BASEL COMMITTEE ON BANKING SUPERVISION

BANK FOR INTERNATIONAL SETTLEMENTS

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Background note on LGD quantification

Introduction

The Basel II revised Framework Document issued by the Basel Committee in June 2004 (henceforth called the Framework Document) requires IRB banks to use estimates of LGD parameters that reflect "economic downturn conditions where necessary to capture the relevant risks."[1] The Framework Document describes approaches to quantifying these "downturn LGDs" in general terms, but deliberately leaves specific details of the quantification process for supervisors to develop in collaboration with the banking industry. The Basel Committee recognises that the quantification of LGD parameters in general, and of downturn LGDs in particular, is evolving and for this reason the Committee has announced its intention to continue to work with industry to develop appropriate approaches to quantifying downturn LGDs.

In September 2004 the Basel Committee's Capital Task Force (CTF) and its Accord Implementation Group (AIG) agreed to set up a joint working group to share views and consider appropriate approaches to clarifying supervisory expectations regarding LGD estimates. In the coming months the LGD Working Group plans to review the existing academic and practitioner literature and engage in a dialogue with industry. The Working Group plans to adopt a two-track approach to accomplishing its work. Over the near-term the Working Group will investigate ways to promote cross-bank consistency in LGD reporting. Such consistency is necessary to properly assess the quantitative impact of Pillar I capital requirements as supervisors and the banking industry move toward implementation of Basel II. Over the longer term the Working Group plans to investigate whether there exist consensus notions of "sound practice" with respect to the data inputs, quantification methods, and validation procedures needed to develop accurate downturn LGDs.

Why does Basel II require downturn LGDs?

The requirement that IRB banks use economic-downturn LGDs is intended to ensure that Pillar I capital requirements properly reflect material systematic volatility in credit losses over time. To the extent that recovery rates on defaulted exposures may be lower during economic downturn conditions than during typical conditions, a capital rule aimed at guaranteeing sufficient capital to cover realised losses during adverse circumstances should reflect this tendency.

[1] Basel Committee on Banking Supervision. *International Convergence of Capital Measurement and Capital Standards. A Revised Framework.* June 2004. http://www.bis.org/publ/bcbs107.htm. Paragraph 468.

A significant body of academic and practitioner research suggests that systematic volatility in recovery rates is a potentially important source of unexpected credit losses for some asset classes. For example, in a study for ISDA that surveys prior research and analyzes bond recovery data Altman, Resti, and Sirona conclude that "[i]t is clear that negative economic cycles and high default periods carry with them higher loss-given-default expectations than if the PD and recovery rate variables were considered stochastic but independent."[2]

The IRB risk-weight formulas contain explicit mathematical functions intended to account for the effect of systematic risk on default rates. In contrast, IRB banks are expected to incorporate the effects of systematic risk on recovery rates directly into estimated LGD parameters. Additional details on the way the IRB risk-weight formulas treat systematic risk in default and recovery rates are provided in the attached technical appendix.

Quantifying downturn LGDs

Criteria for the quantification of LGDs are described in paragraph 468 of the Framework Document.

> A bank must estimate an LGD for each facility that aims to reflect economic downturn conditions where necessary to capture the relevant risks. This LGD cannot be less than the long-run default-weighted average loss rate given default calculated based on the average economic loss of all observed defaults within the data source for that type of facility. In addition, a bank must take into account the potential for the LGD of the facility to be higher than the default-weighted average during a period when credit losses are substantially higher than average. For certain types of exposures, loss severities may not exhibit such cyclical variability and LGD estimates may not differ materially (or possibly at all) from the long-run default-weighted average. However, for other exposures, this cyclical variability in loss severities may be important and banks will need to incorporate it into their LGD estimates. For this purpose, banks may use averages of loss severities observed during periods of high credit losses, forecasts based on appropriately conservative assumptions, or other similar methods. Appropriate estimates of LGD during periods of high credit losses might be formed using either internal and/or external data. Supervisors will continue to monitor and encourage the development of appropriate approaches to this issue.

