advanced data management and maintenance systems that support credible and reliable risk parameter estimates. This chapter describes how a bank should collect, maintain, and manage the data needed to support the other IRB system components for wholesale and retail exposures (e.g., risk rating and segmentation systems, the quantification process, and validation and other control processes), as well as the bank's broader risk management and reporting needs.

#### *Chapter 7: Controls and Validation*

A bank must have a system of controls that ensures that the components of the IRB system are functioning effectively. This chapter provides guidance on the important elements of an effective control environment, including independent review processes, a comprehensive validation process (evaluation of developmental evidence, ongoing monitoring, and outcomes analysis), and an internal audit review and reporting process.

#### *Chapter 8: Stress Testing of Risk-Based Capital Requirements*

Banks must conduct stress testing analysis of their advanced systems for credit risk as part of the risk-based capital management process. Stress testing analysis is a means of understanding how economic downturns, as described by stress scenarios, cause migration across ratings or segments and the concomitant change in required risk-based capital. This chapter discusses considerations for conducting stress testing analyses.

#### *Chapter 9: Counterparty Credit Risk Exposure*

For certain transactions subject to counterparty credit risk, banks may be allowed to recognize the risk mitigating effect of financial collateral through an adjustment to EAD. This chapter supplements the detailed discussion of counterparty credit risk in the NPR by describing some of the elements of counterparty credit risk mitigation,

providing information to aid banks in choosing among the alternative methods to calculate EAD for these transactions, and providing some descriptions and illustrative examples of acceptable modeling practices for the estimation of EAD under the alternative methods.

#### *Chapter 10: Risk-Weighted Assets for Equity Exposures*

This chapter supplements the detailed discussion of equity exposures provided in the NPR. It provides guidance on determining risk-based capital requirements for equity exposures held in the banking book for banks subject to the Market Risk Rule and for all equity exposures for banks not subject to the Market Risk Rule.

#### *Chapter 11: Securitization Exposures*

A securitization exposure is any exposure whose credit risk reflects the tranching of risk of one or more underlying exposures. This chapter describes the concepts, eligibility, and mechanics associated with applying the three approaches for calculating risk-based capital requirements for securitization exposures.

### **Chapter 1: Advanced Systems for Credit Risk**

#### *Rule Requirements*

Part III, Section 22(a)(2): The systems and processes used by a bank for risk-based capital purposes [in the NPR] must be consistent with the bank's internal risk management processes and management information reporting systems.

Part III, Section 22(a)(3): Each bank must have an appropriate infrastructure with risk measurement and management processes that meet the qualification requirements [in the NPR] and are appropriate given the bank's size and level of complexity. Regardless of whether the systems and models that generate the risk parameters necessary for calculating a bank's risk-based capital requirements are located at any affiliate of the bank, the bank itself must ensure that the risk parameters and reference data used to determine its risk-based capital requirements are representative of its own credit risk and operational risk exposures.

Part III, Section 22(j)(1): The bank's senior management must ensure that all components of the bank's advanced systems function effectively and comply with the qualification requirements [in the NPR].

Part III, Section 22(j)(2): The bank's board of directors (or a designated committee of the board) must at least annually evaluate the effectiveness of,

and approve, the bank's advanced systems.

Part III, Section 22(k): Documentation. The bank must adequately document all material aspects of its advanced systems.

#### **I. Overview**

1. This chapter provides a discussion of the governance and system and process requirements for a bank's advanced systems for credit risk. Board of directors and senior management oversight is critical to ensure that the design and function of the advanced systems are appropriate. Regardless of the specifics of a bank's advanced systems for credit risk, a bank should have a rigorous credit risk management infrastructure that complements these systems.

2. A bank subject to the framework for credit risk in the NPR is required to have an internal ratings-based system ("IRB system") for determining risk-based capital requirements for its wholesale and retail exposures.

**S 1-1 An IRB system must have five interdependent components that enable an accurate measurement of credit risk and risk-based capital requirements.**

3. The components of an IRB system are:

- A risk rating and segmentation system that differentiates risk by assigning ratings to individual wholesale obligors and exposures and individual retail exposures to segments;
- A quantification process that translates the risk characteristics of wholesale obligors and exposures and segments of retail exposures into numerical risk parameters that are used as inputs to the IRB risk-based capital formulas. These risk parameters are probability of default ("PD"), expected loss given default ("ELGD"), loss given default ("LGD"), and exposure at default ("EAD"), and for certain wholesale exposures only, the effective remaining maturity ("M");
- A data management and maintenance system that supports the IRB system;
- Oversight and control mechanisms that ensure the IRB system is functioning effectively and producing accurate results; and
- An ongoing process that validates the accuracy of the risk rating assignments, segmentations, and the risk parameters.

4. If applicable, a bank will also need systems to differentiate risk for other credit exposure types, such as for equity and securitization exposures, as well as to recognize the benefits of financial collateral in mitigating counterparty credit risk in certain transactions or to

use double default treatment for certain wholesale exposures.

5. In aggregation, the IRB system and other systems for differentiating credit risk are defined in the NPR and in this guidance as a bank's "advanced systems" for credit risk. Chapters 2 through 7 of this guidance provide supplemental guidance on IRB systems for wholesale and retail exposures. Chapter 8 provides banks with guidance on conducting stress testing analyses of their advanced systems for credit risk. Chapters 9 through 11 cover additional systems a bank may need to have for other credit exposure types.

## II. Governance of Advanced Systems

**S 1-2 Senior management must ensure that all of the components of the bank's advanced systems for credit risk function effectively and comply with the qualification requirements in the NPR.**

6. Senior management should provide ongoing, active oversight of the advanced systems outlined in this supervisory guidance, and articulate the expectations for the technical and operational performance of the advanced systems, including the control framework. To provide effective oversight of the advanced systems, senior management should have extensive knowledge of the advanced systems' policies, underwriting standards, lending practices, account management activities, and collection and recovery practices. Senior management should understand how these factors affect all of the components of the advanced systems.

7. The scope and depth of risk management reports should be sufficient for senior management to monitor the performance of the components of the advanced systems. Detailed reports should include, but are not limited to, the following topics:

- Risk profile by rating for wholesale exposures and by segment for retail exposures;
- Migration across ratings and segments with emphasis on unexpected results;
- Updates to the quantification performance results;
- Validation results;
- Comparative analysis of risk-based and internal capital assessments; and
- Control process assessments.

**S 1-3 The board of directors or its designated committee must at least annually evaluate the effectiveness of, and approve, the bank's advanced systems.**

8. The board of directors or its designated committee should at least annually ensure that management has

appropriate processes and controls in place that support effective advanced systems for credit risk. The board should be provided with information that will enable it to conclude, with reasonable assurance, that management has appropriate processes and controls in place that support effective advanced systems for credit risk. To allow for ongoing monitoring, the board should be provided with reports summarizing the design and performance of the advanced systems. The board's strategic direction and oversight is essential to effective advanced systems.

**S 1-4 Each bank (including each depository institution) must ensure that the risk parameters and reference data used to determine its risk-based capital requirements are representative of its own credit risk.**

9. Each bank must have an appropriate infrastructure with risk measurement and management processes that meet the qualification requirements in the NPR. Each bank's advanced systems for credit risk should also incorporate the supervisory standards in this guidance. This infrastructure must be appropriate given the bank's size and level of complexity. Regardless of whether the systems and models that generate the risk parameters necessary for calculating a bank's risk-based capital requirements are located at any affiliate of the bank, the bank must ensure that the risk parameters and reference data used to determine its risk-based capital requirements are representative of the bank's credit risk profile.

10. While some organizations may conduct rating, segmentation, quantification, and validation activities on a consolidated basis, each bank subject to the capital requirements for advanced systems must determine its risk-based capital requirements for credit risk on a stand-alone basis and hold its own separate risk-based capital in proportion to the risk exposure of its portfolios. Specifically, the PD, ELGD, LGD, and EAD estimates used to determine risk-based capital levels must be applied to exposures at the exposure or segment level, and risk-based capital requirements for each relevant bank should be based on the proportionate share of each exposure or segment owned by such bank.

11. The board of directors should ensure that senior management at each bank confirm, through periodic evaluations, that risk parameters assigned to its credit exposures are appropriate on a stand-alone basis, and that the control and validation standards in Chapter 7 of this guidance are met.

**S 1-5 Banks should establish specific accountability for the overall performance of their advanced systems for credit risk.**

12. An individual or group of individuals should be responsible for the design and operation of the overall advanced systems. This accountability includes oversight for all of the components of the advanced systems for credit risk, regardless of which organizational units perform those processes. Authority and key responsibilities should be thoroughly documented and responsible individuals should be held accountable for the performance of the advanced systems.

**S 1-6 A bank's advanced systems should be transparent.**

13. Banks must adequately document all material aspects of their advanced systems. Adequate documentation will ensure transparency of a bank's advanced systems. A bank demonstrates the transparency of its advanced systems by comprehensively documenting all the systems' components. Transparency through documentation is important so that third parties, such as a bank's supervisors and auditors, are able to understand, evaluate, and assess the effectiveness of the bank's advanced systems.

14. Documentation should encompass, but is not limited to, the internal risk rating and segmentation systems, risk parameter quantification processes, data collection and maintenance processes, and model design, assumptions, and validation results. The guiding principle governing documentation is that it should support the requirements for the quantification, validation, and control and oversight mechanisms as well as the bank's broader credit risk management and reporting needs. Documentation is critical to the supervisory oversight process.

## Chapter 2: Wholesale Risk Rating Systems

### Rule Requirements

Part III, Section 22(b)(1): A bank must have an internal risk rating and segmentation system that accurately and reliably differentiates among degrees of credit risk for the bank's wholesale and retail exposures.

Part III, Section 22(b)(2): For wholesale exposures, a bank must have an internal risk rating system that accurately and reliably assigns each obligor to a single rating grade (reflecting the obligor's likelihood of default). The bank's wholesale obligor

rating system must have at least seven discrete rating grades for non-defaulted obligors and at least one rating grade for defaulted obligors. Unless the bank has chosen to directly assign ELGD and LGD estimates to each wholesale exposure, the bank must have an internal risk rating system that accurately and reliably assigns each wholesale exposure to loss severity rating grades (reflecting the bank's estimate of the ELGD and LGD of the exposure). A bank employing loss severity rating grades must have a sufficiently granular loss severity grading system to avoid grouping together exposures with widely ranging ELGDs or LGDs.

Part III, Section 22(b)(4): The bank's internal risk rating policy for wholesale exposures must describe the bank's rating philosophy (that is, must describe how wholesale obligor rating assignments are affected by the bank's choice of the range of economic, business, and industry conditions that are considered in the obligor rating process).

Part III, Section 22(b)(5): The bank's internal risk rating system for wholesale exposures must provide for the review and update (as appropriate) of each obligor rating and (if applicable) each loss severity rating whenever the bank receives new material information, but no less frequently than annually.

## I. Overview

1. This chapter describes the design and operation of IRB risk rating systems for wholesale exposures. Banks will have latitude in designing and operating wholesale risk rating systems, subject to four broad principles:

Two-dimensional risk rating system—Banks must be able to make meaningful and consistent differentiations among credit exposures along two dimensions—obligor default risk and loss severity in the event of a default.

Rank order risks—Banks must rank obligors by their likelihood of default, and wholesale exposures (e.g., loans, facilities) by the loss severity expected in the event of default.

Quantification—The risk rating system must be designed to facilitate quantification of obligor ratings in terms of PD and loss severity in terms of ELGD and LGD.

Accuracy—The risk rating system must be designed to ensure that ratings are accurate, so that obligors within a rating grade have similar default risk and wholesale exposures within a loss severity rating grade have similar risk of loss in the event of default.

## II. Credit Rating Assignment Techniques

2. In general, a credit rating is a summary indicator of the relative risk of a credit exposure. Credit ratings can take many forms. Regardless of the form, meaningful credit ratings share two characteristics:

- They group exposures to discriminate among possible outcomes.
- They rank the perceived level of credit risk.

3. Banks have used credit ratings of various types for a variety of purposes. Some ratings are intended to rank obligors by risk of default and some are intended to rank wholesale exposures by expected loss, which incorporates risk of default and loss severity. Only risk rating systems that distinguish probability of default from loss given default meet the two-dimensional requirements for the IRB framework.

4. Banks use different techniques, such as expert judgment and models, to assign credit risk ratings. How ratings are assigned is important because different techniques will require different validation processes and control mechanisms to ensure the integrity of the rating system. Validation and controls are discussed in Chapter 7 of this guidance. Some rating assignment techniques are described below; any of these techniques—expert judgment, models, constrained judgment, or a combination thereof—could be acceptable in an IRB system, provided the bank meets the qualification requirements in the NPR and the substance and spirit of the standards outlined in this guidance.

### A. Expert Judgment

5. Historically, banks have used expert judgment to assign ratings to wholesale exposures. With this technique, an individual weighs relevant information and reaches a conclusion about the appropriate risk rating. The rater makes informed judgments based on knowledge gained through experience and training.

6. The key feature of expert-judgment systems is flexibility. The prevalence of judgmental rating systems reflects the view that the determinants of default are too complicated to be captured by a single quantitative model. The quality of management is often cited as an example of a risk determinant that is difficult to assess using a quantitative model. In order to foster internal consistency, banks employing expert judgment rating systems should provide narrative guidelines that set out specific quantitative and qualitative rating criteria for each rating grade. However,

the expert should decide how much weight to give to each of these criteria in assigning a risk rating grade to an obligor.

7. The flexibility possible in the assignment of judgmental ratings has implications for how the accuracy of the ratings is reviewed. One goal of the ratings review validation process is to confirm that raters followed policy. However, two individuals exercising judgment can use the same information to support different ratings. Thus, individuals reviewing an expert judgment rating system should have sufficient credit expertise and a thorough knowledge of how the bank's rating methodology and policies should be applied.

### B. Models

8. In recent years, models have been developed to assign ratings to wholesale exposures. In a model-based approach, inputs are numeric and provide quantitative and qualitative information about an obligor. The inputs are combined using mathematical equations to produce a number that is translated into a categorical rating. An important feature of models is that the rating is perfectly replicable by another party, given the same inputs.

9. Models to assign wholesale ratings typically are statistically derived or based on expert-judgment techniques.

10. Some models are the result of statistical optimization, in which well-defined mathematical criteria are used to choose the model that has the closest fit to the observed data. Numerous techniques can be used to build statistical models; regression is one widely recognized example. Such models are often referred to as scoring models or scorecards, because they produce a single number, or "score," as an output that may be related, for example, to the estimated probability of default of each individual obligor in a portfolio. Regardless of the specific statistical technique used, a knowledgeable independent reviewer should exercise judgment in evaluating the reasonableness of a model's development, including its underlying logic, and the methods used to handle the data.

11. In other cases, banks have built rating models by asking their experts to decide what weights to assign to critical variables in the models. Drawing on their experience, the experts first identify the observable variables that affect the likelihood of default. They then reach agreement on the weights to be assigned to each of the variables. Unlike statistical optimization, the experts are not necessarily using clear,

consistent criteria to select the weights attached to the variables. Indeed, expert-judgment model building is often a practical choice when there is not enough data to support a statistical model building. Despite its dependence on expert judgment, this method can be called model-based as long as the resulting equation, most likely with linear weights, is used to rate the credits. Once the equation is set, the model can be replicated, a feature shared with statistically derived models. However, while some banks refer to these types of expert-derived models as "scorecards," they are not scoring models in the conventional use of the term. The term scoring model or scorecard is customarily reserved for a rating model derived using strictly statistical techniques, as described in the preceding paragraph. Generally, independent credit experts use judgment to evaluate the reasonableness of the development of these expert-derived models.

#### C. Constrained Judgment

12. The alternatives described above present the extremes; in practice, banks use risk rating systems that combine models with judgment. Two approaches are common.

*Judgmental systems with quantitative guidelines or model results as inputs.* Individuals exercise judgment about risks subject to policy guidelines containing quantitative criteria such as minimum values for particular financial ratios. Banks develop quantitative criteria to guide individuals in assigning ratings, but the criteria may need to be augmented with additional information.

One version of this constrained judgment approach features a model output as one among several criteria that an individual may consider when assigning ratings. The individual assigning the rating is responsible for prioritizing the criteria, reconciling conflicts between criteria, and, if warranted, overriding some criteria. Even if individuals incorporate model results as one of the factors in their ratings, they will exercise judgment in deciding what weight to attach to the model result. The appeal of this approach is that the model combines many pieces of information into a single output, which simplifies analysis, while the rater retains flexibility regarding the use of the model output.

*Model-based ratings with judgmental overrides.* When banks use rating models, individuals are permitted to override the results under certain conditions and within tolerance levels for frequency. Credit-rating systems in which individuals can override models

raise many of the same issues presented separately by pure judgment and model-based systems. If overrides are rare, the system can be evaluated largely as if it is a model-based system. If, however, overrides are prevalent, the system will be evaluated more like a judgmental system.

#### D. Rating Overrides

13. Regardless of the rating assignment technique in use, banks should define, within their IRB rating system documentation, what constitutes a ratings override. A judgmental override occurs when judgment is used to reject a rating suggested by an objective rating process, such as a model or scorecard. A policy override occurs whenever a rating is assigned in a manner that deviates from the bank's approved rating policy and procedures. Overrides should be specifically identified, monitored, and analyzed to evaluate their impact on the bank's IRB rating system.

### III. Definition of Default

#### S 2-1 Banks must identify obligor defaults in accordance with the IRB definition of default.

14. The consistent identification of defaults is fundamental to any IRB rating system. For IRB purposes, a bank's wholesale obligor is in default if, for any wholesale exposure of the bank to the obligor, the bank has:

- Placed the exposure on non-accrual status consistent with the Call Report Instructions or the Thrift Financial Report ("TFR") and the TFR Instruction Manual;
- Taken a full or partial charge-off or write-down on the exposure due to the distressed financial condition of the obligor; or
- Incurred a credit-related loss of 5 percent or more of the exposure's initial carrying value in connection with the sale of the exposure or the transfer of the exposure to the held-for-sale, available-for-sale, trading account, or other reporting category.

15. Partial charge-offs or write-downs for reasons not related to the distressed financial condition of the obligor do not trigger the default definition. For example, taking a write-down or charge-off to reflect forgiveness of a minor fee for relationship purposes unrelated to financial distress does not trigger the default definition.

16. An obligor in default remains in default until the bank has reasonable assurance of repayment and performance for all contractual principal and interest payments on all exposures of the bank to the obligor

(other than exposures that have been fully written-down or charged-off).

### IV. Independence of the Wholesale Risk Rating Process

#### S 2-2 Banks should demonstrate that their wholesale risk rating processes are sufficiently independent to produce objective ratings.

17. Independence in the rating process helps to ensure the integrity of ratings. Banks can promote more independence by implementing a variety of controls and reporting structures. For example, a bank could structure its organizational reporting lines so that the credit approval and the rating assignment decisions are separate from each other. Banks that separate the credit approval process from the rating assignment/review functions are often better able to manage the conflicts that arise between loan volume and credit quality goals. Banks should be aware of the full range of potential conflicts and should develop effective controls to mitigate any conflicts that might arise.

18. However, banks that choose to maintain less separation in organizational reporting lines between credit approval and rating assignment should strengthen controls and consider conducting a post-closing review process. A post-closing review provides an independent review of a rating that has been assigned by those who are not fully independent of the approval process. Any post-closing review, which serves to ensure that the initial rating is appropriate, should be conducted shortly after a credit is originated. The less independent the rating process is, the more rigorous the post-closing review should be.

19. Whether ratings integrity is achieved by creating structural independence in reporting lines or through a combination of other control processes, a bank should demonstrate that its rating processes ensure integrity in ratings throughout the economic cycle.

### V. IRB Risk Rating System Architecture

#### A. Two-Dimensional Risk-Rating System

#### S 2-3 IRB risk rating systems must have two dimensions obligor default and loss severity corresponding to PD (obligor default), and ELGD and LGD (loss severity).

20. Regardless of the type of rating system(s) used by a bank, the IRB framework imposes some specific requirements. The first requirement is that an IRB risk rating system must be two-dimensional. Banks will assign obligor ratings, which will be associated with a PD. They will also assign either

a loss severity rating(s), which will be associated with ELGD and LGD estimates, or ELGD and LGD estimates directly to each wholesale exposure.

21. The process of assigning the obligor rating and either loss severity ratings or ELGD/LGD values—hereafter referred to as the rating system—is discussed below, and the process of quantifying the PD, ELGD and LGD risk parameters is discussed in Chapter 4.

#### Obligor Ratings

##### **S 2-4 Banks must assign discrete obligor rating grades.**

22. While banks may use models to estimate probabilities of default for individual obligors, the IRB framework requires banks to group the obligors into discrete rating grades. Each obligor rating grade, in turn, must be associated with a single PD.

##### **S 2-5 The obligor rating system must rank obligors by likelihood of default.**

23. For example, if a bank uses a rating system based on a 10-point scale, with 1 representing obligors of highest financial strength and 10 representing defaulted obligors, rating grades 2 through 9 should represent groups of ever-increasing risk. In a rating system in which risk increases with the rating grade, an obligor with a rating grade 4 is riskier than an obligor with a rating grade 2, but need not be twice as risky.

##### **S 2-6 Banks must assign an obligor to only one rating grade.**

24. As noted above, the IRB framework requires that the obligor rating be distinct from the loss severity rating, which is assigned to the wholesale exposure. The obligor rating should focus on the obligor's ability and willingness to service any obligation and to follow through on any commitments it has with the bank to avoid default. For example, in a 1-to-10 rating system, where risk increases with the number rating grade, an otherwise defaulted obligor with a fully cash-secured transaction should be rated 10—defaulted—regardless of the remote expectation of loss on a specific exposure. Conversely, a nondefaulted obligor whose financial condition warrants the highest investment grade rating should be rated 1, even if the bank's transactions are subordinate to other creditors and unsecured. Since the obligor rating is assigned to the obligor and not to its individual exposures, the bank must ensure that all the exposures to the same obligor bear the obligor's rating grade.

25. At the bottom of any IRB rating scale is at least one default rating grade. Once an obligor is in default on any exposure to the subject bank, the obligor

rating grade associated with all of its exposures to that bank will be the default rating grade—even for those exposures of the obligor that have not triggered any element of the definition of default.

#### Ratings Philosophy and Expected Ratings Migration

##### **S 2-7 A bank's rating policy must describe its ratings philosophy and how quickly obligors are expected to migrate from one rating grade to another in response to economic cycles.**

##### **S 2-8 In assigning an obligor to a rating grade, a bank should assess the risk of obligor default over a period of at least one year taking into account the possibility of adverse economic conditions.**

26. The term *rating philosophy* is used to describe how obligor rating assignments are affected by a bank's choice of the range of economic, business, and industry conditions that are considered in the rating process. It establishes the bank's philosophy on the manner in which it rates credits and the scenarios under which ratings would be expected to change. In assigning an obligor rating grade, banks must consider both the current risk characteristics of the obligor and the impact that adverse economic, business, and industry conditions could have on the obligor's ability to repay; however, nothing in this guidance requires any specific rating philosophy be employed.

27. Rating grades should group obligors that are expected to share similar default frequencies. The rating assignment for an obligor may be based upon a combination of obligor-specific (idiosyncratic) risk characteristics and the general economic, business, and industry (systematic) risk characteristics or conditions that obligors in the rating may experience.

28. The time horizon used for the assignment of obligors to rating grades should be one year or longer. The obligor rating should reflect the obligor's ability as evidenced by its financial capacity, as well as its willingness to service any obligation and to follow through on any commitments it has with the bank to avoid default. The time horizon chosen for the rating assignment process should be appropriate to the business line or geography for which the respective obligor rating system will be used.

29. That general description, however, still leaves open different possible implementations, depending upon what range of future systematic risk conditions the bank considers when making a rating assignment and the weight given to those conditions. In

practice, it appears that most banks have adopted a rating philosophy where an obligor's rating would have some sensitivity to changes in economic conditions. Regardless of the approach taken, banks should document their choice of economic, business, and industry conditions considered in each risk rating system and the expected frequency of rating changes over economic cycles. Such differences have important implications for validation and other aspects of the operation of rating systems, and therefore should be clearly articulated and well understood. A bank should also understand the effects of ratings migration on its risk-based capital requirements and ensure that sufficient capital is maintained during all phases of the economic cycle.

30. A bank's ratings philosophy can be empirically demonstrated through an analysis of how its obligors migrate across rating grades as economic and industry conditions change. While individual obligor ratings may change due to changes in obligor-specific risk characteristics, the average migration observed through time is likely to reveal how sensitive rating assignments are to systematic risk changes. Rating systems in which obligor ratings are more closely linked at a given point in time to particular economic conditions are more likely to be associated with higher overall average rates of rating migration than are other systems. Ratings that respond primarily to obligor-specific (idiosyncratic) changes may be less sensitive to changes in economic and industry conditions, and be more stable throughout the economic cycle.

#### Obligor-Rating Granularity

##### **S 2-9 Banks must have at least seven discrete obligor rating grades for non-defaulted obligors and at least one rating grade for defaulted obligors.**

31. A risk rating system's grades should be sufficiently numerous to ensure that management can meaningfully differentiate risk in the portfolio, without being so numerous that they limit the system's practical use. To determine the appropriate number of rating grades beyond the minimum seven non-default rating grades, each bank should perform its own internal analysis.

##### **S 2-10 Banks should justify the number of obligor rating grades used in its risk rating system and the distribution of obligors across those grades.**

32. Some portfolios may have a majority of obligors assigned to only a few of the available rating grades. The mere existence of a concentration of exposures in a rating grade (or rating

grades) does not, by itself, reflect weakness in a rating system. For example, banks focused on a particular type of lending, such as asset-based lending, may lend to obligors having similar default risk. Banks with focused lending activities may use the minimum number of obligor rating grades, while banks with a broad range of lending activities should have more rating grades. However, banks with a high concentration of obligors in a particular rating grade should perform a thorough analysis that supports such a concentration.

33. A concentration of obligors in a rating grade is inappropriate when the financial strength of those obligors varies considerably. If such is the case, the following questions should be answered:

- Are the criteria for each rating grade clear? Are rating criteria too vague to allow raters to make clear distinctions? Ambiguity may be an issue throughout the rating scale or it may be limited to the most commonly used ratings.
- How diverse are the obligors? Is the bank targeting a narrow segment of obligors with homogeneous risk characteristics?
- Are the bank's internal rating categories considerably broader than those of other lenders?

#### Recognition of Implied Support

**S 2-11 Banks may recognize implied support as a rating criterion subject to specific supervisory considerations; however, banks should not rely upon the possibility of U.S. government financial assistance, except for the financial assistance that the U.S. government has legally committed to provide.**

34. Implied support is support from a third party that is less than a legally enforceable guarantee. Banks that use implied support as a ratings criterion typically rely on a wide range of policies and procedures for its use. As the impact of implied support arrangements has typically been difficult to quantify, the circumstances under which banks use such arrangements as a ratings criterion should be limited.

35. Supervisors will assess the appropriateness of a bank's usage of implied support as a ratings criterion. A bank should recognize implied support only if the following are true:

- The support is from a parent corporation or sovereign; however, banks should not rely upon the possibility of U.S. government financial assistance, except for the financial assistance that the U.S. government has legally committed to provide;

- The implied support provider is rated investment grade by an NRSRO;
- The implied support is a factor only in assigning an obligor rating, not a loss severity rating;
- The final rating assigned to the obligor reflects greater credit risk than the rating assigned to the implied support provider (the parent corporation or sovereign);
- The bank has considered the magnitude of the rating benefit accorded from the recognition of implied support and the bank has performed and documented comprehensive due diligence to assess the parent corporation or sovereign's willingness and capacity to support the obligor. To assess the willingness to support the obligor, a bank may consider prior situations where the support provider has supported the obligor or other obligors under similar circumstances, extended credit to the obligor at beneficial rates, or made large scale investments of cash or resources in the obligor. To assess capacity, a bank should conduct a thorough analysis of the financial position of the support provider and its ability to provide support including during periods of financial stress;
- There is broad market recognition of the implied support. This can be evidenced through a number of market indicators including situations where the external ratings of the parent corporation and subsidiary are closely linked or the ratings of the parent or sovereign reflect an expectation of support. It could also include evidence derived from traded credit spreads of the parent and subsidiary;

• For a bank whose rating system design incorporates external ratings as a tool in assigning an internal rating, the internal rating does not additionally incorporate implied support when there is evidence that the external rating has already benefited from the assumption of support;

- The bank has established a stand-alone rating for the obligor and continues to monitor the stand-alone rating throughout the term of the exposure;
- The bank's internal tracking processes monitor the dollar volume of credit exposures where implied support is a material consideration in the rating assignment; and
- The provision of significant implied support to a subsidiary or subsidiaries is incorporated into the parent corporation's obligor rating.

#### Loss Severity Ratings

**S 2-12 Banks must have a loss severity rating system that is able to**

**assign loss severity estimates (ELGD and LGD) to each wholesale exposure.**

36. The term loss severity rating system refers to the method by which a bank assigns loss severity estimates to wholesale exposures. This assignment can be accomplished through a loss severity rating process or via direct assignment to each wholesale exposure. A wholesale exposure's ELGD and LGD estimates are expressed as a percentage of the estimated EAD of the exposure. Both the ELGD and the LGD are required inputs into the IRB risk-based capital formulas.

**S 2-13 Banks should have empirical support for their loss severity rating system and the rating system should be capable of supporting the quantification of ELGD estimates (and LGD estimates if approved for internal estimates).**

37. ELGD and LGD analysis is in the early stages of development compared to default risk modeling. Over time, banks' methodologies are expected to evolve. Longstanding banking experience and existing research on ELGD and LGD, while preliminary, suggests that type of collateral (in terms of liquidity and marketability), collateral values, seniority, industry position and whether an exposure is secured or unsecured are the most commonly used predictors of loss severity.

38. Whether a bank assigns ELGD and LGD values directly or, alternatively, rates wholesale exposures and then quantifies ELGD and LGD for the rating grades, the bank should conscientiously identify characteristics that influence ELGD and LGD. Each of the loss severity rating categories should be associated with empirically supported ELGD and LGD estimates. (Even though the grouped exposures have common characteristics and a common expected ELGD and LGD, realized loss severity for individual exposures may vary).

#### Loss Severity Rating/LGD Granularity

**S 2-14 Banks must have a sufficiently granular loss severity rating system to group exposures with similar estimated loss severities or a process that assigns estimated ELGDs and LGDs to individual exposures.**

39. While there is no stated minimum number of loss severity ratings, the systems that provide ELGD and LGD estimates must be granular enough to separate wholesale exposures with significantly varying estimated LGDs. For example, a bank using a loss severity rating-scale approach that has credit products with a variety of collateral packages or financing structures should have more ELGD and

LGD rating grades than those banks with fewer options in their credit products.

40. Like obligor rating grades, the mere existence of an exposure concentration in an ELGD or LGD rating grade (or rating grades) does not, by itself, signify a rating system's weakness. However, banks with a high concentration within ELGD and LGD rating grades should perform a thorough analysis that supports such a concentration.

#### B. Other Considerations

##### Rating Criteria

**S 2-15 Rating criteria should be written, clear, consistently applied, and include the specific qualitative and quantitative factors used in assigning ratings.**

41. Each obligor and loss severity rating (including ratings with modifiers such as + or -) should be defined. The definitions should describe all significant quantitative and qualitative ratings criteria used to promote consistent application of risk ratings. The ratings should be sufficiently transparent to allow replication by a third party. This is particularly important in expert-judgment rating systems where establishing the transparency of rating assignments is more challenging. Without clearly defined rating criteria, expert-judgment rating systems are not sufficiently transparent. A risk rating system with vague criteria or one defined only by PDs, ELGDs, or LGDs is neither replicable nor transparent. Transparent criteria promote accurate and consistent ratings within and across business lines and geographies, and permit the rating process to be refined over time.

##### Use of External Rating Tools

42. Banks may use results from external rating tools, such as vendor default models or agency ratings, as inputs into their internal rating processes for obligors and wholesale exposures. The validation standards in this guidance apply to a bank's use of external rating tools as well as internal ones. Therefore, banks should apply the same level of rigor to their external tools as to their internal tools. In addition, any external rating tool employed should be consistent with the architecture of the bank's IRB rating systems. To verify this consistency, a bank should analyze and understand:

- The predictive ability of the external rating tool;
- The factors and criteria used by the external rating tools to assign ratings; and

- The expected effect of using the external rating tool on the migration of internal ratings.

43. Sole reliance on external rating tools is not appropriate. Every rating tool has limitations, and banks should have a process to ensure that accurate ratings are assigned despite such limitations. How much additional analysis is required will depend on the exposure's rating, relative size and complexity. Banks should maintain data on the critical factors underpinning an external rating tool's obligor or loss severity ratings (as the banks would for any rating assignment process).

##### Timeliness of Ratings

**S 2-16 Risk ratings must be updated whenever new material information is received, but in no instance less than annually.**

44. A bank should have a policy that ensures that obligor and loss severity ratings reflect current information. That policy should also specify minimum financial reporting and collateral valuation requirements. When loss severity ratings or estimates depend on collateral values or other factors that change periodically, that policy should take into account the need to update these factors.

45. Banks' policies may include an alternative timetable for updating ratings of exposures below a de minimis amount that the bank determines has no material impact on risk-based capital levels. For example, some banks use triggering events to prompt them to update their ratings on de minimis exposures rather than adhering to a specific timetable.

##### Multiple Ratings Systems

46. A bank's complexity and sophistication, as well as the size and range of products offered, will affect the types and number of rating systems employed. However, each risk rating system should conform to the standards in this guidance, must be validated for accuracy and consistency, and should be used consistently. Validation exercises should produce evidence that the ratings have been applied consistently.

### Chapter 3: Retail Segmentation Systems

#### Rule Requirements

Part III, Section 22(b)(1): A bank must have an internal risk rating and segmentation system that accurately and reliably differentiates among degrees of credit risk for the bank's wholesale and retail exposures.

Part III, Section 22(b)(3): For retail exposures, a bank must have a system

that groups exposures into segments with homogeneous risk characteristics and assigns accurate and reliable PD, ELGD, and LGD estimates for each segment on a consistent basis. The bank's system must group retail exposures into the appropriate retail exposure subcategory and must group the retail exposures in each retail exposure subcategory into separate segments. The bank's system must identify all defaulted retail exposures and group them in segments by subcategories separate from non-defaulted retail exposures.

Part III, Section 22(b)(5): The bank's retail exposure segmentation system must provide for the review and update (as appropriate) of assignments of retail exposures to segments whenever the bank receives new material information, but no less frequently than quarterly.

#### I. Overview

1. This chapter describes the design and operation of an IRB retail segmentation system. An IRB retail segmentation system groups retail exposures into segments with homogeneous risk characteristics within each of the three retail exposure subcategories (residential mortgage exposures, qualifying revolving exposures (QRE), other retail exposures). Examples of segmentation techniques include the use of obligor (such as income and past credit performance) and exposure (such as product type and loan-to-value) characteristics; or grouping loans by similar estimated default rates and estimated loss severities. The segmentation system used for IRB will often differ from segmentation used for other purposes, such as for marketing and scorecards. The retail risk parameter estimates that determine risk-based capital requirements are assigned at the segment level.

2. The retail IRB framework provides banks substantial flexibility to use the retail segmentation that is most appropriate for their activities, subject to the following broad principles:

- Differentiation of risk— Segmentation should provide meaningful differentiation of risk. Accordingly, in developing the segmentation system, banks should select risk drivers that separate risk distinctly and consistently over time.
- Reliable risk characteristics— Segmentation uses borrower risk characteristics and loan-related risk characteristics that reliably differentiate a segment's risk from that of other segments and that perform consistently over time.

- Consistency—The risk drivers used to segment exposures must be consistent with the predominant risk characteristics the bank uses to measure and manage credit risk.

- Accuracy—The segmentation process should generate segments that separate exposures by realized performance. It should be designed so that actual long-run outcomes closely approximate the retail risk parameters estimated by the bank.

3. Defaulted retail exposures must be segmented separately from non-defaulted exposures. In addition, retail segments should not cross national jurisdictions unless the bank can demonstrate that the exposures in the different jurisdictions have homogeneous risk characteristics.

## II. Definition of Default

### S 3-1 Banks must use the IRB definition of default when identifying defaulted retail exposures.

4. For retail exposures, banks must use the following definition of default for its IRB system: A retail exposure of a bank is in default if:

- The exposure is 180 days past due, in the case of a residential mortgage exposure or revolving exposure;
- The exposure is 120 days past due, in the case of all other retail exposures; or
- The bank has taken a full or partial charge-off or write-down of principal on the exposure for credit related reasons.

5. The exposure remains in default until the bank has reasonable assurance of repayment and performance for all contractual principal and interest payments on the exposure.

6. For retail exposures, the definition of default is applied to a particular exposure rather than to the obligor. That is, default by an obligor on one obligation would not require a bank to consider all other obligations of the same obligor in default.

## III. Retail Segmentation Architecture

### A. Criteria for Retail Segmentation

**S 3-2 Banks must first place exposures into one of the three retail exposure subcategories (residential mortgage, QRE, and other retail). Banks must then separate exposures into segments with homogeneous risk characteristics.**

**S 3-3 A retail segmentation system must produce segments that accurately and reliably differentiate risk and produce accurate and reliable estimates of the risk parameters.**

7. While banks have considerable flexibility in determining retail segments, they should consider factors

affecting the risk characteristics of both borrowers and loans when determining segmentation criteria. Statistical modeling, expert judgment, or some combination of the two may determine the most relevant risk drivers.

8. Examples of acceptable approaches to segmentation include:

- Segmenting exposures by common risk drivers that are relevant and material in determining the loss characteristics of a particular retail product. For example, a bank may segment mortgage loans by LTV band, age from origination, geography, and/or origination channel.

- Segmenting exposures by common risk drivers that are relevant and material in determining the loss characteristics of a particular borrower population. For example, a bank may segment by credit bureau score bands, behavior score bands, and/or delinquency status. In the case of mortgage products, more borrower information may be available and a bank could include the debt-to-income ratio, current income, and/or years at present location.

- Segmenting by grouping exposures with similar estimated loss characteristics, such as expected average loss rates, expected default rates, or expected loss severity rates. Some banks have developed models that rank order default risk or generate an estimated default rate, loss severity, and/or exposure at default for individual exposures. A bank could use such estimates as criteria in their segmentation system.

9. Each retail segment will have an estimated PD, ELGD, LGD, and EAD. In some cases, it may be reasonable to use the same risk parameter estimates for multiple segments. This may occur more frequently for bank estimates of ELGD and LGD as banks may have less robust historical data for estimating these IRB risk parameters. In such cases, the bank should demonstrate that there are no material differences in ELGD or LGD among those segments. Over time, supervisors expect banks to develop more precise data and methodologies for determining ELGD and LGD.

10. Data for certain retail loans are sometimes missing or incomplete, such as data for purchased loans or loans originated with policy exceptions. The overall segmentation system should adequately capture the risk associated with these loans based on the data available. In some cases, missing or incomplete data itself may be a significant risk factor used for segmentation purposes.

11. A bank should substantiate the degree of granularity in its segmentation

system and the distribution of exposures across segments. (Here, “granularity” is how finely the portfolio is segmented.)

12. Banks have flexibility in determining the granularity of their segmentation system. Each bank should perform internal analysis to determine how granular segments must be to group homogeneous exposures. For example, a bank using credit score ranges to segment its portfolio should provide the rationale for the ranges chosen.

13. A concentration of exposures in a segment (or segments) does not, by itself, reflect a deficiency in the segmentation system. For example, a bank may lend within a narrow risk range and, therefore, have a smaller number of segments than a bank that lends across a wider spectrum of risk. However, a bank with a high concentration of exposures in a particular segment will be expected to show that the bank’s segmentation criteria are carefully delineated and well-documented. The bank should be able to demonstrate that there is little risk differentiation among the exposures within the segment, and that the segmentation method produces reliable estimates for each of the risk parameters. A bank should not artificially group exposures into segments specifically to avoid the 10 percent LGD floor for mortgage products. A bank should use consistent risk drivers to determine its retail exposure segmentations and not artificially segment low LGD loans with higher LGD loans to avoid the floor.

**S 3-4 Banks should clearly define and document the criteria for assigning an exposure to a particular retail segment.**

14. Banks should choose risk drivers that accurately reflect an exposure’s risk. Risk drivers selected must be consistent with risk measures used for credit risk management.

15. The method of segmentation will help determine the risk parameters, as well as which techniques should be used for validation and which control mechanisms will best ensure the integrity of the segmentation system. Described below are some techniques for determining whether the segmentation was done appropriately:

- Statistical Models—Banks may incorporate results of statistical underwriting models or scoring models directly into their segmentation process. For example, a bank may use a custom or bureau credit score as a segmenting criterion. In that case, the bank should support the choice of the score, and should demonstrate that it has adequate controls for the credit scoring system.



- **Inputs to Models**—Banks may incorporate the variables from a statistical model into their segmentation processes. For example, a bank that uses a statistical model to predict losses for its mortgage portfolio could select some or all of the major inputs to that model, such as debt-to-income and LTV, as segmentation criteria. As part of its validation and controls for the segmentation system, the bank should provide an appropriate rationale and empirical evidence for its choice of the particular set of risk drivers from the loss prediction model.

- **Expert Judgment**—Banks may combine expert judgment with statistical analysis in determining segmentation criteria. However, expert judgment must be well-documented and supported by empirical evidence demonstrating that the chosen risk factors are reliable predictors of risk.

16. A bank should be able to demonstrate a strong relationship between IRB risk drivers and comparable measures used for credit risk management. Specifically, a bank should demonstrate that the segmentation system differentiates credit risk across the portfolio and captures changes in the level and direction of credit risk using measures that are similar to those used in credit risk management. For example, even if a bank uses custom scores for underwriting or account management, generic bureau scores may be used for IRB segmentation purposes if the bank can demonstrate a relationship between these measures.

17. Banks should have clear policies to define the criteria for modifying the segmentation system. Changes in the segmentation system should be documented and supported to ensure consistency and historically comparable measurements.

#### *B. Assignment of Exposures to Retail Segments*

**S 3-5 Banks should develop and document their policies to ensure that risk-driver information is sufficiently accurate and timely to track changes in underlying credit quality and that the updated information is used to assign exposures to appropriate segments.**

18. Under the IRB framework, a bank initially assigns retail exposures to segments based on the risk-driver information available at the time of origination or acquisition. The bank should then continue to monitor the risk characteristics of the exposures and assign exposures to appropriate segments based on refreshed information gathered by the bank as part of its monitoring process.

19. In accordance with industry practices in retail credit risk management, a bank should have a well-documented policy on monitoring and updating information about exposure risk characteristics. The policy should specify the risk characteristics to be updated and the frequency of updates for each product type or sub-portfolio within its retail portfolio. Updating of relevant information on these risk drivers should be consistent with sound risk management.

**S 3-6 The bank's retail exposure segmentation system must provide for the review and update (as appropriate) of assignments of retail exposures to segments whenever the bank receives new material information, but no less frequently than quarterly.**

20. Decisions regarding the frequency of obtaining refreshed information should reflect the specific risk characteristics of individual segments and/or the potential impact on risk-based capital levels. The frequency of updates will generally vary for different risk drivers and for different products. The underlying principle is that, in every estimation period, retail exposures are assigned to segments that accurately reflect their risk profile and produce accurate risk parameters.

21. Banks should assess their approach to updating information and migrating exposures when validating the segmentation process.

#### **Chapter 4: Quantification**

##### *Rule Requirements*

Part III, Section 22(c)(1): The bank must have a comprehensive risk parameter quantification process that produces accurate, timely, and reliable estimates of the risk parameters for the bank's wholesale and retail exposures.

Part III, Section 22(c)(2): Data used to estimate the risk parameters must be relevant to the bank's actual wholesale and retail exposures, and of sufficient quality to support the determination of risk-based capital requirements for the exposures.

Part III, Section 22(c)(3): The bank's risk parameter quantification process must produce conservative risk parameter estimates where 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.

Part III, Section 22(c)(4): PD estimates for wholesale and retail exposures must be based on at least 5 years of default data. ELGD and LGD estimates for wholesale exposures must be based on at least 7 years of loss severity data, and

ELGD and LGD estimates for retail exposures must be based on at least 5 years of loss severity data. EAD estimates for wholesale exposures must be based on at least 7 years of exposure amount data, and EAD estimates for retail exposures must be based on at least 5 years of exposure amount data.

Part III, Section 22(c)(5): Default, loss severity, and exposure amount data must include periods of economic downturn conditions, or the bank must adjust its estimates of risk parameters to compensate for the lack of data from periods of economic downturn conditions.

Part III, Section 22(c)(6): The bank's PD, ELGD, LGD, and EAD estimates must be based on the definition of default [in the NPR].

Part III, Section 22(c)(7): The bank must review and update (as appropriate) its risk parameters and its risk parameter quantification process at least annually.

Part III, Section 22(c)(8): The bank must at least annually conduct a comprehensive review and analysis of reference data to determine relevance of reference data to bank exposures, quality of reference data to support PD, ELGD, LGD, and EAD estimates, and consistency of reference data to the definition of default contained [in the NPR].

#### **I. Overview**

1. Quantification is the process of assigning numerical values to the key risk parameters that are used as inputs to the IRB risk-based capital formulas. This chapter provides guidance on the quantification process for wholesale and retail exposures. For both wholesale and retail portfolios these risk parameters are the probability of default ("PD"), expected loss given default ("ELGD"), loss given default ("LGD"), and exposure at default ("EAD"). Wholesale exposures also require determination of the exposure's maturity ("M"). Risk parameters are assigned to each exposure for wholesale portfolios and to each segment for retail portfolios. Specific quantification issues related to counterparty credit risk transactions, equity exposures, and securitization exposures are described in Chapters 9, 10, and 11, respectively.

2. In any discussions of the IRB system, the risk rating or segmentation system design and the quantification process should be considered together. This chapter focuses on quantification given an existing risk rating or segmentation system design, as covered in Chapters 2 and 3, respectively.

3. Section I establishes an organizing framework for considering

quantification and develops general standards that apply to the entire process. Sections II, III, and IV cover specific supervisory standards that apply to PD, ELGD and LGD, and EAD respectively. The maturity risk parameter receives somewhat different treatment in section V, since it is much less dependent on statistical estimates from historical data. Special cases and applications for quantification are covered in section VI.

#### A. Stages of the Quantification Process

4. For each risk parameter, quantification may be broken down into four stages: obtaining historical reference data; estimating the relationship between risk characteristics and the risk parameters in the reference data; mapping the correspondence between risk characteristics in the reference data and those in the existing portfolio; and applying the relationship between risk characteristics and risk parameters to the existing portfolio. An evaluation of a bank's quantification process focuses on the overall adequacy of the bank's approach, including an understanding of how the bank breaks down the quantification process where applicable into the four stages.

5. Banks are not required to separate the quantification process into four stages. The four stages are a conceptual framework, and may serve as a useful analytical and implementation guide. Readers may find it helpful to refer to the appendices to this chapter, which illustrate how this four-stage framework can be applied to quantification approaches in practice. The four stages of quantification are described below.

#### **Data—First, the bank constructs a reference data set, or source of data, from which risk parameters can be estimated.**

A "reference data set" consists of a set of exposures and their associated identifying information and risk characteristics. Reference data sets may include internal data, external data, or pooled data from different internal and external sources. Internal data refers to any data on exposures held in a bank's existing or historical portfolios, including data elements or information provided by third parties (e.g., data from a credit bureau about one's own customers would be considered internal data). External data refers to information on exposures held outside the bank's portfolio, including aggregate industry trends or economic data.

The reference data is described using a set of observed characteristics; consequently, the data set contains variables that can be used for this

characterization. For example, risk characteristics for wholesale exposures include obligor and exposure characteristics related to the risk parameters, such as agency debt ratings, risk ratings, financial measures, geographic regions, and the economic environment and industry/sector trends during the time period of the reference data. Risk characteristics for retail exposures include borrower and loan characteristics, such as loan terms, loan-to-value, credit score, income, debt-to-income, or payment history. A bank may use more than one reference data set to improve the robustness or accuracy of the risk parameter estimates.

#### **Estimation—Second, the bank applies statistical techniques to the reference data to determine the relationship between risk characteristics and the estimated risk parameter.**

The result of this step is a model that ties descriptive risk characteristics, or drivers, to the risk parameter estimates. In this context, the term "model" is used in the most general sense; a model may be a simple calculation of historical averages or a more sophisticated approach based on advanced statistical techniques (e.g., regression). This step may include adjustments for differences between the IRB definition of default and the default definition in the reference data set, as well as adjustments for data limitations.

More than one estimation technique may be used to generate estimates of the risk parameters, especially if there are multiple sets of reference data or multiple sample periods. If multiple estimates are generated, the bank should have a clear and consistent policy for reconciling and combining them into a single estimate at the application stage.

#### **Mapping—Third, the bank creates a link between its portfolio data and the reference data based on corresponding characteristics.**

Variables or characteristics used in the estimation model are mapped, or linked, to the variables that are available for the existing portfolio. In order to map effectively, a bank should have reference data characteristics that allow the construction of rating and segmentation criteria that are consistent with those used on the bank's portfolio.

An important element of mapping is making adjustments for differences between reference data sets and the bank's exposures. The bank should map each reference data set and each combination of risk characteristics used in any estimation model.

#### **Application—Fourth, the bank applies the relationship estimated for the reference data to the actual portfolio data.**

The ultimate aim of quantification is to attribute a PD, ELGD, LGD, and EAD to each exposure within the wholesale portfolio and to each segment of exposures in the retail portfolio. If multiple data sets or estimation methods are used, the bank should adopt a means of combining the various estimates at this stage.

For wholesale portfolios, this step may include adjustments to default rates or loss rates to "smooth" the final risk parameter estimates. If the estimates are applied to individual transactions, the bank must in some way aggregate the estimates at the rating level.

For retail portfolios, the bank may simply apply the risk parameter estimates derived for each segment to the corresponding segment in the existing portfolio. However the application stage could be more complex if multiple data sets or estimation methods were used or if the mapping stage required adjustments.

6. The four-stage quantification process described above outlines a framework that a bank may use for assigning numerical values to the IRB key risk parameters. Whether the quantification process explicitly delineates each aspect of the four stages of quantification for PD, ELGD, LGD, and EAD, or the quantification process is more integrated, each aspect of the quantification process for the key risk parameters should be justified, documented, and subject to monitoring and follow-up.

7. A number of examples are given in this chapter to aid exposition and interpretation of specific quantification issues. None of the examples is sufficiently detailed to incorporate all of the considerations discussed in this chapter. Moreover, technical progress in the area of quantification is rapid. Thus, banks should not interpret a specific example that is consistent with the standard being discussed, and that resembles the bank's current practice, as being a "safe harbor." Banks should consider this guidance in its entirety when determining whether systems and practices are adequate.

#### *B. General Standards for Sound Quantification*

8. Several core principles apply to the overall quantification process of risk rating and segmentation systems. Those principles and the general standards that reflect them are discussed in this introductory section. Other supervisory

standards specific to particular stages or risk parameters are discussed in later sections.

9. The risk parameters should be estimated in a manner consistent with sound credit risk management practices and the IRB standards. In addition, a bank should have processes to ensure that these estimates are independently and thoroughly validated and the results reported to senior management.

10. Supervisory evaluation of the quantification process requires consideration of all the standards in this chapter, both general and specific. Particular practical approaches to quantification may be highly consistent with some standards, and less so with others. In assessing a bank's approach, supervisors will weigh the approach's strengths and weaknesses using all the supervisory standards in this chapter as a guide.

**S 4-1 Banks should have a fully specified process covering all aspects of quantification (reference data, estimation, mapping, and application). The quantification process should be fully documented.**

11. A fully specified quantification process should describe how all four stages (data, estimation, mapping, and application) are addressed for each parameter. The linkages between the bank's quantification and validation processes should also be explicit.

12. An important aspect of the quantification process is the appropriate capture and analysis of developmental evidence in support of techniques applied by the bank. A few examples of such developmental evidence are:

- For reference data—a discussion of how the best available data are chosen from various sources so that the data include periods of economic downturn conditions and the portfolio in the reference data is comparable to the existing portfolio;

- For estimation—discussions of why the bank uses various averaging methods on historical data, how it specifies downturn estimates, or how it develops predictive models;

- For mapping—discussions of how risk characteristics in the reference data compare with those in the existing portfolio; and

- For application—a discussion of the combination of multiple estimates, aggregations of estimates across exposures, or any judgmental adjustments.

13. Major decisions in the design and implementation of the quantification process should be justified and fully documented. Documentation promotes consistency and allows third parties to review and replicate the entire process.

**S 4-2 Risk parameter estimates must be based on the IRB definition of default. At least annually, a bank must conduct a comprehensive review and analysis of reference data to determine the relevance of reference data to the bank's exposures, quality of reference data to support risk parameter estimates, and consistency of reference data to the IRB definition of default.**

14. Many different sources of data might be appropriately used in an estimation model or the quantification process. Regardless of the data used to derive the risk parameter estimates, such estimates must reflect the IRB definition of default.

15. As part of its annual review of its reference data, a bank must assess the consistency of the reference data with the IRB definition of default. In the early stages of IRB implementation, a bank's internal historical reference data might not include an element that fully conforms to the IRB definition of default. In addition, a bank may change its policies regarding charge-offs or non-accrual. For any internal or external historical data that are not fully consistent with the IRB definition of default, a bank must still ensure that the derived risk parameter estimates are based on the IRB definition of default. This will likely entail making conservative adjustments to reflect data discrepancies; larger discrepancies require greater conservatism.