While this paragraph clearly articulates the need for banks to estimate downturn LGDs, it does not prescribe a specific approach to accomplishing this task. Recognising that there is, as yet, no clear "sound practice" for quantifying downturn LGDs, the Framework Document indicates that a variety of different approaches may be acceptable. An important objective of the LGD Working Group is to catalogue and evaluate approaches to complying with the requirements of paragraph 468.

The Framework Document leaves important details of the definition of downturn LGDs for supervisors to develop in collaboration with industry. For example, it does not describe a specific set of economic downturn conditions that could be used to estimate downturn LGDs. While the Framework Document suggests that downturn LGDs should be calibrated to a

[2] Altman, Edward, Andrea Resti and Andrea Sironi. "Analyzing and Explaining Default Recovery Rates." December 2001. http://www.isda.org/c_and_a/pdf/Analyzing_Recovery_rates_010702.pdf.

period “when credit losses are substantially higher than average” it does not elaborate on this definition. Supervisors working with industry will need to determine whether this standard should be applied to a particular product or business line, a product portfolio (corporate, sovereign, retail, etc.), a bank’s overall loan portfolio, or the economy as a whole. Similarly, it may be necessary to develop specific criteria for identifying periods of substantially higher than average credit losses.

Following its October 2003 decision to tie IRB capital requirements to an unexpected loss (UL) measure rather than a total loss (UL+EL) measure, the Basel Committee considered developing one or more supervisory mapping functions that would link long-run default-weighted average LGDs estimated by banks to downturn LGDs that could be used to set UL capital requirements. This work was undertaken, in part, to address concerns about the burden associated with accurately quantifying and validating downturn LGDs. No such function was included in the Framework Document. However one or more LGD mapping functions may be useful, for example, as a guide to banks in developing internal estimates of downturn LGDs, or perhaps as a means of quantifying downturn LGDs in cases where data or systems are not sufficiently advanced.

Paragraphs 434 through 437 of the Framework Document require that IRB banks establish internal stress-testing processes for assessing capital adequacy. Depending on how a bank complies with this requirement, such processes may provide data or methodologies that can be used to quantify downturn LGDs. Hence, the LGD Working Group is interested in cataloguing proposed approaches to stress testing that specifically relate to the measurement of loss severities.

Discussion questions

Economic downturn LGDs play a central role in the determination of IRB banks’ Pillar I capital requirements. Because these parameters enter the IRB capital functions directly, inaccurate quantification can have a first-order effect on risk-based capital ratios. The LGD Working Group has been tasked to consult with industry to investigate appropriate methods for quantifying and validating downturn LGDs. The following questions are suggested to begin that dialogue.

1. Paragraph 468 of the Basel II Framework Document requires that LGDs be calibrated to periods when “credit losses are substantially higher than average.” What additional elaboration on this description would help your institution to quantify downturn LGDs?

(a) For example, in evaluating whether credit losses are substantially higher than average should losses be measured with respect to a single facility type, a business line, a bank’s overall portfolio, or some other degree of aggregation?

(b) Would it be useful for the LGD working group to articulate specific scenarios or quantitative benchmarks for describing periods of substantially higher than average credit losses?

2. Describe how your institution plans to comply with the LGD quantification standards set forth in paragraph 468 through 472 of the Basel II Framework Document?

(a) Does your institution currently have sufficient data and systems to estimate long-run default-weighted average LGDs?

(b) For what facility types or portfolios do you foresee the greatest challenges in estimating downturn LGDs?

(c) In cases where internal recovery data are sparse, for example because observed defaults are rare, how does your institution plan to quantify LGDs? To what extent will your quantification processes rely on expert judgment or external data?

(d) How does your institution plan to develop LGDs and "best estimates of expected loss" for defaulted assets as described in paragraph 471 of the Framework Document?

3. One approach to quantifying downturn LGDs would be to specify a functional relationship between long-run default-weighted average LGDs and downturn LGDs. One or more such functions – calibrated by supervisors – could be used as a guide to banks in developing internal estimates of downturn LGDs, or as a fallback for quantifying downturn LGDs in cases where data or systems are not sufficiently advanced.

(a) Would one or more LGD mapping functions be a useful way of conveying supervisory expectations concerning the relationship between long-run default-weighted average LGDs and downturn LGDs?

(b) For what portfolios, business lines, or facility types would such a function be most useful?