16. To support quantification and validation of the risk parameter estimates, one of the elements in a bank's internal data should conform to the IRB definition of default. The collection of internal data is discussed in Chapter 6 (Data Management and Maintenance) of this guidance and validation is discussed in Chapter 7 (Controls and Validation).

**S 4-3 Banks must separately quantify wholesale risk parameter estimates before adjusting the estimates for the impact of eligible guarantees and eligible credit derivatives.**

17. As discussed in Chapter 5, the benefits of wholesale credit risk mitigation from eligible guarantees and eligible credit derivatives are recognized through adjustments to ratings and risk parameter estimates. However, banks must perform the basic quantification of the risk parameters separately from the process of determining an adjustment to an exposure's risk rating assignment resulting from the credit protection or any adjustments to the risk parameters for recognition of the credit protection. In quantifying the impact of the credit protection, banks may make necessary adjustments to the reference data or mapping process, or may estimate the

impact of the credit protection on the bank's existing portfolio. Chapter 5 deals with recognized types of contractual arrangements and instruments that transfer all or part of an exposure's credit risk from the bank to one or more third parties.

**S 4-4 Banks may take into account the risk-reducing effects of guarantees in support of retail exposures when quantifying the PD, ELGD, and LGD of the segment.**

18. A bank may take into account the risk reducing effects of guarantees in support of retail exposures in a segment when quantifying the PD, ELGD, and LGD of the segment, but only for guarantees of individual retail exposures, or guarantees covering all or a pro rata portion of all contractual payments due on a group of retail exposures. (See Example 5 in Appendix B of this chapter.) Insurance in support of retail exposures, for example private mortgage insurance ("PMI"), generally would be considered a guarantee.

19. The risk parameters for exposures covered by retail guarantees should be based on historical experience of exposures with similar coverage and the expected benefits of the guarantees on future performance. Segments benefiting from retail guarantees are still subject to applicable regulatory floors, such as the 10 percent LGD floor for residential mortgages.

20. Retail guarantees may affect PD or ELGD and LGD. In most cases, and in particular for PMI, banks reflect the effects of retail guarantees primarily through the quantification of ELGD and LGD. For retail exposures, banks may directly reflect the expected benefit of retail guarantees in the risk parameters, in contrast to the two-step process that is required for guarantees of wholesale exposures.

21. Banks should monitor and assess potential counterparty risk for guarantees of retail exposures through tracking and analyzing the financial strength of each guarantor. When reflecting guarantees of retail exposures in PD or ELGD and LGD estimates banks should take into account the credit quality of the guarantor. Other things equal, PD or ELGD and LGD estimates should be increased if the credit quality of the guarantor deteriorates. In addition, banks should consider the potential for additional counterparty risk during economic downturn conditions.

22. Banks may also choose to incorporate retail guarantee coverage into their segmentation systems. For example, mortgage loans without PMI could be placed into different segments than those with PMI.

23. Since there are a variety of programs for retail guarantees that provide differing types and levels of coverage, banks incorporating retail guarantees into the IRB risk parameters should ensure that their systems are sufficient to estimate the expected benefits based on the actual amount of coverage within the existing portfolio, regardless of whether or not they segment by coverage. This may require exposure-by-exposure tracking over the life of the exposure to accurately reflect the expected benefits for different forms of retail guarantees. Banks also should develop appropriate reference data sets that can be used to estimate the effect on PDs or ELGDs and LGDs for exposures that are covered by retail guarantees.

**S 4-5 Banks may only reflect the risk-reducing benefits of tranching guarantees of multiple retail exposures by meeting the definition and operational criteria for synthetic securitizations.**

24. Guarantees of multiple retail exposures that do not cover all or a pro rata portion of all contractual payments due on the underlying exposures are considered to be tranching. (See Example 5 in Appendix B of this chapter.)

25. A bank may obtain a reduction in risk-based capital requirements in the case of such tranching guarantees of multiple retail exposures, but only through applying the rules for securitization exposures provided in the NPR. To obtain any benefits, tranching guarantees of multiple retail exposures must satisfy all aspects of the definition of synthetic securitization and comply with all requirements for securitization treatment in the NPR. (Also see Chapter 11 (Securitizations) for additional guidance.)

26. In some cases, the determination of the risk-based capital benefit for a qualifying tranching guarantee will be relatively straightforward. For example, the securitization framework provides three general approaches for determining risk-weighted assets: The ratings-based approach, the internal assessment approach, and the supervisory formula approach (“SFA”). A bank can use the RBA if its exposure is externally rated or has an inferred rating. The SFA may be employed when external or inferred ratings are not available for tranching structures. (See Chapter 11 for a more detailed discussion of the applicability of the various approaches in different circumstances.)

**S 4-6 At a minimum, the quantification process and the resulting risk parameters must be reviewed annually and updated as appropriate.**

27. All material aspects of the quantification process should be reviewed annually, with adjustments and enhancements made as needed. A bank should have a well-defined policy for reviewing and updating the quantification design. New analytical techniques and evolving industry practice should be taken into account in considering changes to quantification techniques. The review should evaluate the judgmental adjustments embedded in the estimates; new data or evolving industry practice may suggest a need to modify those adjustments. Particular attention should be given to any changes that may have resulted in a significant change in the composition of exposures, such as new business lines, material mergers or acquisitions, and material divestitures, loan sales or securitizations. Such changes, which raise questions about the appropriateness of risk ratings, the segmentation system, and the quantification process, should trigger a review and revisions as needed.

28. The review process is particularly relevant for the reference data stage because new data become available frequently. A bank must ensure continued applicability of the reference data to its existing exposures, and the reference data should reflect the types of exposures found in the bank’s existing portfolio. Reference data must be of sufficient quality to support PD, ELGD, LGD, and EAD estimates. A well-defined and documented process should be in place to ensure that the reference data are updated as frequently as needed, as fresh data become available or as portfolio changes make necessary. All data sources, characteristics, and the overall processes governing data collection should be fully documented, and that documentation should be readily available for review.

29. At a minimum, risk parameter estimates must be reviewed at least annually, and the process for doing so should be documented in the bank’s policy. If the review reveals that risk parameter estimates should be updated, the updates should be performed promptly and documented clearly. New data should be incorporated into the risk parameter estimates using a well-defined process to correctly merge data sets over time, and the frequency of risk parameter updates and the process for doing so should be justified and documented in bank policy.

30. The risk parameter estimates may be particularly sensitive to changes in the way banks manage exposures. When such changes take place, the bank should consider them in all steps of the quantification process. Changes likely to

significantly increase a risk parameter value should prompt increases in the risk parameter estimates. When changes seem likely to reduce the risk parameter value, estimates should be reduced only after the bank accumulates a significant amount of actual experience under the new policy to support the reductions.

31. The mappings of the existing portfolio to the reference data used in estimation should also be reviewed with sufficient frequency to ensure that the mappings continue to be appropriate. Mappings should be reaffirmed at least annually for both internal and external reference data, regardless of whether the risk rating or segmentation systems have undergone explicit changes during the period covered by the reference data set, because the relationship between a bank’s existing exposures and the reference data may change over time. For example, in wholesale portfolios the relationships between internal rating grades and external agency ratings may change during the economic cycle because of differences in expected rating migration. When significant characteristics have been changed, added, or dropped, the characteristics of the existing exposures should be newly mapped to the characteristics of the reference data.

**S 4-7 Quantification should be based upon the best available data for the accurate estimation of the risk parameters.**

32. Banks should always use the best available data when quantifying the risk parameters. In order to derive accurate risk parameter estimates, banks should incorporate relevant data, whether such data are internal or external. One objective of the IRB framework is to encourage further development of credit risk quantification techniques. Improving the quality, capture, and retention of internal data is an essential prerequisite for such advances.

33. Internal data refers to any data on exposures existing or historically held in a bank’s own portfolio, including historical exposure and risk characteristics as well as exposure performance—even if some data components are purchased from outside sources. For example, property appraisals purchased from a third-party appraiser for updating the LTVs of a bank’s mortgage exposures are considered internal data. However, if a bank purchases data on risk characteristics or performance for exposures outside of its own portfolio, these data would be considered external.

34. A bank should incorporate relevant external data for quantifying risk parameters if internal data are

insufficient to produce accurate and appropriate estimates. For example, the use of external data may be necessary when internal data do not provide adequate coverage of economic downturns or when there are significant data gaps, either for periods of time or for the types of exposures in the bank's existing portfolio. Banks should demonstrate that all data used to quantify risk parameters are relevant.

35. A bank should have a process for vetting potential reference data, whether the data are internal or external. The vetting should assess whether the data are sufficiently accurate, sufficiently complete, sufficiently representative, and sufficiently informative of the bank's existing exposures.

36. Furthermore, a bank should have adequate data to estimate risk parameters for all exposures on the books, even if some are likely to be sold or securitized before their long-term credit performance can be observed.

**S 4-8 The sample period for the reference data must meet the minimum length for each risk parameter by portfolio.**

**S 4-9 The reference data must include periods of economic downturn conditions, or the parameter estimates must be adjusted to compensate for the lack of data from such periods.**

37. For PD estimation, a minimum of five years of data are required for all portfolios. For ELGD, LGD and EAD estimation, a minimum of seven years of data are required for wholesale portfolios, and five years of data are required for retail portfolios.

38. This requirement for a minimum of five or seven years of data should not be taken to imply that reference data sets of this length are optimal. The range of conditions covered by the sample period may be as important as its length. Specifically, lack of inclusion of periods of economic downturn conditions could bias PD, ELGD, LGD, or EAD estimates downward and lead to unjustifiably lower risk-based capital requirements.

39. If a bank's reference data do not include periods of economic downturn conditions, the bank must adjust its risk parameter estimates to compensate for the lack of these data. Given the particular importance of periods of economic downturn, a bank may choose to augment an existing reference data set with additional data from such a period without including all of the intervening years, if the overall data set satisfies required minimums, otherwise covers the appropriate range of economic conditions and is appropriate for the bank's existing portfolio. Alternatively, a bank may draw more heavily on sub-samples of its internal portfolio (for

example, particular MSAs or geographic regions) that experienced economic downturn periods, or use appropriate external data. However, the bank should justify the exclusion of available internal data for portions of its portfolio and any inclusion of alternative internal or external data sources, as well as its weighting assumptions.

40. The minimum data requirement may be met using internal data, external data, or pooled data combining internal data with similar data from other sources. However, as noted above, the minimum sample period for reference data should not be construed as generally providing optimum results. A longer sample period usually fosters more robust estimation; for example, a longer sample will include more default observations for ELGD, LGD or EAD estimation. Banks should consider the use of additional data when more than the minimum length of historical data is available. However, the potential increase in precision afforded by a larger sample should be weighed against the potential for diminished comparability of older data to the existing portfolio; striking the correct balance is a matter of judgment. Reference data must not differ systematically from the existing portfolio in ways that seem likely to be related to default risk, loss severity, or exposure at default.

**S 4-10 Banks should clearly document how they adjust for the absence of significant data elements in either the reference data set or the existing portfolio.**

41. Some exposures in the reference data set and the existing portfolio will have missing data elements, some of which are important factors for measuring risk. Banks may use a variety of statistical methods to impute values for the missing factors—provided these factors are sufficiently correlated to known information about the exposure. Expertise is required to judge whether such correlations can be established. Regardless of the approach and level of sophistication, the bank should have a clear and well-documented process describing how it treats missing data elements in the estimation and mapping stages.

42. For example, in the development of a default model, missing data elements can be imputed and the estimates of the missing data elements input to the model. However, if particular data elements are missing on significant portions of the population, this may justify the estimation of separate models where data elements are missing.

**S 4-11 Judgmental adjustments to risk parameter estimates, either upward or downward, may be an appropriate part of the quantification process, but must not result in an overall bias toward lower risk parameter estimates.**

43. Judgment will inevitably play a role in the quantification process and may materially affect the estimates. Judgmental adjustments to estimates are often necessary because of some limitations on available reference data or because of inherent differences between the reference data and the bank's existing exposures. The bank must ensure that adjustments are not biased toward optimistically low risk parameter estimates. This standard does not prohibit individual adjustments that result in lower estimates of risk, because both upward and downward adjustments are expected. Individual adjustments are less important than broad patterns; consistent signs of judgmental decisions that lower parameter estimates materially may be evidence of bias. The bank should also ensure that large judgmental adjustments are well justified and infrequent, as frequent large adjustments could indicate a problem with the rating methodology.

44. The reasoning and empirical support for any adjustments, as well as the mechanics of the process, should be documented. The bank should conduct sensitivity analysis to demonstrate that the adjustment procedure is not biased toward reducing risk-based capital requirements. The analysis should consider the impact of any judgmental adjustments on estimates and risk-based capital requirements, and should be fully documented.

**S 4-12 Risk parameter estimates should incorporate a degree of conservatism that is appropriate for the overall rigor of the quantification process.**

45. Estimated values of the risk parameters should be as precise and accurate as possible. However, estimates are inherently subject to uncertainty and potential error. Aspects of the quantification process that are apt to induce uncertainty and error include model error, differences in default definitions, errors in judgment, and data deficiencies. A general principle of the IRB framework is that the assumptions and adjustments embedded in the quantification process should reflect the degree of uncertainty or potential error inherent in the process.

46. In practice, a reasonable estimation approach likely will result in a range of defensible risk parameter values. 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. That is, the more uncertainty in the process, the more risk-based capital should be required.

47. The degree of conservatism should be related to factors such as the relevance and depth of the reference data, the quality of the mapping, the precision of the statistical estimates, and the amount of judgment used throughout the process. Conservative methodologies should also be considered for new products, such as new residential mortgage products. Margins of conservatism need not be added at each step, as that could produce an excessively conservative result. Instead, the overall margin of conservatism should adequately account for all uncertainties and weaknesses. Improvements in the quantification process (use of better data, estimation techniques, and so on) may allow risk parameter estimates to become less conservative over time.

**S 4-13 Mapping should be based on a comparison of available data elements that are common to the existing portfolio and each reference data set.**

48. Sound mapping practice uses elements that are available in both the existing portfolio and the reference data. If a bank chooses to ignore certain variables or to weight some variables more heavily than others, those choices should be supported. At least two kinds of mapping challenges may arise:

- First, even if similarly named variables are available in the historical reference data and the existing portfolio data, they may not be directly comparable. Hence, a bank should ensure that linked variables are truly similar. Although adjustments to enhance comparability can be appropriate, they should be rigorously developed and documented.

- Second, levels of aggregation may vary. The bank's information systems for its existing exposures might supply more detail. For example, to apply the estimates derived from the reference data, the portfolio data could be regrouped to match the coarser aggregation of the reference data.

49. Mapping should be consistent with the risk rating and segmentation systems. Levels and ranges of key characteristics for each rating or segment of the bank's existing exposures should approximate the values of similar characteristics for the reference data.

50. The standard allows for use of a limited set of common variables that are

predictive of default, loss or exposure risk, in part to permit flexibility in early years when data may be far from ideal for some portfolios. Nevertheless, mapping exercises should aim to provide the greatest possible assurance that it is appropriate to apply the bank's estimation framework to the existing portfolio of exposures. In instances where banks rely on a limited set of common variables, or where those variables are not clearly identical, banks should compensate by being more conservative in other stages of the quantification process.

**S 4-14 A mapping process should be established for each reference data set and for each estimation model.**

51. Banks should never assume that the rationale for a mapping is self-evident. Even when reference data are drawn from internal default and loss experience, a bank should still link the characteristics of the reference data with those of the existing portfolio. The use of internal data for reference data purposes does not eliminate the need for a mapping requirement because changes in bank strategy or external economic forces may alter the risk characteristics or composition of the portfolio over time, even within the same wholesale obligor/loss severity ratings or within the same retail segments.

- For example, a wholesale rating system that has been explicitly designed to replicate external agency ratings may or may not be effective in producing a replica; formal mapping would be performed. Indeed, in such a system the kind of analysis involved in mapping may help identify inconsistencies in the rating process itself.

- Similarly for retail portfolios, even if the bank uses the same segmentation system over time, it should verify that the risk factors behind the segmentation capture the same types of borrowers in today's portfolio as they did in the reference data. For example, a given product offering may attract types of customers that differ over time in ways that affect risk but are not fully reflected in the risk factors used for segmentation.

52. Banks often use multiple reference data sets, and then combine the resulting estimates to get a risk parameter estimate for a wholesale obligor/loss severity rating or for a retail segment. A bank that does so should conduct a rigorous mapping process for each data set.

**S 4-15 Banks that combine estimates from internal and external data or that use multiple estimation methods should have a clear policy governing the combination process and**

**should examine the sensitivity of the results to alternative combinations.**

53. To ensure that the best available data are used to produce accurate risk estimates a bank might combine data from multiple sources and may use multiple estimation methods. Banks often combine internal data with external data and use data from different sample periods. For example, for a wholesale portfolio a bank may combine results from corporate-bond default databases with results from equity-based models of obligor default.

54. The manner in which the estimates from multiple data sets or estimation methods are combined is extremely important, since different combinations will produce different risk parameter estimates. A bank should investigate risk parameter estimates' sensitivity to different ways of combining data sets or combining estimation methods. When results are highly sensitive to how data or estimates are combined, a bank should make every effort to understand the nature (reasons and implications) of the instability (including use of statistical tests) and choose among the alternatives conservatively. A bank should document why it selected the combination techniques it did, and these techniques should be subject to appropriate approval and oversight by management.

**S 4-16 The aggregation of risk parameter estimates from individual exposures within rating grades or segments should be governed by a clear and well-documented policy.**

55. Because different methods of aggregation are possible, a bank should have a clear and well-supported policy regarding how aggregation should be accomplished. Banks are required to have a quantification system in which the rating grades or segments are homogeneous with regard to risk; in this case, each obligor or exposure within homogeneous grades or segments would receive equal emphasis in quantification.

56. For wholesale exposures, rating grade-based mapping naturally produces an average risk parameter estimate by rating grade. Conversely, obligor-based or loss severity-based mappings require the aggregation of the individual risk parameter estimates to the rating grade level. The bank should document this aggregation and compare the results of alternative mappings. These mappings are discussed in the relevant PD and ELGD and LGD sections.

57. If a bank uses a prediction model for a retail portfolio that assigns a risk parameter estimate to each exposure, it

should specify and document the process by which it aggregates the exposure-level risk parameters to assign segment-level estimates.

## II. Probability of Default (PD)

### A. Data

58. For PD quantification, a minimum of five years of data that include periods of economic downturn conditions is required; in the event that such data are not available, a bank must adjust its PD estimates to compensate for the lack of data from periods of economic downturn conditions. The data for PD quantification should include relevant characteristics of both defaulted and non-defaulted exposures such as information on the exposures at different points in time, payment history and ultimate disposition.

59. To estimate PD accurately and support the determination of risk-based capital requirements, a bank must have a comprehensive reference data set with observations that should be representative of the bank's existing exposures. For wholesale portfolios the reference data should map to obligors, and for retail portfolios the reference data should map to segments of the existing portfolio. Clearly, the data set used for estimation should be similar to the portfolio to which such estimates will be applied. The same comparability standard applies to both internal and external data sets.

60. To ensure ongoing applicability of the reference data, a bank should assess the characteristics of its existing exposures relative to the characteristics of exposures in the reference data. Such variables might include qualitative and quantitative information on the exposure, internal and external wholesale ratings and rating dates, updated retail credit scores, corporate lending relationships, retail product type and loan terms, or geography. A bank should maintain documentation that fully describes all explanatory variables in the data set, including any changes to those variables over time. A well-defined and documented process should be in place to ensure that the reference data are updated as frequently as is practical, as fresh data become available or portfolio changes make necessary.

### Example

A bank determines that the aggregate national retail mortgage portfolio has not experienced downturn conditions during the time horizon for which internal reference data are available. However, regional sub-portfolios did experience default rates that were

significantly higher than average during the available data history. Data are available from regional recessions in New England (late 1980s and 1990–1995), Texas (1983–1989), and California (1991–1995). The bank demonstrates that the drivers of significantly higher default rates in these regional recessions can be extrapolated to the national portfolio, and the bank justifies and documents the resulting adjustments that would be necessary in the mapping and application stages.

### B. Estimation

61. Estimation of PD is the process by which risk characteristics of the reference data are related to default rates for each wholesale obligor or for each retail segment in the reference portfolio. The relevant risk characteristics that are predictive of the likelihood of default are referred to as “drivers of default.” Drivers for wholesale obligors might include financial ratios, management expertise and industry. Drivers for retail segments might include product, loan and borrower characteristics such as loan-to-value, credit line utilization, credit score, or delinquency status. Also, a portfolio separator such as geographic region, while not a direct driver of default, might indicate separate relationships of the PD to these drivers by geographic region.

#### **S 4–17 PD estimates must be empirically based and must represent a long-run average.**

62. The PD is an estimate of the long-run average of one-year default rates for wholesale rating grades, for segments of non-defaulted retail exposures where seasoning is not material, or for a segment of non-defaulted retail exposures in a retail exposure subcategory for which seasoning effects are not material.

63. PD estimates should represent averages of one-year default rates over a mix of economic conditions (including economic downturn conditions) sufficient to provide a reasonable estimate of the one-year default rate over the economic cycle for the rating grade or retail segment as specified above. If a bank uses the best available historical data to estimate PD as the mean of yearly realized default rates over at least five years, and the bank can empirically support that this period includes economic downturn conditions, then this is likely to adequately represent long-run experience. The emphasis should not solely be on time span; the long-run average concept captures the breadth, as well as the length, of experience.

64. Estimation generally should treat data from different time periods similarly. A bank choosing instead to place greater relative weight on data from particular time periods should empirically demonstrate that doing so produces a more accurate estimate of future default behavior for each wholesale rating grade and retail segment in its existing portfolio. For example, more recent data might be given more weight in the estimation process if the bank demonstrates that doing so is more predictive of future default behavior.

65. For a statistical model to satisfactorily produce long-run PD estimates, the reference data used in the default model must meet the long-run requirement. A model can be used to relate risk drivers to the outcome—default or non-default. Drivers might include wholesale financial ratios, retail borrower credit scores, loan terms, economic conditions or industry variables. Such a model must be calibrated to capture the default experience over a reasonable mix of economic conditions. For example, a Merton-style model's estimate of distance to default must be calibrated to the default rate using long-run experience. Whether a PD model is developed internally or by a vendor, a bank should verify that the model's results have been calibrated to a long-run average PD.

66. Adjustments that are part of the PD estimation process must not result in an overall bias toward lower risk parameter estimates. The bank should rigorously validate, justify, and document such adjustments.

### Example 1

If the bank's internal data history does not include any periods of economic downturn, the bank may use external data sources that include an economic downturn period to adjust PD estimates upward. The bank should justify the assumption that the relationship between the long-run average PD and the risk drivers observed in the external data applies to its portfolio. This practice is consistent with this guidance.

### Example 2

A bank uses internal default experience to estimate PDs for its wholesale portfolio. However, the bank has historically failed to recognize defaults under the IRB default definition. For example, exposures sold at a material credit loss were not captured as defaults. The realized PD using the IRB definition would be higher than that observed by the bank

(and LGD rates might differ as well). If the bank made no adjustment for the missing defaults, its practice would not be acceptable.

**S 4-18 Effects of seasoning, when material, must be considered in the PD estimates for retail portfolios.**

67. A bank should determine whether age since origination is a significant risk factor for its retail exposures on the balance sheet. If so, then seasoning may be a material risk factor.

68. Material seasoning effects are generally indicated when default rates of a segment of retail exposures follow a characteristic age profile, rising for the first several periods following origination. Seasoning of this type is often significant for longer-maturity consumer products such as residential mortgages, but may also be important for shorter-lived portfolios.

69. Additional common indicators of material seasoning effects are large or rapidly growing portfolio concentrations of unseasoned exposures where age is a significant risk factor. Such concentrations could result from a high growth rate of originations, unusually high prepayment or attrition rates, or high rates of sales or securitization of seasoned exposures.

70. Even when age is a significant risk factor and default rates follow a characteristic age profile, seasoning effects may not be material if a retail exposure subcategory's age distribution is stable and the age distribution of the portfolio is not concentrated in unseasoned exposures.

71. The operational definition of material seasoning effects for a segment of retail exposures is that the annualized cumulative default rate for that segment materially exceeds the long-run average of one year default rates.

72. If seasoning effects are material for the retail exposure subcategory, banks must use a PD that reflects a longer-run horizon and provides adequate risk-based capital to cover potential credit losses for its unseasoned segments in that subcategory. Specifically, rather than the best estimate of the long-run average of 1-year default rates, the higher PD that must be used is defined as the estimated annualized cumulative default rate of the segment over the expected remaining life of the exposures in the segment.<sup>3</sup>

73. Estimates of expected remaining life should reflect a long-run average for exposures in the segment; banks should avoid undue volatility in their estimates

<sup>3</sup> Expected remaining life is the average period from today until an exposure of a particular type will prepay, pay in full through normal amortization, or default.

caused by short-term fluctuations in market factors (such as interest rates). Also, banks may incorporate discounting of cash flows into their estimates of expected remaining life if they so choose.

74. Even if the exposures are potentially subject to material seasoning effects, a bank may use the definition of PD specified in Paragraph 62 of this chapter for certain exposures that are originated for sale or securitization, provided that:

- The bank credibly demonstrates its ability and intent to sell or securitize the exposures within a 90-day time frame. It can do so by:

- An established historical track record of sales or securitizations for similar exposures; or

- Commitments in the form of forward sales agreements or other contractual pipeline arrangements that provide reasonable assurances that the exposures will be sold within 90 days.

- The exposures are specifically identified at origination.
- The bank monitors sales or securitization market indicators, including an assessment of counterparty risk, to ensure its continuing ability to sell or securitize these exposures in a variety of market conditions.

Exposures that are not sold or securitized within 90 days should be assigned to segments that fully reflect their risk profile based on their updated risk characteristics.

75. Banks should note that under the rules for securitization exposures in the NPR, a bank may need to quantify the IRB risk parameters for some securitized exposures. For that quantification process, a bank must meet the quantification requirements for estimating PDs for retail exposures held on balance sheet, including the requirements for estimating PD when seasoning effects are material.

76. The account age profile may be tracked by using account age as a criterion in the segmentation system for the retail exposures or as a predictive variable in a PD quantification model. Several methods can be used to account for seasoning in the PD estimates. See example 4 in Appendix B of this chapter.

### C. Mapping

77. Mapping is establishing a linkage between the bank's existing exposures and the reference obligor data used in the default model. Hence, mapping involves identifying how drivers of default for the existing exposures correspond to the reference data's drivers. Wholesale drivers include financial and nonfinancial variables,

and assigned rating grades; retail segment drivers include exposure and borrower risk characteristics.

78. Key drivers of default should be factored directly into the obligor rating or segmentation process. But in some circumstances, certain effects related to industry, geography, or other factors are not reflected in wholesale obligor risk rating assignments, retail segmentation, or default estimation models. In such cases, it may be appropriate for banks to capture the impact of the omissions by using different mappings for different business lines or types of exposures. Supervisors expect this practice to be transitional, and that banks eventually will incorporate the omitted effects into the wholesale obligor risk rating, the retail segmentation system or the PD estimation process as they are uncovered and documented, rather than adjusting the mapping.

79. Banks may use multiple reference data sets or estimation methods, and then combine the resulting estimates to get an obligor rating grade or segment PD. A bank that does so should conduct a rigorous mapping process for each data set and estimation method. For example, when using data from a number of wholesale rating agencies, the mapping should take into consideration differences in the agencies' rating methods by mapping each agency's obligor rating scale separately. Similarly, when combining the results from internal historical data and a default prediction model over a retail portfolio, the bank should map both the historical long-run PD and the model's output to the existing portfolio.

### Retail Mapping

80. For retail portfolios, mapping involves linking segments in the reference data to segments in the existing portfolio. If the bank's segmentation process has been in place for a long time, the mapping between internal historical data and the existing portfolio data may be straightforward. However, if the bank's retail segmentation system has varied over time, the bank should demonstrate a mapping between its existing segmentation system and the segments in the reference data. In either case, the bank should demonstrate that the mapping is appropriate and conduct periodic assessments to verify this.

### Example

Even if similarly named characteristics are available in the reference data and the existing portfolio data, they may not be directly comparable. For example, in a retail portfolio of auto loans, the particular



types of auto loans (for example, new or used, direct or indirect) may vary from one application to another. Hence, a bank should ensure that linked drivers are truly similar in PD estimation. Although adjustments to enhance comparability can be appropriate, they should be rigorously developed and documented.

#### Wholesale Mapping

81. There are two broad approaches to the mapping process for wholesale portfolios, obligor mapping and rating grade mapping.

82. In obligor mapping, each existing obligor is mapped to the reference data based on its individual characteristics. For example, if a bank applies a default model to estimate an obligor-level default probability, that model uses certain obligor-level variables as inputs. The values of these variables for each obligor are used as inputs to the obligor-level default probability estimation model.

#### Example

In estimating rating grade PDs, a bank relies on observed default rates on bonds in various agency ratings. To map its internal rating grades to the agency ratings, the bank identifies variables that together explain much of the rating variation in the bond sample. The bank then conducts a statistical analysis of those same variables within its portfolio of obligors, using a multivariate distance calculation to assign each portfolio obligor to the external rating whose characteristics it matches most closely (for example, assigning obligors to ratings so that the sum of squared differences between the external rating averages and the obligor's characteristics is minimized). This practice is broadly consistent with sound mapping practices.

83. In rating grade mapping, characteristics of the obligors within an internal rating grade are averaged or otherwise summarized to construct a "typical" or representative obligor for each rating grade. Then, the bank maps that representative obligor to the reference data. For example, if the bank uses a model that takes certain variables as inputs to produce an obligor-level default probability estimate, a representative value for each input variable would be determined for each internal rating grade, creating in effect a "typical obligor" for a rating grade; the default probability associated with that typical obligor will serve as the rating grade PD in the application stage. As an alternative example, a bank maps the typical obligor from each internal rating grade to a particular external NRSRO

rating based on quantitative and qualitative characteristics and assigns the realized long-run average one-year default rate for that external rating to the internal rating grade in the application stage.

#### Example

A bank uses rating grade mapping to link portfolio obligors to the reference data set described by agency ratings. The bank reviews publicly-rated portfolio obligors within an internal rating grade to determine the most common agency rating, does the same for all rating grades, and creates a linkage between internal and agency ratings. The strength of the linkage is a function of the number of externally rated obligors within each rating grade, the distribution of those agency ratings within each rating grade and the similarity of externally rated obligors in the grade to those not externally rated. This practice is broadly consistent with sound mapping practices, and, for the reasons discussed below, may require adjustments and the addition of margins of conservatism.

84. An acceptable quantification process could include the use of either a rating grade mapping or obligor mapping approach. However, in the absence of other compelling considerations, banks should use obligor mapping because rating grade mapping has the following drawbacks:

- First, default probabilities are nonlinear using many estimation approaches. As a result, the typical obligor's default probability using the rating grade mapping approach is often lower than the mean of the individual obligor default probabilities using the obligor mapping approach.
- Second, a hypothetical obligor with a rating grade's average characteristics may not represent well the risks presented by the rating grade's typical obligor, since different types of obligors might end up in the same grade.

85. A bank electing to use rating grade mapping instead of obligor mapping should be especially careful in choosing a "typical" obligor for each grade. Doing so generally requires that the bank examine the actual distribution of obligors within each rating grade, as well as the characteristics of those obligors. Banks should be aware that different statistical measures (such as mean, median, or mode) will produce different results, and may result in materially different PDs for a particular rating grade. The bank should justify its choice and should have a clear and consistent policy toward the calculation.

86. In addition to the general requirement to compare elements that the reference data and portfolio have in common, both obligor and rating grade mappings should also take into account differences in rating philosophy (as commonly revealed through analysis of rating migration) between any ratings embedded in the reference data set and the bank's own rating regime.

#### D. Application

87. The application stage produces final PD estimates that will be used in the determination of risk-based capital requirements. This stage is expected to be relatively mechanical for most retail portfolios, except when the bank uses multiple reference data sets or multiple estimation methods or significantly changes its segmentation system over time. Judgmental adjustments to the risk parameter estimates should be rare for retail portfolios.

88. This stage may be somewhat more involved for wholesale portfolios. After the bank applies the PD estimation method to its existing exposures using the mapping process, adjustments to the raw results derived from the estimation stage may be appropriate to obtain final rating grade PD estimates. For example, the bank might aggregate individual obligor default probabilities to the rating grade level or otherwise produce a rating grade PD estimate, or might smooth results because a rating grade's PD estimate was higher than a lower quality grade. The bank should explain and support all such adjustments when documenting its quantification process.

89. The bank must ensure that the PD applied in the determination of risk-based capital requirements for each wholesale exposure or retail segment is not less than the regulatory floor of 0.03 percent, except for exposures to or directly and unconditionally guaranteed by a sovereign entity, the Bank for International Settlements, the International Monetary Fund, the European Commission, the European Central Bank, or a multi-lateral development bank, to which the bank assigns a rating grade associated with a PD of less than 0.03 percent.

#### Example

A bank uses external data to estimate long-run average PDs for each wholesale rating grade. The resulting PD estimate for Grade 2 is slightly higher than the estimate for Grade 3, even though Grade 2 is supposedly of higher credit quality. The bank uses statistics to demonstrate that this anomaly occurred because defaults are rare in the highest quality rating grades. The bank judgmentally adjusts the PD estimates for Grades 2

and 3 to preserve the expected relationship between obligor rating grade and PD, but demonstrates that total risk-weighted assets across both rating grades using the adjusted PD estimates are no less than total risk-weighted assets based on the unadjusted estimates, using a typical distribution of obligors across the two rating grades. An adjustment such as given in this example is consistent with this guidance.

### III. Expected Loss Given Default (ELGD) and Loss Given Default (LGD)

90. The ELGD and LGD quantification process is similar to the PD quantification process. Once a bank identifies and obtains a reference data set of defaulted exposures and relevant descriptive characteristics, it selects a technique to estimate the credit-related economic loss per dollar of EAD for a defaulted wholesale exposure with a given array of characteristics or for all defaulted exposures in a reference retail segment. The reference data should then be mapped to the bank's existing exposures so that the bank can estimate ELGD and LGD for each wholesale exposure, loss severity rating, or retail segment, as the case may be. Finally, application adjustments may be made to obtain final risk parameter estimates.

91. The ELGD is an estimate of the default-weighted average economic loss (where individual defaults receive equal weight), per dollar of EAD, the bank expects to incur in the event that the obligor were to default within a one-year horizon over a mix of economic conditions, including economic downturn conditions. LGD estimates reflect the estimate of the economic loss per dollar of EAD that the bank expects to incur if the obligor were to default within a one-year horizon during economic downturn conditions. Accordingly, ELGD estimates incorporate a mix of economic conditions (including economic downturn conditions) while LGD estimates reflect losses that would occur during economic downturn conditions (*i.e.*, conditions in which aggregate default rates are significantly higher than average). LGD estimates cannot be less than ELGD estimates for a particular wholesale exposure or retail segment.

#### A. Data

92. Unlike reference data sets used for PD estimation, data sets for ELGD and LGD estimation contain only exposures to defaulted obligors. At least two broad categories of data are necessary to produce ELGD and LGD estimates.

93. First, factors must be available to group the defaulted exposures in

meaningful ways. Wholesale exposures are grouped by characteristics that are likely to be important in predicting loss rates—for example, whether an exposure is secured and the type and coverage of collateral, the seniority of a claim, economic conditions, and the obligor's industry. The retail segmentation system may separate exposures by borrower and exposure risk characteristics predictive of loss severity or by an ELGD or LGD score—for example, credit score, business line, credit line utilization for unsecured credit lines, or loan-to-value for mortgage loans.

94. Although the characteristics identified above have been found to be significant in academic and industry studies, a bank's quantification of ELGD and LGD certainly need not be limited to these variables. For example, a bank might examine many other potential drivers of loss severity, including geographic location, exposure type, tenor of the relationship, wholesale obligor size, or retail borrower wealth.

95. Second, data must be available to calculate the realized economic loss of each defaulted exposure. Such data may include the market value of the wholesale exposure at default or the market value for a pool of charged-off retail exposures, which can be used to proxy a recovery rate. Alternatively, economic loss may be calculated for wholesale exposures and retail segments using the EAD (including principal and accrued but unpaid interest or fees), losses on the sale of repossessed collateral, direct workout costs, an appropriate allocation of indirect workout costs, the timing and amount of subsequent recoveries, and the discount rate appropriate to the risk of the exposure.

96. Data should be comprehensive. All cash flow data should include dollar amounts and dates. For example, roll to charge-off or non-accrual, number of days past due, or bankruptcy status should be captured if these factors are expected to be significant for ELGD and LGD. Recovery data should include direct payments from the obligor/borrower, the sale of the collateral or realized income from the sale of defaulted exposures. Supportable net realizable value of defaulted exposures and collateral acquired in default that has yet to be disposed of can be included as part of the reference data. Cost data comprise the material direct and indirect costs associated with workouts and collections.

97. Ideally, loss severity should be measured once all recoveries and costs have been realized. However, a bank may not resolve a defaulted wholesale

obligation for many years following default. For practical purposes, banks relying on actual recovery data may choose to close the period of observation before this final resolution occurs—that is, at a point in time when most costs have been incurred and when recoveries are substantially complete. Banks that do so should estimate the additional costs and recoveries that would likely occur beyond this period and include them in ELGD and LGD estimates. A bank should document its choice of the period of observation, and how it estimated additional costs and recoveries beyond this period.

98. Reference data sets may contain individual loss observations that are less than 0 percent or greater than 100 percent. However, extra diligence is required for loss realizations reported to be less than 0 percent to ensure that economic loss is being measured.<sup>4</sup>

#### Example 1

A bank with internal wholesale data covering the period 1997 through 2003 relies primarily on these data for quantifying its wholesale risk parameter estimates. The bank will continue to extend this internal data set as time progresses. Its current policy mandates that credits be resolved within two years of default, so the data set contains the most recent data available. Although the existing data set satisfies the seven-year requirement for ELGD quantification, the bank is aware that it does not include appropriate economic downturn conditions for certain portfolios. In comparing its loss estimates with rates published in external studies that cover longer time periods and include economic downturn periods for similarly stratified data, the bank observes that its estimates are systematically lower. To be consistent with the NPR, the bank must reflect economic downturn conditions in its ELGD estimates, as such estimates represent the loss the bank expects to incur in the event that the obligor of the exposure defaults within a one-year horizon over a mix of economic conditions, including economic downturn conditions.

#### Example 2

A bank develops evidence that during the 2001 to 2003 period of highly

<sup>4</sup> Banks are not required to truncate the loss severity data used to derive ELGD and LGD parameter estimates. Nonetheless, *final* ELGD and LGD estimates should not be negative or zero. Readers are directed to the discussion of the application stage for ELGD and LGD in a later section of this guidance for elaboration of related supervisory expectations regarding ELGD and LGD quantification.

elevated mortgage prepayments owing to record-low interest rates, losses were likely deferred in mortgage portfolios because of readily available refinancing options. The bank also concludes that losses on foreclosures during this period were limited because housing prices generally increased throughout the United States despite a recession. However, the bank notes that a similar (though not as substantial) drop in interest rates occurred in the early 1990s, during a recession that was characterized by a sharp drop in property values in many parts of the country. Because the recent period may have been atypical, the bank chooses to weigh older data (perhaps from external sources) more heavily than recent data for ELGD quantification. Such an approach to weighting the data would be consistent with this guidance.

99. The following examples illustrate how definitions of default in the reference data that are different from the IRB definition complicate ELGD estimation.

#### Example 1

For ELGD estimation, a bank includes in its default database only exposures that actually experience a loss and excludes exposures for which no loss was recorded (effectively applying a “loss given loss” concept). This practice is not consistent with the NPR because the bank’s default definition is narrower than the IRB definition.

#### Example 2

A bank relies on two external data sources to estimate ELGD because it lacks sufficient internal data. Both sources use definitions that deviate from the IRB definition; one uses “bankruptcy filing” to indicate default while another uses “missed principal or interest payment.” Although the different definitions result in significantly different loss estimates for the loss severity ratings defined by the bank, the bank simply combines the external data sources in deriving its ELGD estimates. The bank’s practice is not consistent with the guidance. The bank should determine the impact on the parameter estimates of the different definitions used in the reference data sets. For minor definitional differences, the bank may be able to make appropriate adjustments during the estimation stage. If the differences are difficult to quantify, an appropriate level of conservatism should be applied or the bank should seek other sources of reference data.

#### B. Estimation

100. Estimation of ELGD and LGD is the process by which characteristics of the reference data are related to loss severity. Relevant characteristics for wholesale exposures might include variables such as seniority, collateral, exposure type, or business line. For retail portfolios, as discussed in Chapter 3, a common ELGD or LGD might be applied so long as the estimate is accurate for each segment and exposures within those segments have homogenous risk characteristics.

101. In estimating ELGD and LGD, banks should identify drivers of loss. One estimation approach is to separate the reference defaults into groups that do not overlap, for example, by business line, predominant collateral type, or loan-to-value coverage. The ELGD estimate for each category could then be based on the default-weighted average economic loss per dollar of EAD, and LGD could be similarly derived using data from periods of economic downturn conditions. In most cases, it will not be acceptable to calculate ELGD as the average of annual loss rates (where loss severity for each year receives equal weight). Years with a relatively large number of defaults generally provide richer data for measuring loss severity compared to years when there are relatively few defaults. Thus, in general, years with a relatively large number of defaults contribute more information and should be appropriately weighted when estimating ELGD. In addition, if years of relatively low default rates typically have relatively low loss severity rates, then using the average of annual loss rates will tend to understate ELGD.

102. A statistical model, for example a regression model using data on loss severity and some quantitative measures of the loss drivers, could be applied to estimate ELGD or LGD. Any model must meet the requirements for validation discussed in Chapter 7. Other methods for estimating ELGD or LGD could also be appropriate.

#### Example 1

To estimate ELGD, a bank uses only internal data. Although information on security and seniority is lacking, no adjustments for the lack of data are made in the estimation or application steps. This practice is not consistent with the guidance because there is ample external evidence that security and seniority are relevant in estimating ELGD. A bank with such limited internal default data must incorporate external or pooled data.

#### Example 2

A bank groups observed defaults in the reference data according to geographic region and collateral. One of the pools has too few observations to produce a reliable estimate. By augmenting the loss data with data from similar geographic regions with the same collateralization, the bank derives an ELGD estimate. Provided the bank can adequately support the process used to establish the relevance of the data from other regions, this approach would be consistent with the guidance.

103. Banks should evaluate adjustments in the ELGD and LGD estimation process to ensure that they do not result in an overall bias toward lower estimates of risk.

#### Example 1

A bank is unable to properly discount a segment’s cash flows because the reference data do not include the dates of recoveries (and related costs). However, the bank has sufficient internal data to calculate economic loss for defaulted exposures in another portfolio segment. The bank can support the assumption that the timing of cash flows for the two segments is comparable. Using the available data and informed judgment, the bank adjusts the estimates for the data-poor segment to reflect how much the measured loss without discounting should be grossed up to account for the time value of money and the distressed nature of the assets. This practice is consistent with the guidance.

#### Example 2

Collateral is one factor used by a bank to estimate ELGD. Although the available internal and external data indicate a higher ELGD, the bank judgmentally assigns a loss estimate of 2 percent for exposures secured by cash collateral. The bank contends that the lower estimate is justified because it expects to do a better job of following policies for monitoring cash collateral in the future. Such an adjustment is generally not appropriate because it is based on projections of future performance rather than realized experience. This practice generally is not consistent with the guidance.

#### **S 4-19 ELGD and LGD estimates must be empirically based and must reflect the concept of “economic loss.”**

104. ELGD and LGD are based on the concept of economic loss, which is a broader, more inclusive concept than accounting measures of loss. Broadly speaking, economic loss incorporates the mark-to-market loss of value of a defaulted exposure and collateral,

including material accrued but unpaid interest or fees, and all material direct and indirect costs of workout and collections, net of recoveries. Losses, recoveries, and costs should all be discounted to the time of default. See the fourth paragraph of the LGD definition in section 2 of the NPR for the definition of economic loss.

105. Banks often estimate loss using data on costs and recoveries from workouts of defaulted exposures; however, appropriate estimates may sometimes be developed using market data on defaulted exposures.

106. The scope of cash flows included in recoveries and costs is meant to be broad. Material recovery costs that can be clearly attributed to certain exposures, plus material indirect cost items, must be reflected in the bank's ELGD and LGD assignments for those exposures. Recovery costs include the costs of running the bank's collection and workout departments and the cost of outsourced collection services directly attributable to recoveries during a particular time or for a particular segment or portfolio, at as granular a level as possible. Recovery costs also include an appropriate percentage of other ongoing costs, such as overhead.

107. Recovery costs can be allocated using the same principles and techniques of cost accounting that are usually used to determine the profit and loss of activities within any large enterprise. Collection and workout departments, however, may cover services not 100 percent attributable to defaulted exposures. For example, the same call center may manage reminder calls to delinquent retail accounts, many of which will never default, as well as collection calls. The expenses for these functions should be differentiated to allocate only collection expenses attributable to defaulted exposures.

108. When costs cannot be allocated because of data limitations, the bank may assign those costs using broad averages. For example, the bank could allocate costs by outstanding dollar amounts of loans, including accrued but unpaid interest or fees at the time of default, within each rating grade or segment.

109. All costs, and recoveries should be discounted to the time of default using the time interval between the date of default and the date of the realized loss, incurred cost, or recovery; this calculation should be on a pooled basis for retail exposures. The discount rate should reflect the costs of holding defaulted assets over the workout period, including an appropriate risk

premium.<sup>5</sup> As such, an appropriate discount rate will reflect the uncertainty of recovery cash flows and the presence of undiversifiable risk.

**S 4-20 ELGD estimates must reflect the expected default-weighted average economic loss rate over a mix of economic conditions, including economic downturn conditions.**

110. For wholesale exposures, ELGD is the best estimate of the economic loss per dollar of EAD that would be incurred in the event that the obligor (or a typical obligor in the applicable loss severity rating) defaults within a one-year horizon. For retail segments, ELGD is the best estimate of the economic loss per dollar of EAD that would be incurred on the segment from exposures that default within a one-year horizon.

111. ELGD estimates should reflect expected long-run loss severities and should represent an estimate of the default-weighted average economic loss as observed over a complete credit cycle. Similar to PD quantification, loss severity data must include periods of economic downturn conditions or the bank must adjust its estimates to compensate for the lack of data from economic downturn conditions.

**Economic Downturn LGD**

**S 4-21 LGD estimates must reflect expected loss severities for exposures that default during economic downturn conditions, and must be greater than or equal to ELGD estimates.**

112. In addition to ELGD, banks must quantify LGD in a way that appropriately reflects downturn conditions for each wholesale exposure and for each retail segment. LGD is an estimate of the percentage of EAD that would be lost in the event of a default during the one-year horizon, if that default were to occur during a period of economic downturn. Under economic downturn conditions default rates are higher than under more neutral conditions, and LGD estimates must reflect expected loss rates resulting from downturn conditions.

113. If a bank obtains supervisory approval to use its own estimates of LGD for an exposure subcategory, it must use internal estimates of LGD for all exposures within that subcategory. Within retail, the three subcategories are residential mortgage, QRE, and other retail, while within wholesale credit the two subcategories are high-volatility commercial real estate ("HVCRE") and all other wholesale.

<sup>5</sup> This implies that the appropriate discount rate for IRB purposes likely will differ from the interest rate required under FAS 114 for accounting purposes.

114. If a bank has not received prior written approval from its primary Federal supervisor to use internal LGD estimates, the bank must use the supervisory mapping function. The supervisory mapping function calculates LGD by taking 92 percent of the ELGD and adding eight percentage points to that result.

115. The LGD estimate for an exposure or segment may never be less than the ELGD assigned to that exposure or segment, and must be higher than ELGD if a higher estimate is appropriate based on robust analysis of the impact of economic downturn conditions on loss severity. The LGD for some exposures or segments may be substantially higher than ELGD, while for others it may not.

**S 4-22 A bank may use internal estimates of LGD only if supervisors have previously determined that the bank has a rigorous and well-documented process for assessing the effects of economic downturn conditions on loss severities and for producing LGD estimates consistent with downturn conditions. The process must appropriately identify downturn conditions, identify the impact of economic downturn conditions on loss rates, identify any material adverse correlations between drivers of default and LGD, and incorporate any identified correlations and/or downturn impact into the quantification of LGD.**

116. In determining whether to approve a bank's use of internal estimates of LGD for a subcategory of exposure, supervisors will consider whether the process for generating LGD estimates is consistent with the supervisory standard above and produces internal estimates of LGD that are reliable and sufficiently reflective of economic downturn conditions.

117. To meet the requirements for internal estimates, a bank should satisfy the following conditions:

- The bank should establish policies to govern the process for identifying downturn conditions and generating LGD estimates. The policy should address:
  - Criteria for identifying downturn conditions;
  - The level of product and geographic scope to be used for identification of economic downturn conditions;
  - Data requirements;
  - Methods to determine the impact of downturn conditions on loss severities; and
  - Quantification methodologies to produce LGD estimates.
- The bank must have a rigorous quantification process (covering all stages of quantification, including

reference data, estimation, mapping, and application) for estimating LGD. The bank must be able to identify economic downturns, determine the impact of downturn conditions on loss severities, and appropriately quantify LGD.

118. In principle, quantification of LGD is no different from quantification of any other IRB risk parameter. The target of the quantification process is different, but the stages of quantification (data, estimation, mapping, and application) apply to LGD just as they do to other risk parameters such as PD and ELGD. However, the details necessarily differ; the remainder of this section discusses supervisory standards related to quantification of own-estimates of LGD to reflect economic downturn conditions.

#### *Identifying Economic Downturn Conditions*

119. To identify periods of downturn conditions, the bank should first articulate both product and geographic scope, since default rates for different types of exposures in different areas are themselves likely to differ. At the product level, the highest level of aggregation is a given IRB subcategory of exposure (*i.e.*, residential mortgage, QRE, other retail, HVCRE, and all other wholesale). Thus, for example, downturn conditions for wholesale exposures other than HVCRE are defined as periods of high default rates for non-HVCRE wholesale exposures in general. A bank may choose to use lower levels of aggregation in order to achieve better measurement of actual credit risk and greater risk sensitivity. For example, a bank with an industry concentration in a subcategory of exposures (such as corporate exposures to technology companies) may find that information relating to a downturn in that industry sector may be more relevant for the bank than a general downturn affecting many regions or industries.

120. The geographic scope for identification of economic downturn conditions is the geographic “footprint” of the bank within an exposure subcategory, that is, the geographic area from which exposures of each type are drawn (or can be expected to be drawn customarily). This “footprint” need not be the same for each subcategory of exposures. Banks are not required to further subdivide with regard to geography; for example, if a bank’s HVCRE exposures are drawn from two distinct regions such as the Southeast and the Northeast, they may define a downturn in HVCRE as a period of significantly above-average default rates

in HVCRE for the two regions jointly, rather than considering each separately. Nonetheless, as is the case with product scope, banks are permitted to further subdivide geographically if they choose to do so.

121. The exception to the “footprint” scope is that separate countries must be treated separately. For example, a bank with residential mortgage exposures in the United States and Japan must separately identify the conditions under which residential mortgage default rates would be significantly higher than average in each national jurisdiction.

122. Given these requirements for product and geographic scope, downturn conditions with respect to a wholesale exposure or retail segment are defined as those conditions under which the aggregate default rate for the exposure’s wholesale or retail exposure subcategory (or subdivision of such subcategory selected by the bank) within the related geographic footprint and/or jurisdiction (or finer subdivision selected by the bank) would be significantly higher than average.

123. It may be useful to distinguish this definition of economic downturn from other definitions that might seem reasonable. For example, an economic downturn for purposes of LGD estimation is *not* defined as a period of high loss severity, that is, a period in which realized losses given default are high. Loss severities may be high during an economic downturn—indeed, that is the primary motivation for the separate estimation of economic downturn LGD—but this is not the defining characteristic; high realized loss severity rates do not *define* a downturn. Similarly, economic downturns are *not* defined as periods of depressed collateral values, although collateral values may be low when default rates are high. Finally, economic downturn conditions for purposes of LGD estimation are *not* defined as periods of poor economic performance as determined by other measures such as GDP growth or other traditional measures of business conditions and economic climate. Traditional measures of economic activity may indeed show weakness during periods corresponding to “economic downturn conditions” as defined for purposes of LGD estimation, but a period of weak economic activity does not in and of itself indicate the existence of economic downturn conditions as defined in the NPR. Economic downturn conditions are identified only through reference to default rates for exposure subcategories within relevant geographic regions.

#### *Estimation of LGD*

124. Once relevant downturn conditions are identified, a bank must determine the impact of such conditions on loss severities and construct appropriate estimates of LGD under economic downturn conditions for each wholesale loss severity rating grade or exposure and each retail segment. LGD should be the empirically based best estimate of the loss severity as a percentage of exposure if the obligor were to default during economic downturn conditions. Note that although estimates are empirically based, the purpose of quantification is not to measure past patterns and dependencies, but to generate predictions of likely future outcomes.