© At what level of aggregation could such functions be applied? For example, would it be appropriate to provide a single function for all wholesale exposures, or would separate functions be needed for different types of wholesale exposures?

(d) What data are available for calibrating mapping functions?

(e) Do you have an alternative to the supervisory "mapping function" approach to propose for benchmarking or estimating downturn LGDs? What would be the advantages of this alternative approach versus the mapping function approach?

4. Please describe any analysis your institution has undertaken to measure the extent to which recovery rates vary over time or are correlated with default rates.

(a) For what facilities, business lines, or portfolio do you observe or expect to observe significant systematic variation in loss severities over time? What facilities, business lines, or portfolios exhibit little systematic variation in loss severities? Are there any facilities, business lines, or portfolios which in your judgment exhibit significantly high or low systematic variation in loss severities, but for which you lack convincing empirical evidence, perhaps because of data scarcity?

(b) What factors contribute to or reduce systematic variation in loss severities over time? What facility characteristics (collateral, seniority, etc.) affect systematic variation in loss severities? How does the way workouts are managed (e.g. internal workouts versus secondary market sales) affect systematic variation in loss severities?

(c) Some institutions have proposed using secondary market prices for defaulted obligations to measure LGDs (market LGDs) rather than data on the discounted value realised recoveries (workout LGDs). Do you observe differences in the degree of systematic variation in market versus workout LGDs?

(d) There are a range of possible interest rates that could be used to discount future cash flows from defaulted exposures for the purpose of quantifying LGDs. Please describe your institution's approach to discounting recoveries. How does the approach used for discounting of future cash flows affect assessments of the degree of systematic variation in loss severities?

(e) How does your institution deal with systematic variation in recovery rates for the purpose of managing economic capital? To the extent you have the capacity to measure loss severities that evolve over time as current conditions change, what types of LGD parameters do you use internally? For example do you use something akin to a long-run default-weighted average LGD, the most current LGD estimate available (i.e. a point-in-time measure), a downturn LGD, or some other metric?

5. Paragraphs 434 through 437 of the Framework Document require that IRB banks establish internal stress-testing processes for assessing capital adequacy. Do you see any synergies between your stress-testing processes and procedures for measuring downturn LGDs?

Technical Appendix

Downturn LGDs and the Basel II risk-weight functions

The asymptotic-single-risk-factor (ASRF) framework underpinning Basil II's IRB capital formulas provides a theoretical foundation for examining the role of systematic variation in recovery rates on risk-based capital requirements. Under this theoretical framework correlations in realised losses across exposures are assumed to be driven by a single systematic risk factor meant to capture the effects of unexpected changes in economic conditions. It can be shown that given this dependence assumption the loss rate for a well-diversified credit portfolio depends only on the systematic factor, and not on idiosyncratic risk factors associated with individual exposures. Furthermore, the total economic resources (both capital and provisions) that a bank must maintain in order to satisfy a portfolio-wide Value-at-Risk target can be determined by estimating the sum of the conditional expected losses (CEL) associated with each exposure in the portfolio.[3]

The CEL for an exposure is defined as the expected loss on the exposure given specific assumptions about the realised value of the single systematic risk factor. If X denotes the systematic risk factor and L denotes the loss rate on the exposure (L is zero if the exposure does not default) then, using standard probability notation, the CEL for the exposure is defined as

$$\text{CEL} = \text{E}\left[\text{L} \mid \text{X}\right]. \tag{1}$$

To satisfy a portfolio-wide 99.9% VaR target under the ASRF framework, a well-diversified bank must hold sufficient provisions and capital against each exposure to cover that exposure's conditional expected loss given a 99.9% adverse draw of the systematic risk factor. The Framework Document ties provision requirements to a measure of "expected" losses (EL) and capital requirements to a measure of "unexpected" losses (UL). For a given credit exposure, the sum of these requirements (ULEL) are derived from the exposure's CEL by the formula

$$\text{ULEL} = \text{E}\left[\text{L} \mid \text{X} = \text{x}_{99.9}\right] \tag{2}$$

where $\text{x}_{99.9}$ is the 99.9$^{\text{th}}$ percentile of the systematic factor.