125. Banks may choose to focus the quantification process on LGD directly. However, in many cases it may be more practical to estimate the extent to which loss rates can be expected to exceed ELGD under economic downturn conditions, through estimation of the difference (LGD–ELGD) or estimation of the percentage increase in the loss rate, or perhaps through some other translation of ELGD into LGD. In that case, the result of one estimation process—that for ELGD—is used an input to the LGD estimation process, and any evaluation of the robustness of LGD estimates would have to adequately consider the potential modeling error and estimation error introduced by their reliance on ELGD as a key input.

126. Identification of the impact of economic downturn conditions on LGD, and incorporation of that impact into LGD estimates, requires suitable design of all stages of the quantification process. No single approach is presumed to be correct, and there are many alternative approaches that, if properly carried out, could satisfy the supervisory requirements for use of internal estimates of LGD. Several examples, while not intended to be exhaustive, can serve to illustrate the point.

#### *Example 1*

A bank estimates a relationship between loss rates and a set of independent variables or risk drivers that is robust over periods covering a wide range of conditions, including economic downturns. The bank determines that the main impact of an economic downturn on LGD arises through changes in certain risk drivers (such as collateral values) under economic downturn conditions. The bank quantifies LGD through a process similar to a stress test, with the

identified drivers of loss severity stressed to the values they would assume under economic downturn conditions, based on historical observations.

#### Example 2

A bank conducts rigorous analysis to construct a model linking risk drivers for LGD to variables that characterize economic downturn conditions, including underlying economic variables and the way those variables tend to change in a downturn. The bank uses that model to directly simulate the impact of downturn conditions on LGD rather than using downturn values for the variables that tend to determine loss severity rates under more normal conditions.

#### Example 3

A bank determines that the impact of economic downturn conditions on LGD arises from a fundamental change in the relationship between risk drivers and LGD during a downturn. That is, the bank finds that loss severities rise in a downturn because certain risk drivers or variables that have an impact on losses, such as collateral type or seniority, have a different quantitative influence on loss severity during a downturn than during other periods. The bank estimates a relationship between loss severity rates and risk driving variables using data from periods of economic downturn conditions.

The approaches briefly described in the examples above also require careful consideration of appropriate mapping, since use of an estimated relationship between LGD and any other variables or risk drivers would require mapping of currently observed values of those variables for exposures, rating grades, or segments to the corresponding values of those drivers during economic downturn conditions.

#### Example 4

A bank conducts a rigorous comparison of average recovery rates with recovery rates observed during appropriately identified downturn periods, finding that the impact of economic downturn conditions can be characterized as a fixed, across-the-board reduction in recovery rates. The bank is able to provide evidence that this relationship is statistically robust, and superior to other approaches to LGD quantification. The bank uses the implied, empirically based adjustments in the application stage of the LGD quantification process to reflect the impact of economic downturns.

### C. Mapping

127. ELGD and LGD mapping follows the same general standards as PD mapping. A mapping should be plausible and should be based on a comparison of loss severity-related data elements common to both the reference data and the existing portfolio. The mapping approach is expected to be unbiased, such that the exercise of judgment does not consistently lower ELGD and LGD estimates. The default definitions in the reference data and the existing portfolio of exposures should be comparable, as should be the methods of recovery. The mapping process should be updated regularly, well-documented, and independently reviewed.

128. Mapping involves matching exposure-specific data elements available in the existing portfolio to the factors in the reference data set used to estimate expected loss severity rates. Examples of factors that influence loss rates include collateral type and coverage, seniority, industry, and location. Reference data often do not include workout costs and will often use different discount rates. Judgmental adjustments for such differences should be well-documented and empirically based to the extent possible.

129. Different data sets and different approaches to ELGD and LGD estimation may be appropriate, especially for different business segments or product lines. Each mapping process must be specified and documented.

### D. Application

130. At the application stage, banks apply the ELGD and LGD estimation framework to their existing portfolio of credit exposures. This step might require banks to aggregate retail segment-level ELGD and LGD estimates derived from more granular reference data into estimates applicable to broader segments in the existing portfolio, to aggregate individual wholesale ELGD and LGD estimates into discrete loss severity ratings, or to combine estimates.

131. The inherent variability of recovery, due in part to unanticipated circumstances, demonstrates that no exposure type is risk-free, regardless of structure, collateral type, or collateral coverage. The existence of recovery risk dictates that the application stage should result in an ELGD and LGD above 0 percent. As was discussed in the data section, a data set may include observations with negative realized loss rates. Although these transactions may be included in the ELGD and LGD

estimation process, no exposure or rating grade should be assigned an ELGD or LGD estimate that is less than or equal to zero percent for purposes of risk-based capital calculations.

132. The LGD (*i.e.*, the economic downturn loss estimate) for each segment of residential mortgage exposures (other than segments of residential mortgage exposures for which all or substantially all of the principal of each exposure is directly and unconditionally guaranteed by the full faith and credit of a sovereign entity) may not be less than 10 percent.

### IV. Exposure at Default (EAD)

133. As EAD quantification is somewhat less advanced than other areas of quantification, it is addressed in somewhat less detail in this guidance. Banks should continue to innovate in the area of EAD estimation, refining and improving practices in EAD measurement.

134. A bank must provide an estimate of EAD for each exposure in its wholesale portfolio and for each segment in its retail portfolio. For fixed exposures like term loans, EAD is equal to the carrying value unless there is an allocated transfer risk reserve for the exposure or the exposure is held available-for-sale. For variable exposures such as loan commitments, revolving exposures and other lines of credit, EAD for each exposure includes the outstanding balance at the point of capital measurement plus an estimate of net additions to the total balance due, including estimated future additional advances of funds, including principal and accrued but unpaid interest and fees that are likely to occur before and after default assuming that the exposure were to default within a one-year horizon. The estimate of net additions must reflect what would be expected during a period of economic downturn conditions.

135. Refer to Chapter 9 of this guidance and the NPR for guidance on quantifying EAD for OTC derivative contracts, repo-style transactions, and eligible margin loans.

136. For retail and wholesale exposures in which only the drawn balance has been securitized (*e.g.*, a typical credit card securitization), the bank must reflect its share of the exposures' undrawn balances in EAD. The undrawn balances of exposures for which the drawn balances have been securitized must be allocated between the seller's and investors' interests on a pro rata basis, based on the proportions of the seller's and investors' shares of the securitized drawn balances.

137. A number of methods can be used to estimate EAD. One common approach is based on loan equivalent exposure ("LEQ"), which is typically expressed as a percentage of the current total committed but undrawn amount.<sup>6</sup> EAD can thus be represented as:

$$\text{EAD} = \text{current outstanding} + \text{LEQ} \times (\text{total committed} - \text{current outstanding})$$

#### A. Data

138. Like reference data sets used for ELGD and LGD estimation, EAD data sets typically contain only exposures to defaulted obligors, although data on troubled non-defaulted obligors also could be informative in estimation of these parameters. The same reference data are often used for ELGD, LGD and EAD quantification. In addition to relevant descriptive characteristics (referred to as "drivers") that can be used in estimation, the reference data must include historical information on the exposure (both drawn and undrawn amounts) as of some date prior to default, as well as the drawn exposure at the date of default.

139. As discussed below under "Estimation," EAD estimates may be developed using either a cohort method or a fixed-horizon method. The bank's reference data set should be structured so that it is consistent with the estimation method the bank applies. Thus, the data should include information on the total commitment, the undrawn amount, and the exposure drivers for each defaulted exposure, either at fixed calendar dates for the cohort method or at a fixed interval prior to the default date for the fixed-horizon method.

140. The reference data should contain variables that enable the bank to group the exposures to defaulted obligors in meaningful ways. Banks should consider how a wide range of obligor and exposure characteristics affect EAD. Examples include time from origination, time to expiration or renewal, economic conditions, risk rating changes, or certain types of covenants. Some potential drivers may be linked to a bank's credit risk management skills, while others may be external to the bank.

#### B. Estimation

141. To derive EAD estimates for lines of credit and loan commitments, characteristics of the reference data are related to additional drawings on an exposure up to and after the time a default event is triggered. Estimates of any additional extensions of credit

expected by a bank subsequent to realization of a default event should be factored into the quantification of EAD. The estimation process should be capable of producing a plausible average estimate of draws on unused available credit (e.g., LEQ) to support the EAD calculation for each exposure or retail segment.

#### Example

A bank determines that a business unit forms a homogeneous pool for the purposes of estimating EAD. That is, although the exposures in this pool may differ in some respects, the bank determines that the credit lines share a similar drawdown experience in default. The bank should provide reasonable support for this pooling through analysis of lending practices and available internal and external data.

142. Two broad types of estimation methods are used in practice, the cohort method and the fixed-horizon method.

143. Under the cohort method, a bank groups defaults into discrete calendar periods, such as a year. A bank may use a longer period if it provides a more accurate estimate of future gross losses arising from undrawn exposures. For retail exposures, the bank estimates the relationship between the balances for defaulted exposures at the start of the calendar period and at the time at default. For wholesale exposures, the bank estimates the relationship between the drivers as of the start of that calendar period and LEQ for each exposure to a defaulter. For each exposure category or retail segment (that is, for each combination of exposure drivers identified by the bank), an LEQ estimate could be based on the mean additional drawing for exposures in that category or segment as a proportion of the undrawn lines. One approach to combine results for multiple periods into a single long-run average would be weighting the period-by-period means by the proportion of defaults occurring in each period, so that each default receives equal weight.

144. Under the fixed-horizon method, for each defaulted exposure the bank compares additional drawdowns to the gross committed but undrawn amount that existed at a fixed date prior to the date of the default (the horizon). For example, the bank might base its estimates on a reference data set that supplies the actual amount outstanding and any additional extensions along with the drawn and undrawn amounts (as well as relevant drivers) at a date a fixed number of months prior to the date of each default, regardless of the actual calendar date on which the default occurred. Estimates of LEQ for

wholesale exposures are computed from the average drawdown proportions that occur over the fixed-horizon interval, for whatever combinations of the driving variables the bank has determined are relevant for explaining and predicting EAD. LEQs estimated for retail segments are computed from the increase in balances that occur over the fixed-horizon interval for the defaults in the segment relative to their credit limits. The time interval used for the fixed-horizon method should be sufficiently long to capture the additional drawdowns generated by exposures that default during the year for which the risk parameters are being estimated. In particular, the appropriate fixed interval will be influenced by charge-off policies. For example, using a six-month time interval for credit card loans would underestimate EAD.

#### Special Considerations for Retail EAD Estimation

145. Different methods are used to estimate EAD for open credit lines. The LEQ method outlined in this guidance is one technique observed in practice. Other methods directly estimate the defaulted balances for a segment over a one-year window without taking the committed line limit into account. These other methods may be acceptable if the bank could show that the size of the line is not relevant given the other risk factors used in the analysis.

146. EAD for a segment should accurately estimate the total exposure at default for the segment. Poor segmentation may result in inaccurate EADs. For example, if loans within a segment do not have homogenous risk characteristics because larger exposures are more likely to default than smaller exposures, then estimated EADs may be biased downward.

#### **S 4-23 Estimates of additional drawdowns must reflect net additional draws expected during economic downturn periods.**

147. Conceptually, banks should approach EAD quantification in a fashion parallel to LGD quantification with respect to the potential for volatility over the economic cycle. Specifically, estimates of net additional drawdowns should reflect what would be expected during economic downturn periods. Certain exposure types may not exhibit cyclical EAD variability; in these cases, use of a long-run default-weighted average draw proportion used to derive EAD in the IRB risk-based capital calculation is appropriate. But for exposure types for which drawdowns are expected to be larger when default rates are significantly higher than average EAD—estimates

<sup>6</sup> This is frequently referred to as the credit conversion factor (CCF).

should take into account this cyclical variability. In such cases, the estimated draw proportion used to derive the EAD input to the risk-based capital calculation should exceed the long-run default-weighted average, and should be the bank's estimate of the net additional drawdown proportion per default expected during economic downturn conditions. For this purpose, banks may use averages of EADs observed during economic downturn periods, forecasts based on appropriately conservative assumptions, or other similar methods.

### C. Mapping

148. If the characteristics that drive EAD in the reference data are the same as those used for the risk rating or segmentation system of the bank's existing portfolio, mapping may be relatively straightforward. However, if the relevant characteristics are not available in a bank's existing portfolio, the bank will encounter the same mapping complexities that it does when mapping PD, ELGD, and LGD in similar circumstances.

### D. Application

149. In the application stage, the estimated relationship between risk drivers and EAD is applied to the bank's existing portfolio. Multiple reference data sets may be used for EAD estimation and combined at the application stage, subject to the general standards for using multiple data sets.

#### **S 4-24 Estimates of additional drawdowns prior to default for individual wholesale exposures or retail segments must not be negative.**

150. Analogous to the prior discussion of ELGD and LGD quantification, reference data sets used for estimation of additional drawdowns may contain individual negative drawdown observations and observations that exceed 100 percent of the undrawn line amount. Regardless, final estimates of additional drawdowns prior to default for individual wholesale exposures or retail segments must not be negative.

### V. Maturity (M)

151. A bank must assign an effective maturity ("M") to each wholesale exposure in its portfolio; this measure is also referred to as "average life." In general, M is the weighted-average remaining maturity, measured in years, of the cash flows that the bank expects under the contractual terms of the exposure, using the undiscounted amounts of the cash flows as weights. Alternatively, a bank may apply the nominal remaining maturity, measured in years, of the exposure. M is a direct

calculation; as such it is not subject to the four stages of the quantification process.

152. The data required to calculate M are the undiscounted amount and timing of each remaining contractual cash flow, measured in years from the date of the calculation. Specifically, M is calculated as the sum of all time-weighted cash flows, where the weights are equal to the fraction of the total undiscounted cash flow to be received at each date.

#### Example

A bank holds an asset with two remaining contractual cash flows. 33 percent of the total remaining contractual cash flow is expected at the end of one year and the other 67 percent is expected two years from today. For risk-based capital purposes, M for this asset could be calculated as:  $M = (1 \times 0.33) + (2 \times 0.67) = 1.67$ ; or simply  $M = 2$ , applying the nominal remaining contractual maturity.

153. The relevant cash flows are the future payments the bank expects to receive from the obligor, regardless of form; they may include payments of principal, interest, fees, or other types of payments depending on the structure of the transaction.

154. For exposures with pre-determined cash flow schedules (fixed-rate loans, for example), the calculation of the weighted-average remaining maturity is straightforward, using the scheduled timing and amounts of the individual undiscounted cash flows. Cash flows associated with other types of credit exposures may be less certain. In such cases, the bank should establish a method of projecting expected cash flows. In general, the method used for any exposure should be the same as the one used by the bank for purposes of valuation or risk management. The method should be well-documented and subject to independent review and approval. A bank should demonstrate either that the method used is standard industry practice, or that it is widely used within the bank for purposes other than risk-based capital calculations. A bank may use its best estimate of future interest rates to compute expected contractual interest payments on a floating-rate exposure, but it may not consider expected but non-contractually required returns of principal when estimating M.<sup>7</sup>

<sup>7</sup> Question 31 in the NPR requests comment on the appropriateness of permitting a bank to consider prepayments when estimating M, and on the feasibility and advisability of using discounted (rather than undiscounted) cash flows as the basis for estimating M.

155. To be conservative, a bank may set M equal to the maximum number of years the obligor could take to fully discharge the contractual obligation (provided that the maximum is not longer than five years, as noted below). This maximum will often correspond to the stated or nominal maturity of the instrument. Banks should make this conservative choice (maximum nominal maturity) if the timing and amounts of the cash flows on the exposure cannot be projected with a reasonable degree of confidence.

156. For repo-style transactions, eligible margin loans and over-the-counter derivatives contracts subject to qualifying master netting agreements, the bank may compute a single value of M for the transactions as a group by weighting each individual transaction's effective maturity by that transaction's share of the total notional value subject to the netting agreement, and summing the result across all of the transactions.

157. For risk-based capital calculations, the value of M for any exposure is subject to certain upper and lower limits, regardless of the exposure's actual effective maturity. The value of M should never exceed 5 years. If an exposure clearly has a greater effective maturity, the bank may simply use a value of  $M = 5$  rather than calculating the actual effective maturity.

158. For most exposures, the value of M should be no less than one year. For certain short-term exposures that are not part of a bank's ongoing financing of a borrower and that have an original maturity of less than one year, M must be greater than or equal to one day or to the nominal or effective remaining maturity.<sup>8</sup>

## VI. Special Cases and Applications

### A. Loan Sales

#### **S 4-25 Quantification of the risk parameters should appropriately recognize the risk characteristics of exposures that were removed from reference data sets through loan sales or securitizations.**

159. Loan sales and securitizations can pose substantial difficulties for quantification. For example, PDs might appear disproportionately low if loans are sold before their inherent long-term

<sup>8</sup> Section 31(d)(7) of the NPR defines an exposure that is not part of a bank's ongoing financing of the obligor as one where the bank (1) has a legal and practical ability not to renew or roll over the exposure in the event of credit deterioration of the obligor, (2) makes an independent credit decision at the inception of the exposure and at every renewal or rollover, and (3) has no substantial commercial incentive to continue its credit relationship with the obligor in the event of credit deterioration of the obligor.



risk becomes manifest. Upwardly adjusting risk parameter estimates to account for sales or securitization would be particularly important for a bank that sells off primarily exposures that are performing poorly (for example, delinquent loans).

160. When risk parameter estimates use internal historical data as reference data sets and the potential bias created by loan sales and securitizations is material, the bank should identify, by detailed risk characteristics, the loans sold out of the pool or portfolio. Any potential bias caused by removing these loans should be corrected.

161. For banks with a history of regularly selling or securitizing loans of particular types, long-run performance data may be available from the servicers or trustees. Alternatively, banks may be able to estimate the performance of the loans sold or securitized by constructing comparable reference data sets with similar risk drivers using internal historical data from retained pools or external data.

#### *B. Multiple Legal Entities*

162. Some banks have various portfolios that are centrally managed, even though the exposures are held by multiple legal entities. Certain activities, including ratings activities, segmentation and quantification, can be conducted across multiple legal entities. However, each bank member of the consolidated group must separately ensure that risk parameters assigned to its credit exposures are appropriate on a standalone basis. For example, if a particular bank within the banking group holds exposures with characteristics not representative of the broader consolidated organization (such as credit card loans originated through a specific marketing channel or mortgage loans in a certain location), the bank must ensure the quantification process produces PDs, ELGDs, LGDs, and EADs that reflect the risk associated with the exposures within that legal entity.

163. Each bank (including each depository institution) within a banking group that has centrally managed quantification processes should perform periodic evaluations to confirm that its risk-based capital requirements accurately reflect its risk profile.

#### **Appendix A: Illustrations of the Quantification Process for Wholesale Portfolios**

This appendix provides examples to show how the logical framework described in this guidance, with its four stages (data, estimation, mapping, and application), applies when analyzing

quantification practices. The framework is broadly applicable—for PD, ELGD, LGD or EAD; using internal, external, or pooled reference data; for simple or complex estimation methods—although the issues and concerns that arise at each stage depend on a bank's approach. These examples are intended only to illustrate the logic of the four-stage IRB quantification framework, and should not be taken to endorse the particular techniques presented in the examples.

#### **Example 1: PD Quantification From Bond Data**

- A bank establishes a correspondence between its internal rating grades and external rating agency grades; the bank has determined that its Grade 4 is equivalent to <sup>3</sup>Ba and <sup>1</sup>B on the Moody's scale.
- The bank regularly obtains published estimates of mean default rates for publicly rated Ba and B obligors in North America from 1970 through 2002.
- The Ba and B historical default rates are weighted 75/25, and the result is a preliminary PD for the bank's internal Grade 4 exposures.
- However, the bank then increases the PD by 10 percent to account for the fact that the Moody's definition of default differs from the IRB definition.
- The bank makes a further adjustment to ensure that the resulting rating grade PD is greater than the PD attributed to Grade 3 and less than the PD attributed to Grade 5.
- The result is the final PD estimate for Grade 4.

#### Process Analysis for Example 1:

**Data**—The reference data set consists of issuers of publicly rated debt in North America over the period 1970 through 2002. The data description is very basic: Each issuer in the reference data is described only by its rating (such as Aaa, Aa, A, Baa, and so on).

**Estimation**—The bank could have estimated default rates itself using a database purchased from Moody's, but since these estimates would just be the mean default rates per year for each rating grade, the bank could just as well (and in this example does) use the published historical default rates from Moody's; in essence, the estimation step has been outsourced to Moody's. The 10 percent adjustment of PD is part of the estimation process in this case because the adjustment was made prior to the application of the agency default rates to the internal portfolio data.

**Mapping**—The bank's mapping is an example of a rating grade mapping; internal Grade 4 is linked to the 75/25 mix of Ba and B. Based on the limited

information presented in the example, this step should be explored further. Specifically, the bank should justify the appropriateness of the 75/25 mix.

**Application**—Although the application step is relatively straightforward in this case, the bank does make the adjustment of the Grade 4 PD estimate to give it the desired relationship to the adjacent rating grades. This adjustment is part of the application stage because it is made after the adjusted agency default rates are applied to the internal rating grades.

#### **Example 2: PD Quantification Using a Merton-Type Equity-Based Model**

- A bank obtains a 20-year database of North American firms with publicly-traded equity, some of which defaulted during the 20-year period.
- The bank uses the Merton approach to modeling equity in these firms as a contingent claim, constructing an estimate of each firm's distance-to-default at the start of each year in the database.<sup>9</sup> The bank then ranks the firm-years within the database by distance-to-default, divides the ordered observations into 15 equal groups or buckets, and computes a mean historical one-year default rate for each bucket. That default rate is taken as an estimate of the applicable PD for any obligor within the range of distance-to-default values represented by each of the 15 buckets.
- The bank next looks at all obligors with publicly-traded shares within each of its internal rating grades, applies the same Merton-type model to compute distance-to-default at quarter-end, sorts these observations into the 15 buckets from the previous step, and assigns the corresponding PD estimate.
- For each internal rating grade, the bank computes the mean of the individual obligor default probabilities and uses that average as the rating grade PD.

#### Process Analysis for Example 2

**Data**—The reference data set consists of the North American firms with publicly-traded equity in the acquired database. The reference data are described in this case by a single variable, specifically an identifier of the specific distance-to-default range from the Merton model (one of the 15 possible in this case) into which a firm falls in any year.

**Estimation**—The estimation step is simple: The average default rate is calculated for each distance-to-default

<sup>9</sup> The term "Merton approach" is meant to include any structural credit risk model that values equity as a contingent claim, as promulgated in the seminal work of Merton and Black and Scholes.

bucket. Since the data cover 20 years and a wide range of economic conditions, including downturn conditions, the resulting estimates satisfy the long-run average requirement.

**Mapping**—The bank maps selected portfolio obligors to the reference data set using the distance-to-default generated by the Merton model. However, not all obligors can be mapped, since not all have traded equity. This introduces an element of uncertainty into the mapping that requires additional analysis by the bank: Were the mapped obligors representative of other obligors in the same rating grade? The bank should demonstrate comparability between the publicly-traded portfolio obligors and those not publicly traded. It may be appropriate for the bank to make conservative adjustments to its ultimate PD estimates to compensate for the uncertainty in the mapping. The bank also should perform further analysis to demonstrate that the implied distance-to-default for each internal rating grade represented long-run expectations for obligors assigned to that rating grade; this could involve computing the Merton model for portfolio obligors over several years of relevant history that span a wide range of economic conditions.

**Application**—The final step is aggregation of individual obligors to the rating grade level through calculation of the mean for each rating grade, and application of this rating grade PD to all obligors in the grade. The bank might also choose to modify PD assignments further at this stage, combining PD estimates derived from other sources, introducing an appropriate degree of conservatism, or making other adjustments.

### Example 3: ELGD Quantification From Internal Default Data

- For each wholesale exposure in its portfolio, a bank records collateral coverage as a percentage, as well as which of four types of collateral applies.

- A bank has retained data on all defaulted exposures since 1995. For each defaulted exposure in the database, the bank has a record of the collateral type within the same four broad categories. However, collateral coverage is only recorded at three levels (low, moderate, or high) depending on the ratio of collateral to EAD.

- The bank also records the timing and discounted value of recoveries net of workout costs for each defaulted exposure in the database. Cash flows are tracked from the date of default to a “resolution date,” defined as the point

at which the remaining balance is less than 5 percent of the EAD. A recovery percentage is computed, equal to the value of recoveries discounted to the date of default, divided by the exposure at default.

- For each cell (each of the 12 combinations of collateral type and coverage), the bank computes a simple arithmetic mean realized loss severity percentage as the mean of one minus the recovery percentage. One of the categories has a mean realized loss severity percentage of less than zero (recoveries have exceeded exposure on average), so the bank sets the loss rate at zero.

- The bank assigns each exposure in the existing portfolio to one of the 12 cells based on collateral type and coverage. As its ELGD, the bank applies the mean historical realized loss severity percentage for that cell plus an additional five percentage points to account for the bank’s relatively small number of default observations—in relation to the total number of defaults in the reference data—from years with the largest default rates.

#### Process Analysis for Example 3

**Data**—The reference data is the collection of defaults and associated loss amounts from the bank’s historical portfolio. The reference data are described by the two categorical variables (level of collateral coverage and type of collateral). It would be important to determine whether the defaults over the past few years are comparable to defaults from the existing portfolio. One would also want to ask why the bank ignores potentially valuable information by converting the continuous data on collateral coverage into a categorical variable.

**Estimation**—Conceptually, the bank is using a loss severity model in which 12 binary variables—one for each loan coverage/type combination—explain the percentage loss. The coefficients on the variables are just the arithmetic mean realized loss figures from the reference data.

**Mapping**—Mapping in this case is fairly straightforward, since all the relevant characteristics of the reference data are also in the data system for the existing portfolio. However, the bank should determine whether the variables are being recorded in the same way (for example, using the same definitions of collateral types), otherwise some adjustment might be appropriate.

**Application**—The bank is able to apply the loss severity model by simply plugging in the relevant values for the existing portfolio (or what amounts to the same thing, looking up the cell

mean). The bank’s assignment of zero ELGD for one of the cells merits special attention; while the bank represented this assignment as conservative, the adjustment does not satisfy the supervisory requirement that ELGD must exceed zero. A larger upward adjustment is necessary. Finally, the upward adjustment of the mean historical realized loss severity percentages to account for the relatively small influence of downturn conditions on the realizations may be appropriate but should be the outcome of a well-documented decision process supported by empirical analysis.

### Appendix B: Illustrations of the Quantification Process for Retail Portfolios

#### Example 1: Quantification of Segment PD

A bank that has been making indirect installment loans through furniture stores for a number of years. Seven years of internal data history are available, over a period that includes economic downturn conditions. The bank has segmented this portfolio over the entire period in a consistent manner: By bureau score, internal behavioral score and monthly disposable income. In addition, realized loss severities for this portfolio have demonstrated significant cyclical variability over the period covered by the bank’s data history.

The bank can empirically show that the participating furniture retailers, underwriting criteria, and collection practices have remained reasonably stable over the seven-year period, and the definition of default has been consistent with the IRB definition. However, there are frequent changes in the bank’s products and in the borrowing population that affect the risk characteristics of its loans. Therefore, in quantifying PD the bank assigns more weight to recent data within the seven-year history. The segment PD is calculated as a weighted-average of the seven annual realized historical default rates with the assigned weights progressively lower for the earlier years of the sample.

#### Process Analysis for Example 1

As discussed in the main chapter text, quantification processes need not be explicitly structured as four stages. The four-stage structure is a conceptual framework, and an analytical and implementation guide. However, as in other wholesale and retail examples, this bank’s quantification process for PD can be interpreted in terms of the four-stage framework:

Data—The bank's own seven-year historical data serve as the reference data.

Estimation—Estimation consists of calculating a weighted-average of the annual default rates for each segment in the reference data.

Mapping—Mapping consists primarily of ensuring that the segmentation schemes and the definition of default are consistent for the reference data and the bank's existing portfolio.

Application—Application is a matter of using the PD estimate derived from the reference data for each segment of the existing portfolio in the risk-based capital formulas.

### Example 2: Quantification of PD for First-lien Mortgages

- For the past four years, a mortgage lender has begun making loans in a geographic region that has experienced relatively lower default rates than the bank had experienced previously. The bank has fourteen years of internal data history. The bank has analyzed external mortgage data over the same time period and has identified risk characteristics that vary by geographic region (e.g., volatility of house prices in a region). Analysis of the internal reference data also indicates the importance of these geographic risk factors.

- The recent four-year period does not include economic downturn conditions, so the bank uses its full fourteen years of data history to reflect downturn conditions. To estimate the PD parameter over a long run of data history that is also comparable to the current portfolio, the bank develops a statistical model of the PD based on the combined internal and external performance history. The variables used as PD predictors include geographic risk factors such as the volatility of employment and house prices in the region. The model also includes borrower risk characteristics (credit score, debt-to-income ratio) and loan risk characteristics (loan-to-value ratio and tenor). Models are built for each major product type, such as fixed-rate and adjustable-rate mortgages (FRM and ARM). The model results are robust according to standard statistical diagnostic tests, and the models have continued to perform satisfactorily in validations outside the development sample.

#### Process Analysis for Example 2

Data—The existing portfolio of first-lien mortgages is segmented by region, LTV, credit score, tenor, mortgage type (fixed-rate or ARM), and debt-to-income ratio. For a given segment, the bank has

historical data from its own portfolio. The reference data consist of fourteen years of internal performance history for loans originated between 1990 and 2003. However, only four years of those internal data cover loans for the region of the country where the bank currently has a substantial mortgage portfolio. The internal data are supplemented by external mortgage data over the full fourteen year history (1990–2003).

Estimation—The bank builds a set of statistical models for different product types in the portfolio (e.g., FRM and ARM). The models estimate segment PD as a function of the loan-to-value ratio, credit score, debt-to-income ratio, loan tenor, and measures the volatility of regional employment and house prices. The model is estimated on both the internal and external data.

Mapping—Since the bank shifted a significant amount of its first-lien mortgage business to a different region of the country with generally lower default rates starting only in 2000, the bank has only four years of internal historical data (2000–2003) reflecting the performance of its mortgage business in the new region. Its older internal data from 1990 to 1999 represent credit performance in higher-risk regions. Therefore, the bank does not have sufficient historical data representing its current mortgage business to map directly, segment by segment, to estimate the PDs of the existing portfolio on the basis of the long-run average of the annual default rates of the comparable segments in the reference data.

Instead, the bank has adopted the technique of building default prediction statistical models, based on internal and external data from the entire fourteen year history (before and since the change in the regional focus of the business in 2000) and using as causal, or independent, variables the risk drivers of mortgage default, including regional risk factors.

In this framework, mapping consists of ensuring that the segmentation systems and definition of default for the two data historical data sets and the existing portfolio are all consistently applied in the process of deriving the values of the risk drivers used as inputs to the statistical models for each segment of the existing portfolio.

Application—Application consists of using the estimated segment PDs produced by the statistical models as inputs into the residential mortgage formula for risk-based capital.

### Example 3A: PD Estimation in Dollar Terms

The text defines both the historical default rate and estimated PD in unit, or account, terms. That is, the number of defaults in a segment as a proportion of the number of exposures on the balance sheet at the beginning of the time period under analysis.

- Many banks, however, prefer to, or have historically calculated the default rate in terms of dollar losses. This example shows that it is possible to derive PDs from dollar loss rates that will equal the required unit-or account-based default rates. However, a bank choosing to derive a default rate or PD in this manner must segment its portfolio properly and in a sufficiently granular manner, and must ensure that its estimates of EAD are accurate. A credit card bank directly measures its average dollars of economic loss for each segment and uses the percentage of dollars defaulted, rather than the percentage of loans defaulted, to derive the estimate of PD. Specifically, the ratio employed is the gross dollar loss divided by the exposure at default (EAD) over a one-year time horizon. The bank estimates EAD for a segment as the current outstanding balances plus the expected drawdowns on open lines (including accrued but unpaid interest and fees at the time of default) if all accounts in the segment default.

- The bank uses the appropriate IRB definition of default.
- The bank segments exposures by size of credit line and credit line utilization as well as by credit score.
- The bank regularly validates the accuracy of the EAD estimates and the consistency of the percentage-of-dollars-defaulted measure with the account-based default rate.

#### Process Analysis for Example 3A

Data—The historical reference data consist of measurements of the outstanding dollar balances and open credit lines for each segment at the beginning of the year. For accounts that defaulted over the following year, the gross defaulted balances (including accrued interest and fees) are also measured. The bank also tracks the number of accounts open at the beginning of the year in each segment and the number that default.

Estimation—The bank's PD parameter is estimated as the long-run average of the one-year realized default rates in dollar terms, that is the gross balances of defaulted loans divided by the estimated EAD.

The following table shows two segments of card exposures, both with

estimated default rates of 1 percent as measured from a single year of the historical reference data in the required manner in terms of numbers of accounts. In this case, the portfolio was

segmented by average outstanding dollar balance and by average credit line per account. In addition, the EADs were estimated separately and accurately<sup>10</sup> at the segment level, with the result that

the dollar-denominated default rate (gross dollar loss / EAD) is equal to the unit-or account-measured PD.

Segment	Number of Accounts in Segment	Number of Accounts that Defaulted	Required Default Rate (Unit-based)	Average Outstanding Balance per Account	Average Credit Line per Account	Total Segment Outstanding Balance	Total Segment Undrawn Lines	Estimated Segment LEQ	Estimated Segment EAD	Segment Gross Loss	Estimated Dollar-based Default Rate = Gross Loss / EAD
1	200	2	1.0%	\$150	\$400	\$30,000	\$50,000	0.9	\$75,000	\$750	1.0%
2	1800	18	1.0%	\$300	\$800	\$540,000	\$900,000	0.6	\$1,080,000	\$10,800	1.0%

However, banks that attempt to estimate default rates or PDs in dollar terms from their historical reference data are often not as accurate as the example above, and they arrive at incorrect values. Most often, this results from insufficiently granular segmentation and consequent inaccuracy in the estimation of EADs.

Because of the difficulties often encountered in dollar-denominated default and PD estimates, banks that choose this method should periodically demonstrate, as part of the validation of their PD quantification, that the dollar-derived PDs are essentially equal to those derived using an account-based definition.

Mapping—Mapping involves linking segments in the reference data to segments in the existing portfolio based on the same drivers of default risk and drawdowns.

Application—Application is generally a straightforward process, linking the estimates from segments in the reference data to segments in the existing portfolio.

**Example 3B: Another Case of Dollar Estimates of PD**

Once again, a bank prefers to calculate default rates or PDs in dollar terms. However, this example is based on fixed loans rather than revolving lines of credit such as the credit cards in the previous example. Because of a critical segmentation factor, the dollar-based default rates will rarely if ever equal the correct unit- or account-based rates.

- Using the cohort method for EAD discussed in the main chapter text, a bank calculates default rates or PDs as the accumulated gross dollar losses for each segment over the course of a year divided by the total outstanding dollar balances of the segment at the beginning of the year.<sup>11</sup>
- The bank uses the appropriate IRB definition of default.
- The bank’s segmentation is not particularly granular and uses few risk drivers, such that the average balance for those accounts defaulting tended to be much greater than those that did not.

Process Analysis for Example 3B

Data—The bank has 5 years of internal data history for this particular

portfolio, including numbers and dollar balances of accounts at the beginning of each year and the number and dollar balances of defaulted accounts in the course of each year. The data include economic downturn conditions.

Estimation—Because of the inadequate degree of granularity, the average January 1 dollar balances of accounts that ultimately defaulted at any time within the following year typically exceeded the beginning balances of accounts that did not default. In this case, the dollar-denominated PD (gross dollar losses divided by total beginning outstanding balances) consistently overestimated the correct (unit-based) PD. (See first line of table below, representing a single year in the historical reference data.) Conversely, if the beginning balances of accounts that ultimately defaulted were smaller than those that did not default within the following year, an unusual situation, this measure consistently underestimated PD. (See second line of table.)

Segment	Number of Accounts in Segment	Number of Accounts that Defaulted	Required Default Rate (Unit-based)	Total Segment January 1st Beginning Outstanding Balances	Average Beginning Outstanding Balance for Loans that Defaulted During Year	Average Beginning Outstanding Balance for Loans that Did Not Default	Total Segment Gross Losses	Estimated Dollar-based Default Rate = Gross Loss / EAD
1	1000	20	2.0%	\$1,000,000	\$1,245	\$995	\$24,900	2.5%
2	1000	20	2.0%	\$1,000,000	\$755	\$1,005	\$15,100	1.5%

Mapping and Application—Since the estimation stage using this approach is very likely to be flawed, the quantification should not proceed to the mapping and application stages. Rather, the bank should revise its estimation to employ the required unit-or account-based methods of calculating historical default rates and of estimating PDs before proceeding to mapping and application.

**Example 4: PD Quantification With Adjustments for Seasoning**

- Realized default rates for a bank’s credit card portfolio exhibit a characteristic time profile by age—a “seasoning curve.” Using data from the past five years, including economic downturn conditions, the bank estimates the shapes of a family of “seasoning curves for specific products,

loan characteristics, and borrower credit quality at origination.

- The bank presents analyses indicating that the seasoning curves can be reasonably specified by borrower credit quality at origination, and the bank regularly analyzes new cohorts to capture any changes in the curves over changing economic and market environments. Systematic changes are incorporated into new seasoning curves.

<sup>10</sup>In this example, EADs are estimated by way of the LEQ ratio. As discussed in the main chapter

text, this is only one method of estimating EAD currently in use.

<sup>11</sup>For simplicity, we assume no amortization of principal over the course of the year.

- The portfolio is segmented by borrower, product, and loan characteristics, including account age, or “time on books.”

#### Process Analysis for Example 4

Data—The reference data consists of five years of portfolio history, including economic downturn conditions. Supplemental data from earlier periods for similar products, borrower credit quality at origination, and loan type permit the estimation of annualized default rates over the remaining expected life of the loans.

Estimation—It is necessary to calculate two different PDs for each segment of the portfolio: (1) The long-run average of one-year default rates from the historical reference data, in the same manner as for wholesale PDs, and (2) the estimated annualized cumulative default rate (“ACDR”) over the remaining expected life of the loans in the segment.

If the ACDR is larger than the long-run average of one-year rates, then seasoning effects for this segment are deemed to be material, and the ACDR must be used as the estimated segment PD.<sup>12</sup>

For example, if the expected remaining life for a segment of cards that has been on the books for one year, based on historical data for defaults and attrition, is six years, and the estimated cumulative default rate over that period is five percent, the  $ACDR = 5/6 = 0.833$ . If, for the same segment, the five-year average of annual default rates from the historical reference data set is 0.75, then seasoning effects are deemed to be material and the bank must use 0.833 as the PD estimate for the coming (2nd) year.

Mapping—The segmentation of the existing portfolio is the same as that employed for the reference data. This makes the mapping straightforward along the lines of product and loan characteristics and borrower credit quality.

Application—At the application stage, either the ACDR or the long-run average default rate estimated from the reference data is applied as the estimated PD to the segments in the existing portfolio respectively, depending on whether or not seasoning effects are deemed to be material.

<sup>12</sup> If the bank intends to sell or securitize the exposures in the segment within a 90-day time frame, the “wholesale” PD can be used even if the ACDR is greater than the long-run average. See the main chapter text for more details.

#### Example 5: Guarantees for retail exposures

##### *Guarantees on individual retail exposures*

The following are examples of retail guarantees that would qualify under Standard 4–4:

- Consider an exposure of \$85,000 secured by property valued at \$100,000. The guarantee covers all losses up to \$85,000.
  - The guarantee covers a pre-specified dollar amount of losses less than \$85,000, for example a first loss position of \$20,000.
  - The guarantee covers a pre-specified pro rata (or proportional) share of all losses, for example up to 20 percent of the \$85,000 exposure, or \$17,000.
  - The guarantee covers a pre-specified pro-rata or proportional share of losses, but the pre-specified pro rata share is defined in terms of the value of the property that secures the exposure. For example, in the case of the exposure cited above, the guarantee covers losses up to 12 per cent of the value of the collateral, or \$12,000. (This case represents traditional Private Mortgage Insurance (PMI) for first lien residential mortgages, where insurance is typically required for loan-to-value (“LTV”) ratios above 80 percent; for LTVs up to 85 percent, the typical requirement is for PMI in an amount equal to 12 percent of the value of the property.)

##### *Guarantees of Multiple Retail Exposures*

Guarantees of multiple retail exposures that involve tranching of the aggregate credit risk of the underlying exposures do not qualify under Standard 4–4. Such guarantees may qualify for treatment as synthetic securitizations (provided they meet all other requirements for securitization treatment) as specified in Standard 4–5 and succeeding paragraphs. Other guarantees of multiple retail exposures where there is no tranching of the aggregate credit risk, such as those in the following examples, may qualify under Standard 4–4:

- In some cases, a guarantee covers multiple retail exposures; however, coverage for each individual exposure meets all the requirements of Standard 4–4 and succeeding paragraphs and is consistent with any one of the four examples above. Furthermore, there are no additional limits, caps, or restrictions of any kind pertaining to the aggregate coverage. Such guarantees would meet the requirements as guarantees of individual retail exposures.

—Consider a guarantee that covers multiple retail exposures, with a total

exposure amount of \$9.5 million secured by 100 residential properties each with a value of \$100,000, thus an aggregate value of \$10 million. The guarantee covers losses on each exposure up to an amount that will reduce the LTV on each exposure considered separately to 90 percent.

- Other guarantees on multiple retail exposures qualify under Standard 4–4, but only if they cover all or a pro rata, or proportional, share of all payments due on the aggregate exposure amount.

—Consider the same multiple-exposure retail pool as before. There are 100 retail exposures with an aggregate exposure amount of \$9.5 million. The guarantee covers all losses on the underlying exposures up to the full \$9.5 million aggregate exposure amount.

—Once again, consider the pool of multiple retail exposures above. In this case, the guarantee covers a pro rata share of losses, for example 20 percent of the \$9.5 million aggregate exposure, or \$1.9 million. (Alternatively, if the guarantee coverage had been pre-specified as a dollar amount, say the first \$1.9 million of losses, rather than a pro rata share of the aggregate losses, that guarantee would not reflect the benefits of retail credit risk mitigation treatment. Such guarantees of multiple retail exposures would need to meet the requirements set forth in Standard 4–5 in order to qualify for securitization treatment.)

#### Chapter 5: Wholesale Credit Risk Protection

##### *Rule Requirements*

Part III, Section 22(e): Double default treatment. A bank must obtain the prior written approval of [AGENCY] under section 34 [of the NPR] to use the double default treatment.

Part IV, Section 33: Guarantees and Credit Derivatives: PD Substitution and LGD Adjustment Treatments

Part IV, Section 34: Guarantees and Credit Derivatives: Double Default Treatment

1. This chapter supplements the detailed discussion of credit risk mitigation in the NPR by providing guidance on how banks may recognize contractual arrangements for exposure-level credit protection—eligible guarantees and eligible credit derivatives—that transfer risk to one or more third parties. Each of these forms of credit protection must meet certain specific standards of eligibility, as articulated in the NPR, for recognition of the associated risk mitigation.

2. An important aspect of either of these types of credit protection is that they are implemented at the exposure-

level, reducing credit risk faced by the bank due to a specific exposure to an individual obligor. Banks may use similar mitigants—for example, portfolio credit derivatives—to transfer credit risk associated with groups of exposures or whole portfolios. While such contracts may make a valuable contribution to broader risk management within the bank, and may be appropriately considered in an assessment of overall capital adequacy, their effects are not recognized for IRB calculations of risk-based capital requirements except in limited circumstances.

3. Exceptions are made for certain types of basket credit derivatives and securitization exposures. In addition, banks may recognize the benefits in IRB calculations of pool-level guarantees (or credit derivatives) that are the functional equivalent of an exposure-by-exposure guarantee provided the following minimum conditions are met:

- The guarantee is an eligible guarantee.
- The contractual provisions of the guarantee must identify the specific exposures in the pool to which the guarantee applies.
- The guarantee must cover all or a pro-rata share of the pool's aggregate credit losses in a manner that ensures each individual exposure is provided the same level of loss protection under the guarantee.
- The guarantee must not contain cap provisions, deductibles, or other payout limitations that would effectively limit coverage.

Once a bank demonstrates that the pool-level guarantee is the functional equivalent of an exposure-by-exposure guarantee, the benefits may be recognized in the IRB calculations using the credit risk mitigation framework as provided in the NPR and this document. This requires that the bank calculate its risk-based capital requirement for the pool on an exposure-by-exposure basis, as if the guarantee were applied at the level of each individual exposure.

**S 5-1 Risk-based capital benefits are only recognized for credit protection that transfers credit risk to third parties.**

4. Banks may recognize the risk-based capital benefits of credit protection associated with eligible guarantees and eligible credit derivatives from third parties. A bank may recognize the benefits of credit protection from a parent or sister company only if (a) the credit protection provider has the ability to fulfill its obligations to the bank independent of the financial support of the bank, and (b) the internal risk rating assigned to the affiliate fully excludes

any support that is or may be derived from bank operations. Under no circumstances may a bank receive a risk-based capital benefit from credit protection from an internal department of the bank or from the bank's own subsidiary. Banks often manage credit risk through internal transactions that, while possibly structured in ways similar to guarantees or credit derivatives, do not in themselves result in a reduction of credit risk at the consolidated level. Such credit protection purchased internally may not be recognized for IRB purposes. Once the bank reliably demonstrates that the credit risk is ultimately transferred to a third party, for example through a matched offsetting contract, credit protection may be realized from the third party provider. However, if this protection provider is an affiliate, all of the above limitations apply.

5. For wholesale exposures, credit risk mitigation from eligible guarantees and eligible credit derivatives is recognized through one of three mutually exclusive approaches. The approaches are identified by the primary mechanism through which risk mitigation is recognized: PD substitution, LGD adjustment, or the recognition of double-default benefits. Recognition is at the exposure level, so a bank may select among the three alternative approaches for each wholesale exposure, subject to the NPR and to relevant elements of the bank's internal policies and procedures.

6. If a bank chooses to recognize credit protection through PD substitution, it substitutes the PD associated with the internal rating grade assigned to the protection provider in place of the PD of the obligor in the capital calculation. However, if the bank determines that this substitution overstates the degree of risk mitigation, a lesser adjustment may be made by using a PD associated with any internal rating grade inferior to that of the protection provider. Note that in either case, the PD applied is one that is associated with one of the bank's internal rating grades, determined in accordance with the bank's established processes for quantifying the default risk of those grades. Similar considerations apply in the case of double-default treatment; the PD for the protection provider used in the capital calculation should be the PD for an internal rating grade assigned to the protection provider.

7. Under the LGD adjustment approach, the bank modifies the LGD assigned to the hedged exposure to reflect the risk mitigating effects of the credit protection, subject to limitations

on the resulting risk weight as specified in the NPR. In determining the magnitude of any LGD adjustment, the bank should apply the general approach to IRB quantification developed elsewhere in this guidance; quantification of LGD adjustments for credit protection should reflect a rigorous application of standards no different from those that apply to LGD quantification generally.

8. The NPR specifies various criteria that must be met in order for a bank to apply the double default treatment. Among those requirements are that a bank must have policies and processes to detect excessive correlation between the creditworthiness of the protection provider and the obligor for the hedged exposure. For example, the creditworthiness of a protection provider and an obligor would be excessively correlated if the obligor derives a high proportion of its income or revenue from transactions with the protection provider. Similarly, excessive correlation could arise from exposure to a common risk factor or set of risk factors, such as industry or region; in some cases a bank may be able to leverage other components of the bank's internal credit risk management processes to identify such dependence on common risk factors.

9. A bank's choice among these approaches for reflecting the impact of credit protection for a given exposure should be made in accordance with specific criteria contained in a bank's credit policy. In addition to the specific eligibility requirements in the NPR and general consideration of the credit protection provider's ability and willingness to perform under the agreement, the criteria should include an assessment of the effect of the payout structure of the credit protection on the level and timing of recoveries. In some cases, the nature of the contractual arrangement reduces the likelihood that the bank will experience an obligor default (as defined within the IRB framework); in such cases, PD substitution (or double-default treatment, if applicable) is often more appropriate. In other cases, notably those in which the protection is likely to come into effect only after a default has occurred, it is more likely that the appropriate adjustment should be made through LGD.

10. A bank recognizing risk mitigation from eligible guarantees or eligible credit derivatives should also have policies that ensure adequate control of any residual risks related to the use of such forms of credit protection.

**S 5-2 Banks must ensure that credit protection for which risk-based capital**

**benefits are claimed represents unconditional and legally binding commitments to pay on the part of the guarantors or counterparties.**

11. As specified in the NPR, forms of written third-party support that are conditional or are not legally binding are not recognized as credit risk mitigation. Refer to Standard 2–11 in the Wholesale Risk Rating Systems chapter of this guidance regarding the use of implied support as a rating criterion.

12. In some instances, an eligible credit derivative may incorporate a reference asset that differs from the underlying asset for which a bank has acquired credit protection. A bank may recognize an eligible credit derivative that hedges an exposure that is different from the credit derivative's reference exposure used for determining the derivative's cash settlement value, deliverable obligation, or occurrence of a credit event only if:

- The reference exposure ranks *pari passu* (that is, equal) or junior to the hedged exposure; and
- The reference exposure and the hedged exposure share the same obligor (that is, the same legal entity) and legally enforceable cross-default or cross-acceleration clauses are in place.

13. In such cases, a bank should evaluate and document the relationship between the reference asset and the hedged exposure to ensure that the reference asset is a reasonable proxy for the hedged exposure and is likely to behave in a similar manner upon the occurrence of a credit event.

## Chapter 6: Data Management and Maintenance

### Rule Requirements

Part III, Section 22(i)(1): A bank must have data management and maintenance systems that adequately support all aspects of its advanced systems and the timely and accurate reporting of risk-based capital requirements.

Part III, Section 22(i)(2): A bank must retain data using an electronic format that allows timely retrieval of data for analysis, validation, reporting, and disclosure purposes.

Part III, Section 22(i)(3): A bank must retain sufficient data elements related to key risk drivers to permit adequate monitoring, validation, and refinement of its advanced systems.

### I. Overview

1. Banks using the IRB framework for risk-based capital purposes must have advanced data management and maintenance systems that support

credible and reliable risk parameter estimates. This chapter describes how a bank should collect, maintain, and manage the data needed to support the other IRB system components for wholesale and retail exposures (e.g., risk rating and segmentation systems, the quantification process, and validation and other control processes), as well as the bank's broader risk management and reporting needs. Additional detail specific to wholesale and retail exposures is provided in the appendices to this chapter.

2. While this chapter specifically addresses data management and maintenance systems for wholesale and retail exposures, the framework outlined in this chapter generally applies to all of a bank's advanced systems for credit risk as described in Chapter 1 of this guidance. In addition, specific data requirements for securitizations are described in Chapter 11.

3. Banks may implement different data management and maintenance systems for wholesale and retail exposures. Within a bank, moreover, such data systems and processes may differ across business lines and countries. Therefore, the data structures and practices, and the precise data elements to be collected will be dictated by the features and methodology of the IRB system employed by each bank.

4. Reference data requirements related to IRB quantification, which are discussed in Chapter 4 of this guidance, describe the minimum requirements for historical default and loss reference data using the best available data for quantification, inclusive of internal, external or pooled data sets. Best available data should include historical performance information necessary to accurately estimate risk parameters for exposures in the bank's existing portfolio. Reference data for quantification are likely to comprise a smaller subset of the internal data elements cited in this chapter because the objectives of ongoing internal data management cover a wider range of purposes, such as the development of risk ratings or segmentation and the validation of the IRB system. Data histories built from the internal data maintenance framework described in this chapter will gain growing significance in the risk parameter estimation process over time.

### II. General Data Requirements

#### S 6–1 Banks must collect and maintain sufficient data to support their IRB systems.

5. While banks have substantial flexibility in designing their data

management systems, the underlying principle in this guidance is that the data systems should be of sufficient depth, scope, and reliability to implement and evaluate the IRB system. The systems should be able to support the bank's ability to:

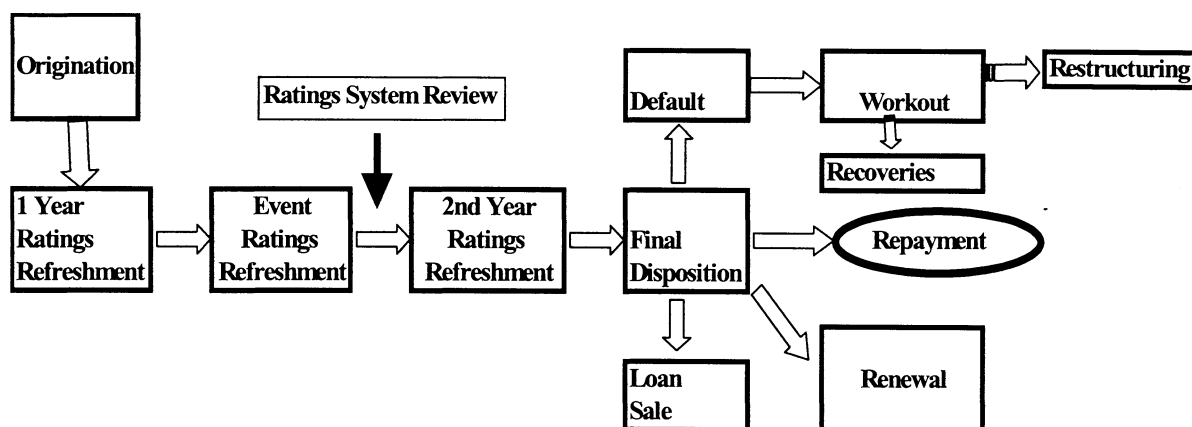
- Track obligors of wholesale exposures and to track wholesale exposures throughout their life cycle from origination to disposition;
- Capture all rating assignment data for wholesale portfolios, which include the significant quantitative and qualitative factors used to assign the obligor and loss severity ratings;
- Capture exposure and borrower characteristics and performance history for retail exposures over a historical time period;
- Capture all data for retail exposures necessary to develop the segmentation system and to assign exposures to segments;
- Develop internal risk parameter estimates;
- Validate risk parameter estimates;
- Validate the IRB system and processes;
- Refine the IRB system;
- Calculate risk-based capital ratios; and
- Produce internal and public reports.

6. Data management and maintenance systems should enable banks to undertake necessary changes in their IRB systems and improve methods of credit risk management over time. Systems should be capable of providing detailed historical data and capturing new data elements for enhancing an IRB system. Given the importance of developing robust data histories in this process and the costs associated with collecting additional data at a later date, banks should err on the side of collecting not only data that they are currently using but also data that may potentially be useful to their IRB models or in validation processes.

#### A. Life Cycle Tracking for Wholesale Exposures

#### S 6–4 For wholesale exposures, banks must collect, maintain, and analyze essential data for obligors and exposures. This should be done throughout the life and disposition of the credit exposure.

7. Using a life cycle or "cradle to grave" concept for each obligor and exposure supports front-end validation, backtesting, system refinements, and risk parameter estimates. A depiction of life-cycle tracking follows:



8. Data elements must be recorded at origination and whenever the rating is reviewed, regardless of whether the rating is changed. Data elements associated with current and past ratings must be retained. These elements include:

- Key borrower and exposure characteristics;
- Ratings for obligors and exposures;
- Key factors used to assign the ratings;
- Person responsible for assigning the rating and model(s) used in that assignment;
- Date rating assigned; and
- Overrides to the rating and authorizing individual.

At disposition, data elements should include:

- Nature of disposition: Renewal, repayment, loan sale, default, restructuring;
- For defaults: Exposure, actual recoveries, source of recoveries, costs of workouts and timing of recoveries and costs;
- Guarantor support;
- Sale price for loans sold; and
- Other key elements that the bank deems necessary.

See Appendix A for examples of data elements that banks should collect and maintain under an IRB data management framework for wholesale exposures.

#### B. Rating Assignment Data for Wholesale Exposures

**S 6-3 Banks must capture and maintain all significant factors used to assign obligor and loss severity ratings.**

9. Assigning a rating to an obligor requires the systematic collection of various borrower characteristics, both quantitative and qualitative, because these factors are critical to validating the rating system. Obligor ratings are rated using various methods, as discussed in Chapter 2. Each of these methods presents different challenges for input

collection. For example, in judgmental rating systems, the qualitative factors used in the rating decision have not traditionally been explicitly recorded. For purposes of the IRB framework, to the extent qualitative factors play an important role in assigning ratings, banks should maintain these factors in a readily available database for validation purposes and to facilitate analysis to help banks improve the rating system over time.

10. For loss severity estimates, banks should record the basic structural characteristics of exposures and the factors used in developing the loss severity rating or LGD estimate. These often include the seniority of the credit, the amount and type of collateral, the most recent collateral valuation date and the collateral's fair value.

11. Banks should also track any overrides of the obligor or loss severity rating. Tracking overrides separately allows banks to identify whether the outcome of such overrides suggests either problems with rating criteria or too much discretion to adjust the ratings.

12. Historical data, including rating histories on wholesale exposures, may be lost or irretrievable; for example, when exposures are acquired through mergers, acquisitions, or portfolio purchases. Banks are encouraged, whenever practical, to collect any missing historical data on rating assignment drivers and to re-rate the acquired obligors and exposures for prior periods. When retrieving historical data is not practical, banks may attempt to create a rating history by carefully mapping the legacy system and the new rating structure. Mapped ratings should be reviewed for accuracy. The level of effort placed on filling gaps in data should be commensurate with the size and significance of the exposures to be incorporated into the bank's IRB system.

#### C. Segmentation Data for Retail Exposures

**S 6-4 For retail exposures, banks must collect and maintain all essential data elements used in segmentation systems and the quantification process. The data must cover a period of at least five years and must include a period of economic downturn conditions, or the bank must adjust its estimates of risk parameters to compensate for the lack of data from periods of economic downturn conditions.**

13. Banks should maintain a minimum five-year exposure-level history of the entire retail portfolio, including all exposures and lines that were open at any time during this period. The standard above establishes key risk drivers used in the segmentation system and in the quantification of the risk parameters. However, banks should retain additional data elements that are used in their internal credit risk management systems. (See Appendix A of this chapter for examples of retail data elements.)

14. For retail exposures, if the most recent period of economic downturn conditions occurred more than five years ago, banks should retain additional data to cover the downturn period. These data need not cover the period between the downturn period and the most recent five-year period. These data may be in the form of representative statistical samples of the portfolio rather than data from all exposures. The method of any sampling should be statistically sound and well-documented.

15. Banks should gather and retain disposition data, including recovery data on defaulted exposures (e.g., date and dollar value of recoveries and collection expenses) sufficient to develop ELGD, LGD, and EAD estimates for retail exposures. For many banks, information related to recoveries and



collection expenses currently exists only at an aggregate level. These banks should develop interim solutions and a plan to improve exposure-level data availability.

16. For retail exposures, historical segmentation data can be lost or irretrievable; for example, when exposures are acquired through mergers, acquisitions, or portfolio purchases. In these cases, as an interim measure, banks should seek to obtain data from external sources to supplement internal data shortfalls. Alternatively, the reference data sometimes may be drawn from other sections of the portfolio, but only when the business lines, and exposure and borrower characteristics are sufficiently similar (for examples, see Chapter 3).

#### D. Outsourced Activities

##### **S 6-5 Banks should ensure that outsourced activities performed by third parties are supported by sufficient data to meet IRB requirements.**

17. Certain processes, such as loan servicing, broker and correspondent origination, collection, and asset management, may be outsourced to or otherwise involve third parties. The necessary data capture and oversight of risk management standards for these portfolios and processes should be carried out as if they were conducted internally.

#### E. Asset Sales

##### **S 6-6 Banks should maintain data to allow for a thorough review of asset sale transactions.**

18. It is important that banks be able to quantify the impact of asset sale activity on its IRB system. Documentation for these transactions should be sufficient for supervisors to determine how asset sale activity affects the integrity of the IRB system and the resulting risk-based capital calculation. For retail, asset sales may involve exposures from a variety of portfolio segments, and sale pricing may not be available at a granular level. A bank should be able to quantify the effect of removing a portion of the loans or other exposures from segments and the effect of such asset sale activity on risk parameter estimation.

### III. Data Applications

#### A. Validation and Refinement

19. The data elements collected by banks should facilitate meeting the validation standards described in Chapter 7. These standards include validating the bank's IRB system processes, including the "front end" aspects, such as assigning ratings or risk

drivers used for segmentation, so that issues can be identified early. The data should support efforts to identify whether raters and models are following rating criteria and policies and whether ratings are consistent across portfolios. In addition, data should support the validation of risk parameters, particularly the comparison of realized outcomes with estimates. For backtesting risk parameters, data on default and disposition characteristics should be thorough.

20. Data for validation should be rich in scope and depth in order to provide insights on the performance of the IRB system. This can contribute to a learning environment in which refinements can be made to the systems. These potential refinements include enhancements to rating assignment controls, segmentation design, processes, criteria or models, IRB system architecture, and risk parameter estimates.

#### B. Applying IRB System Improvements Historically

21. To maintain a consistent series of information for credit risk monitoring and validation purposes, banks should be able to take improvements they make to their risk rating systems for wholesale exposures and segmentation systems for retail exposures and apply them historically. Moreover, banks are encouraged to retain data beyond the minimum requirements because they should have robust historical databases containing key risk drivers and performance components over as long a historical period and as many variables as possible to facilitate the development and validation of better models and methods.

*See Appendix B for an example as to how a bank could apply new information to improve its risk rating system.*

#### C. Calculating Risk-Based Capital Ratios and Reporting to the Public

22. Data retained by the bank will be essential for risk-based capital calculations and public reporting under the Pillar 3 disclosures. These uses underscore the need for a well-defined data management framework and strong controls over data integrity. Total exposures should be tied to systems of record and documentation should be maintained for this process for all reporting periods. Control processes and data elements themselves should also be subject to periodic verification and testing by internal auditors. Supervisors should rely on these processes and should also perform testing as circumstances warrant.

23. This guidance should also be considered with the Proposed Agency Information Collections published by the Agencies on September 25, 2006 for public comment along with the NPR. The notice contained information collection templates (FFIEC 101) and information about the components of reporting entities' risk-based capital, risk-weighted assets by type of credit risk exposure under the IRB framework, including templates for credit risk and definitions of the data elements contained therein. These templates will assist banks in determining their data retention needs related to the risk-based capital requirements for credit risk under the IRB framework.

#### D. Supporting Risk Management

24. The information that can be gleaned from more extensive data collection will support a broad range of risk management activities. Risk management functions will rely on accurate and timely data to track credit quality, make informed portfolio risk mitigation decisions, and perform portfolio stress tests. Obligor and loss severity risk rating and segmentation data will be used to support such operations as internal capital allocation models, pricing models, ALLL calculations, and performance management measures. Summaries of these are included in reports to banks' boards of directors, regulators, and in public disclosures.

### IV. Managing Data Quality and Integrity

##### **S 6-7 Banks should develop policies and controls around the integrity of the data maintained both internally and through third parties.**

25. Because data are collected at so many different stages involving a variety of groups and individuals, ensuring the quality of the data poses numerous challenges. For example:

- Qualitative risk-rating variables will have subjective elements and will be open to interpretation;
- Exposures will be acquired through mergers and purchases, but without an adequate and easily retrievable institutional rating history; and
- Data purchased from or maintained through third parties may not have controls similar to the bank's controls.

Bank policies and controls should address these potential challenges. Specifically, banks should have policies employing change control management processes and practices to ensure the integrity of the data. In addition, banks should seek reasonable assurances from significant third-party providers concerning the integrity of the data.

### A. Documentation and Definitions

#### S 6–8 Banks should document the process for delivering, retaining, and updating inputs to the data warehouse and ensuring data integrity.

#### S 6–9 Banks must maintain detailed documentation of changes to the data elements supporting the IRB system.

26. Given the many challenges presented by data for an IRB system, the management of data should be formalized and banks should develop comprehensive definitions for their data elements. Fully documenting how the bank's flow of data is managed provides a means of evaluating whether the data management framework is functioning as intended. Moreover, banks should be able to communicate to persons developing or delivering various data the precise definition of the items intended to be collected. Consequently, a "data dictionary" and/or a "data standards manual" would ensure consistent inputs from business units and data vendors and would allow third parties (e.g., IRB system review process, auditors, or banking supervisors) to evaluate data quality and integrity.

27. When changes are made to the IRB system and the supporting data elements, the source of any significant changes in the risk-based capital requirements should be documented. Therefore, it would be desirable to use change control management processes.

### B. Electronic Storage and Access

#### S 6–10 Banks must retain data using an electronic format that allows timely retrieval of data for analysis, validation, reporting, and disclosure purposes.

28. To meet the significant data management challenges presented by the validation and control features of the IRB system, banks must store their data electronically. Banks will have a variety of storage techniques and potentially a variety of systems to create their data warehouses and data marts. The data architecture should be designed to be scalable to allow for growth in portfolios, data elements, history, and product scope. IRB data requirements can be achieved by melding together existing accounting, servicing, processing, workout and risk management systems, provided the linkages between these systems are well-documented and include sufficient edit and integrity checks to ensure that the data can be used reliably.

29. Banks lacking electronic databases for wholesale exposures would be forced to resort to manual reviews of paper files for ongoing backtesting and ad hoc "forensic" data mining and

would be unable to perform that work in the timely and comprehensive manner required of the IRB system. Forensic mining of paper files to build an initial data warehouse from the bank's credit history is encouraged. Paper research may sometimes be necessary to identify data elements or factors not originally considered significant in estimating the risk of a particular class of obligor or exposure. The time and expense of this recovery effort highlights the importance of collecting a broad array of variables during the initial design of the IRB data system.

#### Appendix A: Data Elements for Wholesale and Retail Exposures

For illustrative purposes, the following section provides examples of the kinds of data elements banks should collect under an IRB data management and maintenance framework first for wholesale exposures and second for retail exposures.

##### A. Examples of Data Elements for Wholesale Exposures

###### General Descriptive Obligor and Exposure Data

The data below could be from an exposure record or from various sources within the data warehouse. Data maintained for guarantors would be the same as that maintained for obligors.

###### Obligor/Guarantor Data

- General data: name, address, industry;
- ID number (unique for all related parent/sub relationships);
- Rating, date, and rater; and
- PD corresponding to rating.

###### General Exposure Characteristics

- Exposure amounts: committed, outstanding;
- Exposure type: term, revolver, bullet, amortizing, etc.;
- Purpose: acquisition, expansion, liquidity, inventory, working capital etc.;
- Covenants;
- Exposure ID number;
- Origination and maturity dates;
- Last renewal date;
- Obligor ID link;
- Rating, date and rater;
- ELGD;
- LGD; and
- EAD.

###### Rating Assignment Data

The data below provide an example of the categories and types of data that banks should retain in order to continually validate and improve rating systems. These data items should tie

directly to the documented criteria that the bank employs when assigning ratings. For example, rating criteria often include ranges of leverage or cash flow for a particular obligor rating. In addition, banks are encouraged to develop and record quantitative representations of qualitative factors (such as management effectiveness) in numeric form. For example, a 1 may signify exceptionally strong management and a 5 very weak management. The rating data elements should be sufficient for evaluating the factors driving the rating decisions.

###### Quantitative factors in obligor ratings

- Asset and sale size; and
- Key ratios used in rating criteria:
  - Profitability;
  - Cash flow;
  - Leverage;
  - Liquidity; and
  - Other relevant factors.

###### Qualitative factors in obligor ratings

- Quality of earnings and cash flow;
- Management effectiveness, reliability;
- Strategic direction, industry outlook, position;
- Country factors and political risk; and
- Other relevant factors.

###### Third-party obligor ratings

- Public debt rating and trend; and
- External credit model score and trend.

###### Rating Notations

- Flag for overrides or exceptions; and
- Authorized individual who can change rating.

###### Key exposure factors in ELGD and LGD ratings

- Seniority;
- Collateral type (cash, marketable securities, AR, stock, RE, etc.);
- Collateral value and valuation date;
- Advance rates, LTV;
- Industry; and
- Geography.

###### Rating Notations

- Flag for overrides or exceptions; and
- Authorized individual who can change rating.

###### Final disposition data

Many banks maintain subsidiary systems for their problem exposures with details recorded, at times manually, on systems that are not linked to the bank's central exposure or risk management systems. The unlinked

data are a significant hindrance in developing reliable risk parameter estimates.

In advanced systems, the "grave" portion of obligor and exposure tracking is essential for producing and validating risk parameter estimates and is an important feedback mechanism for adjusting and improving these estimates over time. Essential data elements are outlined below.

#### Obligor/guarantor

- Default date; and
- Circumstances of default (e.g., nonaccrual, bankruptcy chapters 7–11, nonpayment).

#### Exposure

- Outstandings at default; and
- Amounts undrawn and outstanding plus time series prior to and through default.

#### Disposition

- Amounts recovered and dates (including source: cash, collateral, guarantor, etc.);
- Collection cost and dates;
- Discount factors to determine economic cost of collection;
- Final disposition (e.g., restructuring or sale);
- Sales price, if applicable; and
- Accounting items (charge-offs to date, purchased discounts).

#### B. Examples of Data Elements for Retail Exposures

##### Data Elements at Origination

- Customer identifiers, such as borrower name;
- External credit bureau attributes;

- Application attributes, such as income and financial information;
- Credit scores, including custom scores or generic scores;
- Other underwriting data used in the origination process;
- Score overrides and policy exceptions;
- Origination channel, such as a third-party vendor, telemarketing, direct mail, or Internet;
- Product type and loan terms, such as line amount, interest rate, payment terms, balance transfer amount, and reward programs;
- Collateral characteristics, such as appraised value, geographic location, and loan-to-value; and
- Guarantees or other credit risk mitigants, such as PMI.

##### Ongoing Data Elements

- Refreshed credit bureau attributes;
- Payment history and performance characteristics, including payments, draws, fees, NSF checks, delinquency, overlimit status, and utilization;
- Collections activity, including workout or forbearance programs, restructurings, payment deferrals, re-aging and other similar programs;
- Behavior scores;
- Transaction-level information;
- Account management activities, such as line increase or decrease programs, pricing adjustments, changes in payment requirements or fee structures, and reward programs;
- Updated borrower information; and
- Updated collateral information.

##### Collection and recovery information

- Default date;
- Loss severity information;

- Circumstances of default (e.g., nonaccrual, bankruptcy chapters 7–11, nonpayment);
- Outstandings at default;
- Amounts undrawn and outstanding plus time series prior to and through default;
- Amounts recovered and dates (including source: cash, collateral, guarantor, etc.);
- Collection cost and timing;
- Discount factors to determine economic cost of collection;
- Final disposition (e.g., restructuring or sale);
- Sales price, if applicable; and
- Accounting items (charge-offs to date, purchased discounts).

#### Appendix B: Applying Risk Rating System Improvements Historically

In the example below for wholesale exposures, a bank experiences unexpected and rapid migrations and defaults in its rating grade 4 category during 2006. Analysis of the actual financial condition of borrowers that defaulted compared with those that did not suggests that the debt-to-EBITDA range for its expert judgment criteria of 3.0 to 5.5 is too broad. Research indicates that rating grade 4 should be redefined to include only borrowers with debt-to-EBITDA ratios of 3.0–4.5 and that rating grade 5 should be 4.5–6.5. In 2007, the change is initiated, but prior years' numbers are not recast (see Exhibit A). Consequently, a break in the series prevents the bank from evaluating credit quality changes over several years and from identifying whether applying the new rating criteria historically provides reasonable results.

**Exhibit A (Revision of Grades 4 and 5 in 2007)**

	Distribution of Obligor Risk Grades (%)					Change
	2004	2005	2006	2007	2008	
1	1	1.1	1.2	1.2	1.3	0.3
2	10	11	12	13	13	3.0
3	22	23	24	26	25	3.0
4	30	30	32	16	17	(13.0)
5	20	21	19	33	34	14.0
6	8	7	7	7	6	(2.0)
7	4	4	3	2	1	(3.0)
D	5	2.9	1.8	1.8	2.7	(2.3)
Total	100	100	100	100	100	0

Recognizing the need to provide senior managers and board members with a consistent risk trend, the new criteria are applied historically to obligors in rating grades 4 and 5 (see Exhibit B). The original ratings assigned to the rating grades are maintained along with notations describing what

the grade would be under the new rating criteria. If the precise weight an expert has given one of the redefined criteria is unknown, banks are expected to make estimates on a best efforts basis. After the retroactive reassignment process, the bank observes that the mix of obligors in rating grade 5 declined somewhat

over the past several years while the mix in rating grade 4 increased slightly. This contrasts with the trend identified before the retroactive reassignment. The result is that the multiyear transition statistics for rating grades 4 and 5 provide risk managers a clearer picture of risk.

### Exhibit B (After Recasting 2004-06)

	Distribution of Obligor Risk Grades (%)					Change 04-'08
	2004	2005	2006	2007	2008	
<b>1</b>	1	1.1	1.2	1.2	1.3	0.3
<b>2</b>	10	11	12	13	13	3.0
<b>3</b>	22	23	24	26	25	3.0
<b>4</b>	<b>15</b>	<b>15</b>	<b>16</b>	<b>16</b>	<b>17</b>	<b>2.0</b>
<b>5</b>	<b>35</b>	<b>36</b>	<b>35</b>	<b>33</b>	<b>34</b>	<b>(1.0)</b>
<b>6</b>	8	7	7	7	6	(2.0)
<b>7</b>	4	4	3	2	1	(3.0)
<b>D</b>	5	2.9	1.8	1.8	2.7	(2.3)
<b>Total</b>	100	100	100	100	100	0

This example is based on applying ratings historically using data already collected by the bank. However, for some risk rating system refinements, banks may in the future identify drivers of default or loss that might not have been collected for borrowers or exposures in the past. That is why banks are encouraged to collect data that they believe may serve as stronger predictors of default in the future. For example, certain elements of a borrower's cash flow might currently be suspected of overstating the operational health of a particular industry. In the future, should a bank decide to reduce the weight given to cash flow for this overstatement, resulting in a downgrade of many obligor ratings, the bank that collected these data could apply this rating change to prior years. This would provide a consistent picture of risk over time and also present opportunities to validate the new criteria using historical data. Recognizing that banks will not be able to anticipate fully the data they might find useful in the future, banks are expected to reassign rating grades on a best efforts basis when practical.

#### Chapter 7: Controls and Validation

##### Rule Requirements

Part III, Section 22(a)(2): The systems and processes used by a bank for risk-based capital purposes under [the NPR]

must be consistent with the bank's internal risk management processes and management information reporting systems.

Part III, Section 22(j)(2): The bank's board of directors (or a designated committee of the board) must at least annually evaluate the effectiveness of, and approve, the bank's advanced systems.

Part III, Section 22(j)(3): A bank must have an effective system of controls and oversight that:

(i) Ensures ongoing compliance with the qualification requirements [in the NPR];

(ii) Maintains the integrity, reliability, and accuracy of the bank's advanced systems; and

(iii) Includes adequate governance and project management processes.

Part III, Section 22(j)(4): The bank must validate, on an ongoing basis, its advanced systems. The bank's validation process must be independent of the advanced systems' development, implementation, and operation, or the validation process must be subjected to an independent review of its adequacy and effectiveness. Validation must include:

(i) The evaluation of the conceptual soundness of (including developmental evidence supporting) the advanced systems;

(ii) An on-going monitoring process that includes verification of processes and benchmarking; and

(iii) An outcomes analysis process that includes backtesting.

Part III, Section 22(j)(5): The bank must have an internal audit function independent of business-line management that at least annually assesses the effectiveness of the controls supporting the bank's advanced systems and reports its findings to the bank's board of directors (or a committee thereof).

#### I. Overview

1. A bank must have a system of controls that ensures that the components of the IRB system are functioning effectively. This chapter provides guidance on the essential elements of an effective control environment for an IRB system for wholesale and retail exposures, including independent review processes, a comprehensive validation process, and an internal audit review and reporting process.

2. While this chapter specifically addresses the control framework supporting a bank's IRB systems for wholesale and retail exposures, the framework outlined in this chapter generally applies to all of a bank's advanced systems for credit risk as described in Chapter 1 of this guidance.

In addition, specific validation requirements for certain counterparty credit risk transactions, equity exposures, and securitization exposures are provided in Chapters 9, 10, and 11, respectively.

**S 7-1 Banks must have an effective system of controls that ensures ongoing compliance with the qualification requirements, maintains the integrity, reliability, and accuracy of the IRB system, and includes adequate governance and project management processes.**

3. An accurate and reliable IRB system will allow bank management to make informed risk management and capital management decisions. While banks have flexibility in determining how integrity in the IRB system is achieved, the control framework that supports the IRB system should be constructed to ensure that the IRB system's design and performance are effective and that it continues to operate as intended.

4. The specific IRB-system controls, as outlined in this chapter as well as in Chapter 1 of this guidance, should be part of a broader control infrastructure that embodies more generic control principles such as dual controls, separation of duties, and appropriateness of incentives that enable prudential corporate oversight.

**S 7-2 Control processes should be independent and transparent to supervisors and auditors.**

5. The objective of independence is to ensure the integrity of the IRB system. When independence is not fully achieved, there should be compensating controls to confirm that actions and conclusions are not compromised.

6. Independence can be achieved structurally with organizational separation, or functionally, through policy and/or incentive based separation. For example, reviews performed by individuals who are not structurally independent could be acceptable as functionally independent reviews if the structure does not inhibit an objective evaluation. In these cases, job responsibilities and reporting relationships should be assessed to determine if they present any inherent conflicts that could impede conducting an effective review. Banks should consider a variety of factors when designing a control structure to adequately address independence, including:

- Expertise and experience of individuals conducting control activities;
- Potential for conflicts of interest and influence that could compromise the effectiveness of controls;

- Incentives for individuals that perform critical reviews;
- Separation of duties (individuals should not review their own work); and
- Fully documenting all aspects of the control structure to ensure it can be understood and evaluated by supervisors and auditors.

## II. Reviews of the IRB System

**S 7-3 The annual assessment of the IRB system presented to the board of directors should be supported by the bank's comprehensive and independent reviews of the IRB system.**

7. As discussed in Chapter 1, the bank's board of directors must at least annually evaluate the effectiveness of, and approve, the bank's advanced systems for credit risk. To do so, the board should be provided with information that would enable it to conclude, with reasonable assurance, that management has appropriate processes and controls in place that support an effective IRB system. This information should include results from the bank's comprehensive and independent reviews of the IRB system.

8. The bank's independent review process may be tailored to the bank's management and oversight framework. The objective of these reviews should be to evaluate compliance with the requirements in the NPR and this supervisory guidance and to measure the effectiveness of the IRB system's design and operation. The review should include all components of the IRB system:

- Risk rating and segmentation systems;
- Quantification process, particularly the selection of reference data sets and risk parameter estimation techniques;
- Ongoing validation process;
- Data management and maintenance system that supports the IRB system; and
- Control infrastructure supporting the IRB system.

9. Responsibility for the review process could be distributed across multiple areas or housed within one unit, so long as the bank can demonstrate that the review process provides a comprehensive and objective assessment of the areas reviewed. Individuals performing the reviews should possess the requisite technical skills and expertise.

10. Validation will encompass some of the IRB system review standards described above. However, to the extent that validation or other control functions do not address a component of the IRB system or if they do not meet the independence requirements, a separate independent review of

business-line management, risk management, and internal audit should be conducted as applicable. The validation activities, which are the evaluation of conceptual soundness (including developmental evidence), ongoing monitoring (i.e., process verification and benchmarking), and outcomes analysis (backtesting), are described in more detail later in this chapter.

**S 7-4 Validation activities must be conducted independently of the advanced systems' development, implementation, and operation, or subjected to an independent assessment of their adequacy and effectiveness.**

11. The developmental evidence supporting risk rating and segmentation systems' design and quantification is generally compiled by the systems' designers. This evidence should be subject to an ongoing substantive independent assessment by qualified staff. This independent review should be conducted at the time of system development and then updated whenever significant changes in methodology, data, or implementation occur.

12. Furthermore, when process verification, benchmarking, or outcomes analysis (backtesting) activities are not completed by individuals independent of the risk rating and segmentation systems' design or use, these activities must be the focus of an ongoing substantive independent assessment. Responsibility for the assessment of developmental evidence and ongoing validation may be drawn from a variety of organizational structures provided functional independence and sufficient expertise are demonstrated.

## III. Consistency Between IRB Systems and Risk Management Processes

**S 7-5 The systems and processes used by a bank for risk-based capital purposes must be consistent with the bank's internal risk management processes and management information reporting systems.**

13. The systems and processes a bank uses for risk-based capital purposes must be consistent with the bank's internal credit risk management processes and management information reporting systems such that data from the latter system and processes can be used to verify the reasonableness of the risk parameter inputs the bank uses for risk-based capital purposes.

14. The wholesale risk ratings used for risk-based capital purposes should be consistent with those used to guide day-to-day wholesale credit risk management activities. Wholesale risk ratings for IRB purposes should be

incorporated into and be consistent with a bank's credit risk management, internal capital assessment and planning, and corporate governance processes. The different uses and applications of the risk rating systems' outputs should promote greater accuracy and consistency of ratings across an organization. Banks should demonstrate that ratings used for IRB purposes are consistent with the bank's internal credit risk management processes.

15. The risk drivers used for IRB retail segmentation should be consistent with those used to guide day-to-day retail credit risk management activities. Risk drivers for IRB segmentation purposes should correspond to risk drivers used as part of the overall credit risk management of business lines. Banks should demonstrate that the risk drivers used for IRB segmentation purposes are consistent with those used in its day-to-day planning, execution, and monitoring of retail lending activities. However, the IRB segmentation criteria do not have to be identical to those used in credit risk management.

16. Risk parameters used for credit risk management should be consistent with the IRB risk parameters. Banks will be afforded some flexibility in their use of estimated risk parameters, since the estimates prescribed for risk-based capital purposes may not be appropriate for other uses. For example, the PDs used to estimate loan loss allowances could reflect current economic conditions that are different from the long-term averages appropriate for risk-based capital calculations. While risk parameters used for internal risk management purposes could be different from those used for risk-based capital purposes, banks should be able to demonstrate that the IRB measures of credit risk are consistent with similar measures used in internal credit risk management.

#### IV. Internal Audit

**S 7-6 Internal audit must, at least annually, assess the effectiveness of the controls supporting the IRB system and report its findings to the board of directors (or a committee thereof).**

17. A bank must have an internal audit function that is independent of business line management and that assesses at least annually the effectiveness of the controls supporting the IRB system and reports its findings to the board of directors (or its designated committee). At least annually, internal audit should review the validation process including procedures, responsibilities, appropriateness of results, timeliness,

and responsiveness to findings. Further, internal audit should evaluate the depth, scope, and quality of the independent review processes and conduct appropriate testing to ensure that the conclusions of these reviews are well founded.

#### V. Validation Activities

18. Validation is an ongoing process that includes the review and monitoring activities that verify the accuracy of the risk rating and segmentation systems and the quantification process. The components of validation include evaluation of conceptual soundness (including developmental evidence), ongoing monitoring, and outcomes analysis.

##### A. General Validation Requirements

**S 7-7 A bank's validation policy should cover the key aspects of risk rating and segmentation systems and the quantification process.**

19. The validation policy should be approved by the bank's senior management, and should:

- Describe the validation process;
- Outline the documentation requirements;
- Assign responsibilities;
- Outline the process for corrective actions; and
- Be updated periodically to incorporate new developments in validation practices and to ensure that validation methods remain appropriate.

**S 7-8 Validation must assess the accuracy of the risk rating and segmentation systems and the quantification process.**

20. The accuracy of risk rating and segmentation systems and the quantification process is measured by determining whether the:

- Assignment of exposures to risk ratings or segments has been implemented as designed;
- Performance data show that the risk rating or segmentation systems adequately differentiate risk over time;
- Migration of wholesale risk ratings is consistent with the bank's rating philosophy;
- Retail segmentation system separates exposures into stable and homogeneous segments; and
- Actual default, loss severity, and exposure experience of each rating grade or segment is consistent with risk parameter estimates.

21. Some differences between observed outcomes for individual ratings or specific retail segments and the estimated risk parameters are expected. Risk parameter estimates should reflect a degree of conservatism appropriate for the inherent uncertainty

in the bank's quantification process. As such, observed outcomes should not consistently or significantly exceed risk parameter estimates. This applies to each of the following:

- Actual long-run average default rates for each rating grade or segment and the assigned PD estimates;
- Actual long-run average economic loss rates on defaulted exposures and the assigned ELGD estimates;
- The economic loss rates on defaulted exposures during actual economic downturn conditions and the assigned LGD estimates; and
- The exposure size of defaulted exposures during actual economic downturn conditions and the assigned EAD estimates.

Bias that results in a reduction of risk-based capital requirements should receive immediate attention from management.

**S 7-9 Validation processes for risk rating and segmentation systems, and the quantification process must include the evaluation of conceptual soundness, ongoing monitoring, and outcomes analysis.**

22. Validation should be designed to give the greatest possible assurances of the accuracy of the risk rating and segmentation systems and the quantification process. Three activities must be carried out:

- Evaluating conceptual soundness using developmental evidence—determining whether the approach is sound;
- Ongoing monitoring—verifying the process and comparing results to other sources of data or estimates (benchmarking); and
- Outcomes analysis—comparing actual outcomes with estimates by backtesting and other methods.

These integral, ongoing activities must evaluate both internally and externally developed risk rating and segmentation systems, models, and the quantification process.

23. Validation processes, especially outcomes analysis, should recognize that realized outcomes for default, loss severity, and additional drawdowns can vary in a systematic fashion with the economic cycle. Thus, realized outcomes for a given risk parameter can vary around the estimate of long run average. A bank's validation policy should specify how realized outcomes are expected to vary with the economic cycle given the design of the IRB system. For example, given a bank's obligor rating system design, a bank might expect realized defaults to be systematically below the PD estimate during good states of the economic cycle and systematically above the PD

estimate during bad states of the economic cycle. This should be specified in the policy documentation. Realized outcomes for loss severity are not directly comparable with LGD estimates unless an economic downturn is experienced. Nonetheless, outcomes analysis for conditions less severe than an economic downturn can shed light on the validity of the LGD quantification process.

#### *B. Validation Activities*

##### *Evaluating Conceptual Soundness using Developmental Evidence*

24. Developmental evidence is the primary mechanism used to evaluate the conceptual soundness of the IRB system. The developmental evidence for risk rating and segmentation systems, and the quantification process should include documentation and empirical evidence supporting the methods used and the variables selected in the design and quantification of the IRB system. Where models are used, the evidence should include documentation and a description of the logic that supports the model and an analysis of any statistical model-building techniques.

25. Developmental evidence supporting the risk rating system should include the reasons the system was selected over other systems. Other developmental evidence should at a minimum describe the bank's obligor ratings approach and ratings philosophy, the mapping methodology, and the use and design of facility ratings or loss severity estimates.

26. In supporting the segmentation system, developmental evidence should describe the statistical design of the segmentation system and the selection of risk drivers. Additionally, it should explain why the system was selected over other segmentation approaches.

27. Developmental evidence supporting a bank's quantification process should address each aspect of the quantification process, whether the process explicitly delineates the four stages of quantification or implicitly incorporates the stages.

28. Developmental evidence is more persuasive when it includes empirical evidence. Developmental evidence in support of any model used in the risk rating and segmentation systems or the quantification process should include documentation and a discussion of the logic that supports the model, an analysis of any model-building techniques, sensitivity analysis (analysis of outcome sensitivity with respect to model input changes and model breakdown points), and an assessment of forecast quality. Models should be

supported by evidence that they work well across reference data sets. Use of a "holdout" sample is a good model-building practice to ensure that a model is robust. It is possible to perform several out-of-sample tests by varying the holdout samples.

29. Empirical developmental evidence for a judgmental rating system will likely be derived differently than such evidence for a model-driven system. One approach to capture empirical developmental evidence for analysis might entail having qualified, independent raters rate credits from prior periods. Ideally, the raters would not be familiar with the circumstances of the disposition of the credits (e.g., default, downgrade, upgrade, paid as agreed, etc.) and would only use information available to the original rater(s) at the time the credits were underwritten and subsequently reviewed. These retrospective ratings could then be compared to the outcomes to determine whether the ratings adequately differentiate risk. Conducting such tests may be difficult if historical data sets do not include a sufficient amount of the information actually used when a rating was assigned. Careful consideration should be given to future data needs and anticipated uses for validation, even if some variables are not used in the current model.

#### **S 7-10 Banks must evaluate the developmental evidence supporting the risk rating and segmentation systems and the quantification process.**

30. Evaluating developmental evidence involves assessing how well the risk rating and segmentation systems and the quantification process are designed and constructed. The review of developmental evidence should determine whether:

- Risk rating systems can be expected to accurately assess obligor and facility risk;
- Segmentation systems can be expected to separate exposures into segments with homogenous risk characteristics and to allow for the accurate measurements of risk within segments over time; and
- The quantification process can be expected to accurately estimate PDs, ELGDs, LGDs, and EADs.

31. Developmental evidence should be reviewed whenever the bank makes material changes in its risk rating and segmentation systems or quantification process.

32. Evaluation of developmental evidence includes comparisons of a bank's implemented framework with alternatives considered in the development process and the reason the

bank selected the chosen framework. For retail portfolios, data may be available on alternative risk drivers for segmentation, and developmental evidence should include the empirical analysis conducted to choose between risk drivers.

33. The development of risk rating and segmentation systems and the quantification process requires developers to exercise informed judgment. Whether the developmental evidence is sufficient will itself be a matter of expert opinion. Even if a system is model-based, an evaluation of developmental evidence will entail judging the merits of the model-building technique. Expert judgment is essential to the evaluation of the risk rating and segmentation systems and the quantification process development. Experts should be able to draw conclusions about the likelihood of the satisfactory performance of an implemented system.

##### *Ongoing Monitoring: Process Verification and Benchmarking*

34. The second component of the validation process for risk rating and segmentation systems and the quantification process is ongoing monitoring. The objective of ongoing monitoring is to confirm that the processes were implemented appropriately and continue to perform as intended. Such analysis involves process verification and benchmarking.

#### **S 7-11 Banks must conduct ongoing process verification of the risk rating and segmentation systems and the quantification process to ensure proper implementation and operation.**

35. Process verification encompasses a range of activities that are used to assess whether all internal risk rating and segmentation processes, as well as all quantification processes, are being used, monitored, and updated as designed and intended. It includes determining that data essential to these processes have appropriate integrity, and that all elements of these processes continue to be appropriate to the nature of the bank's exposures. Process verification should also ensure that identified deficiencies are corrected.

36. Verification activities will vary depending on the risk rating and segmentation systems and quantification approaches and their related guidelines. Verification that data are accurate and complete is important for all IRB systems and applies to both internal and external data, including the data provided by a third party.

37. For models-based risk rating and segmentation, verification includes an evaluation of the automated assignment

processes, such as verification of the correct computer coding of the model and data inputs. For expert-judgment and constrained-judgment risk rating systems, verification includes an evaluation of whether the rater adhered to the rating policy and criteria, given the information available to the rater and the documented rationale for the rating decisions.

38. Process verification of risk rating and segmentation systems includes monitoring and analysis of overrides. An override is a generic term that may have different meanings in different contexts. Two types of overrides are discussed below.

- “Judgmental overrides” occur when judgments are made to reject the decision of an objective process, such as a model or scorecard, which rates a wholesale obligor, assigns an exposure to loss-severity rating grade, or assigns an exposure to a retail segment; judgmental overrides are an explicit component of such a rating system’s design. As a matter of policy in a constrained judgment rating system for wholesale lending, a rater is generally allowed to adjust or override the results of a statistical rating model. For retail lending, the assignment of an exposure to a segment could be overridden, but such overrides generally are rare.

- “Policy overrides” refer to exceptions to bank policy with regard to risk rating assignment or segmentation. In the case of pure models-based rating and segmentation systems, an override would be considered to override policy. In a constrained judgment model, a policy override would occur when a rating is assigned by judgmental decision that does not conform to the bank’s rating criteria. Overrides outside of policy are expected to be rare.<sup>13</sup>

39. Frequent overrides may call into question aspects of the risk rating or segmentation system. Overrides and adjustments should be monitored and the performance of ratings that have been adjusted or overridden should be tracked for both the validation of rating and segmentation systems and the IRB system as a whole. Banks should have a policy addressing criteria for judgmental overrides and tolerance levels for policy overrides. The frequency of overrides will depend upon the portfolio, the risk rating and segmentation design, and a bank’s practices.

<sup>13</sup> Another common use of overrides in retail lending, not included in this context, relates to underwriting decisions. “Low side” overrides approve applications that would normally be rejected and “high side” overrides reject applications that would normally be approved.

#### **S 7–12 Banks must benchmark their risk rating and segmentation systems, and their risk parameter estimates.**

40. Benchmarking is using alternative methods or alternative data to draw inferences about the appropriateness of ratings, segments, risk parameter estimates or model outputs before outcomes are actually known. Benchmarking is a useful validation method that can be applied to all rating, segmentation, and quantification processes.

41. Benchmarking allows a bank to compare the consistency of its risk parameter estimates with those of other estimation techniques and data sources. Benchmarking can be a valuable diagnostic tool for uncovering potential weaknesses in a bank’s quantification process. While benchmarking allows for inferences about the accuracy of the risk rating and segmentation systems, and the risk parameter estimates, it does not substitute for backtesting. When differences are observed in the benchmarking exercise, this does not necessarily indicate that the risk rating and segmentation systems, or the risk parameter estimates, are in error. A benchmark is merely an alternative measure, and the difference may be due to different data or methods. Nevertheless, when differences are revealed, proper benchmarking requires the bank to investigate the source of the differences and whether the extent of the difference is appropriate. This investigative process may identify ways in which a bank can improve its risk rating and segmentation systems, and the quantification process.

42. To benchmark risk ratings and segmentation, a bank must at a minimum establish a process in which a representative sample of its internal ratings, portfolio segmentation, and risk parameters are compared to results from another source for the same exposures. Examples of other sources include independent internal raters such as loan review, external corporate rating agencies, or retail credit bureau models, and alternative internally developed credit risk models (“challenger models”).

43. Benchmarking of a risk rating, regardless of the rating approach, customarily asks whether another rater or rating method attaches a comparable rating to a particular obligor or exposure. Benchmarking of a segmentation system customarily asks whether other risk drivers or other segmentation methods provide similar risk separation and assessments of the portfolio risk distribution.

44. Benchmarking of quantification generally involves comparing different

choices made in the four stages of quantification. Such benchmarking compares:

- Reference data with data from other data sources;
- Estimates of risk parameters with estimates developed by alternative methods using the same reference data;
- Mappings with alternative mappings that would be expected to provide similar results; and
- Adjustments at the application stage with alternatives.

45. Benchmarking activities can be accomplished in a number of ways and at different levels of aggregation. Some benchmarking activities are conducted more frequently than others; for example, a bank benchmarks a system to evaluate its performance more frequently than it benchmarks the system to determine whether to renovate it completely, an activity that must be considerably more thorough. Examples of benchmarking activities for risk rating and segmentation systems, and the quantification process are listed below:

#### **Risk Ratings or Segmentation Benchmarking**

- On an ongoing basis, analyzing the characteristics of obligors or exposures that have been assigned the same wholesale risk rating or retail segment, and comparing the distribution of the portfolio by these ratings or segments between different time periods.

- Periodically re-rating a sample of wholesale credits previously rated under the bank’s standard method; examples of benchmark ratings include alternate individual raters in a judgmental system, an alternative internally developed rating model, or third-party credit or debt ratings.

- Periodically comparing the separation power of the IRB retail segmentation to alternative segmentations used in credit risk management and comparing the risk parameter estimates derived from the IRB retail segmentation with an alternative segmentation.

#### **Quantification Benchmarking**

- On an ongoing basis, comparing a bank’s PD, ELGD, LGD, and EAD estimates with available alternative risk estimates, such as business line loss forecasts or allowance methodologies. Within retail portfolios, vintage analyses (tracking loss rates over the life of the loan, given the same origination time and borrower characteristics) can be compared between different origination periods.

- Periodically comparing a bank’s PD, ELGD, LGD, and EAD estimates with



risk parameter estimates derived from alternative choices at some step(s) of the quantification process, such as different reference data sources, different estimation models, etc.

#### Outcomes Analysis

##### **S 7-13 Banks must analyze outcomes and must develop statistical methods to backtest their risk rating and segmentation systems and the quantification process.**

46. The third component of the validation process is outcomes analysis, which is the comparison of risk parameter estimates and model results with actual outcomes. Although banks are expected to employ all the components of the validation process, the data to perform comprehensive outcomes analysis on the existing portfolio may not be available in the early stages of implementation and may be difficult when a bank's process for assessing risks changes significantly. Therefore, banks may at times need to rely more heavily on other validation activities such as developmental evidence, process verification, and benchmarking.<sup>14</sup>

47. Backtesting is the statistical comparison of estimates to realized outcomes. Banks must back-test their risk parameter estimates by regularly comparing actual portfolio or rating grade/segment-level default rates, loss severities, and exposure-at-default experience with the PD, ELGD, LGD, and EAD estimates on which risk-based capital calculations are based. Backtesting indicates the combined effectiveness of the assignment of exposures to wholesale obligor and loss severity ratings or to retail segments and the quantification of the risk parameters attached to those ratings or segments.

##### **S 7-14 Banks should establish ranges around the estimated values of risk parameter estimates and model results in which actual outcomes are expected to fall and have a validation policy that requires them to assess the reasons for differences and that outlines the timing and type of remedial actions taken when results fall outside expected ranges.**

<sup>14</sup> For wholesale risk rating systems, banks face the challenge of how to measure the system's performance when backtesting is not conclusive. Because of the rarity of defaults in most years and the bunching of defaults in a few years, the other parts of the validation process will assume greater importance. If risk rating and segmentation processes are developed in a learning environment in which banks attempt to change and improve them, backtesting may be delayed even further. In its early stages, the validation of risk rating and segmentation systems will depend on bank management's exercising informed judgment about the strength of the systems, not simply on empirical tests.

48. Banks have considerable flexibility in developing statistical tests to back-test the performance of their risk rating and segmentation systems and the accuracy of their quantification process. Regardless of the backtesting method used, the bank should establish expected ranges for validation results. Backtesting often will not identify the specific reasons for discrepancies between expectations and outcomes. Rather, it will indicate only that further investigation is necessary.

49. When establishing expected ranges, banks should consider relevant elements of a bank's risk rating or segmentation systems that may affect outcomes, for example whether the system is designed to measure risk parameter estimates at a point in time, through the cycle, or at stressed periods. Also, changes in economic or market conditions and portfolio composition between the historical data and data from the present period can lead to differences between outcomes and risk parameter estimates.

50. In establishing expected ranges, a bank should consider which elements of its risk rating or segmentation system, and the quantification process, are most likely to affect outcomes of the risk parameter estimates. However, determining expected ranges can be difficult if a bank has changed its method of quantifying risk parameters and the estimates were calculated by a different method than the outcomes. If so, it may be appropriate to recalculate historical estimates in a manner consistent with the new method. If a bank adjusts final risk parameter estimates to be conservative, it may be appropriate to do its backtesting on the unadjusted estimates.

51. Differences in realized default, loss severity, or exposure rates from expected ranges may point to issues in the reference data, estimation, mapping or application elements of quantification. They may also indicate potential problems in other parts of the risk rating or segmentation system. The bank's validation policy should describe (at least in broad terms) the types of responses that should be considered when actual outcomes fall outside the expected ranges. If the discrepancies demonstrate a systematic tendency to decrease risk-based capital requirements, the nature and source of the bias requires even more detailed scrutiny.

#### *C. Minimum Frequency of Validation*

##### **S 7-15 Each of the three activities in the validation process should be conducted often enough to ensure the ongoing integrity, reliability, and**

##### **accuracy of the IRB risk rating and segmentation systems, and the quantification process.**

##### **S 7-16 Developmental evidence must be updated whenever significant changes in methodology, data, or implementation occur. Other validation activities must be ongoing and must not be limited to a point in time.**

52. Process verification, benchmarking, and backtesting activities should be conducted often enough to ensure ongoing integrity of the risk rating and segmentation systems, and the quantification process. For example, during high-default periods, banks should analyze realized default and loss severity rates more frequently, perhaps quarterly. They should document the results of validation, report them to appropriate levels of senior risk management, and take action as appropriate.

#### **Chapter 8: Stress Testing of Risk-Based Capital Requirements**

##### *Rule Requirements*

Part III, Section 22(j)(6): The bank must periodically stress test its advanced systems. The stress testing must include a consideration of how economic cycles, especially downturns, affect risk-based capital requirements (including migration across rating grades and segments and the credit risk mitigation benefits of double default treatment).

1. Under the IRB framework, changes in borrower credit quality will lead to changes in the risk-based capital requirements. Because credit quality typically improves or deteriorates in conjunction with economic conditions, risk-based capital requirements may also vary with the economic cycle. During an economic downturn, risk-based capital requirements typically increase as obligors or exposures migrate toward lower credit quality risk ratings or segments.

2. Stress testing analysis is a means of understanding how economic cycles, especially downturns, as represented by stress scenarios, will affect risk-based capital requirements through migration across risk ratings or segments, effects on double default treatment, and through effects on other relevant aspects of a bank's advanced systems.<sup>15</sup>

##### **S 8-1 Banks must conduct and document stress testing of their advanced systems as part of managing risk-based capital.**

<sup>15</sup> Stress testing is a general term that can be applied to different types of analysis, depending on the purpose of the exercise. Examples of stress testing that have a different purpose than contemplated here include a stress test of bank solvency and a stress test of an individual obligor.

3. Supervisors expect that banks will manage their risk-based capital position so that they remain at least adequately capitalized during all phases of the economic cycle. A bank that is able to accurately estimate risk-based capital levels during a downturn can be more confident of appropriately managing risk-based capital. Stress testing analysis consists of identifying a stress scenario and then translating that scenario into its effect on the levels of key performance measures, including risk-based capital ratios.

4. Banks should use a range of scenarios and methods when stress testing to manage risk-based capital. Scenarios may be historical, hypothetical, or model-based. Key variables specified in a scenario could include, for example, interest rates, transition matrices (ratings and score-band segments), asset values, credit spreads, market liquidity, economic growth rates, inflation rates, exchange rates, or unemployment rates. A single scenario may apply to the entire portfolio, or a number of scenarios may apply to various sub-portfolios. The severity of the stress scenario should be consistent with the periodic economic downturns experienced in the bank's market areas. Such scenarios may be less severe than those used for other purposes, such as testing a bank's solvency.

5. Given a scenario, a bank then estimates the effect of the scenario on risk-weighted assets and its future capital ratios relative to the risk-based capital minimums. Estimating capital ratios includes estimating levels of capital (the numerator of the ratio) as well as measures of risk-weighted assets (the denominator).

6. For example, suppose the scenario for both a retail and a wholesale portfolio is a specific historical recession. For the retail portfolio, score-band transition matrices observed during the recession could be used to quantify migration between segments and thus supply the new distribution of segments expected for the current portfolio, given the scenario. For the wholesale portfolio, internal or rating agency ratings transition matrices observed during the recession could be used to quantify ratings migration, and thus supply the distribution of rating grades. The distribution of segments and rating grades would allow the calculation of risk-weighted assets that would be expected during the recession scenario. Transitions into default would allow banks to estimate the effects of credit losses on income and capital. As part of this analysis, the bank should ensure that the rating philosophy (as

revealed by rating migration patterns) of the rating agency, or any other source of ratings, associated with the recession transition matrix is consistent with the bank's rating system, or appropriate adjustments should be made for differences in rating philosophy.

7. The scope of this estimation exercise should be broad and include all material portfolios under the framework for advanced systems. The time horizon of the stress testing analysis should be consistent with the specifics of the scenario and should be long enough to measure the material effects of the scenario on key performance measures. For example, if a scenario such as a historical recession materially affected income and segment or ratings migration over two years, the appropriate time horizon is at least two years.

8. The bank's management of risk-based capital should also take into account the effect of a bank's discretionary actions on risk-based capital levels. For example, a bank's plan to reduce dividends in the face of lowered income would, if implemented, affect retained earnings and the capital accounts. Such discretionary actions should be consistent with the bank's documented risk-based capital management policy. Because discretionary plans may or may not be implemented, a bank should estimate the relevant capital ratios both with and without these actions.

## Chapter 9: Counterparty Credit Risk Exposure

### Rule Requirements

Part III, Section 22(d): Counterparty credit risk model. A bank must obtain the prior written approval of [AGENCY] under section 32 [of the NPR] to use the internal models methodology for counterparty credit risk.

Part IV, Section 32: Counterparty Credit Risk

### I. Overview

1. This chapter supplements the detailed discussion of counterparty credit risk in the NPR by describing some of the elements of counterparty credit risk mitigation, providing information that may aid banks in choosing among the alternative methods to calculate EAD for these transactions, and providing some descriptions and illustrative examples of acceptable modeling practices for estimation of EAD under the alternative methods.

### II. Transactions With Counterparty Credit Risk

2. Transactions with counterparty credit risk are those where the credit

risk exposure varies with a market variable such as an interest rate or security price. For certain transactions subject to counterparty credit risk where there is financial collateral, a bank may be allowed to recognize the risk mitigating effect of that collateral through an adjustment to EAD.

3. As provided in the NPR, transactions with counterparty credit risk for which a bank may adjust EAD rather than LGD include:

- Repo-style transactions including repurchase and reverse repurchase agreements, and securities lending and securities borrowing transactions;
- Eligible margin loans; and
- Over-the-counter ("OTC") derivatives transactions.

4. Several methods are available to calculate EAD depending on the type of transaction, presence of eligible collateral, legal agreements surrounding a transaction, the operational capability of a bank, and the modeling capability of a bank:

- A collateral haircut approach that includes standard supervisory haircuts or the bank's own estimates of the haircuts—applied to individual repo-style transactions, eligible margin loans, and single-product groups of such transactions subject to a qualifying master netting agreement (netting set). Additionally, the haircut approach is available to recognize financial collateral in the current exposure methodology for OTC derivatives;
- A simple VaR methodology—applied to single-product netting sets of repo-style transactions and eligible margin loans;
- A current exposure methodology for OTC derivatives; and
- An internal models methodology available for all three transaction types.

5. Supervisor approval is required for all methods except the collateral haircut approach using standard supervisory haircuts and the current exposure methodology for OTC derivatives. To receive approval, a bank should demonstrate to its primary Federal supervisor:

- Internal operational processes used to determine the eligibility of transactions for the method chosen;
- Internal processes used to determine the regulatory and legal ability to net transactions in bankruptcy;
- Appropriate model validation and backtesting procedures;
- Appropriate internal controls for counterparty credit risk;
- Appropriate collateral management processes, which, at a minimum, determine whether collateral meets the definition of financial collateral; and