The IRB risk-weights for Basel II are determined by combining bank-reported risk parameters with a simple supervisory model intended to approximate the ULEL calculation for each exposure in a bank's portfolio. If D is an indicator variable that is equal to one if an exposure defaults over a one-year horizon and zero otherwise, then the ULEL calculation in equation (2) can be expressed as

$$\begin{aligned} \text{ULEL} &= \text{P}\left[\text{D} = 1 \mid \text{X} = \text{x}_{99.9}\right] \cdot \text{E}\left[\text{L} \mid \text{D} = 1, \text{X} = \text{x}_{99.9}\right] \\ &= \text{CPD} \cdot \text{CLGD} \end{aligned} \tag{3}$$

[3] See M. Gordy ("A Risk Factor Model Foundation for Ratings-Based Bank Capital Rules*." Journal of Financial Intermediation, Vol. 12*. 2003. Pp. 199-232) for a detailed analysis of risk-based capital requirements under the ASRF framework.

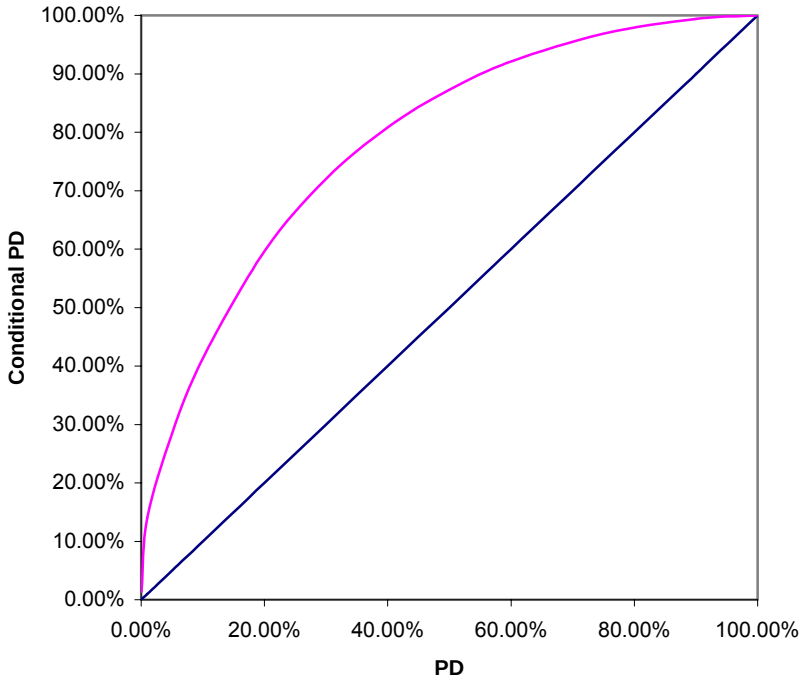
CPD is the conditional default probability of the exposure given the 99.9th percentile adverse draw of X, and CLGD is the conditional loss-given-default based on the same adverse draw of X.

IRB banks are not required to estimate CPDs directly. Instead, a supervisory mapping function is used to derive an exposure's conditional default probability from a bank-reported expected default probability (PD).

(4) $$\text{CPD} = \Phi\left(\frac{\Phi^{-1}(\text{PD}) + \sqrt{\rho}\cdot\Phi^{-1}(0.999)}{\sqrt{1-\rho}}\right)$$

where $\Phi(x)$ is a standard normal cumulative density function, $\Phi^{-1}(p)$ is the inverse of this function, and ρ is an asset-value-correlation (AVC) parameter prescribed by the Basel Committee. The details of the derivation of equation (4) are beyond the scope of this note, but the essential feature of this mapping function is that it is designed to extrapolate an estimate of the likelihood that an obligor will default given economic conditions that are much worse than expected.[4]

The magnitude of the difference between the CPD implied by equation (4) and the bank-reported PD depends on the level of the asset-value-correlation parameter. The AVC is a measure of the relative importance of systemic risk; the higher is the AVC, the greater is the gap between CPD and PD. The figure below plots the CPD as a function of PD given the AVC assumption used for corporate, sovereign, and interbank exposures in the Framework Document.



[4] See Basel Committee on Banking Supervision ("An Explanatory Note on the Basel II IRB Risk Weight Functions", Oct. 2004) and the documents cited therein for details on the derivation of the PD mapping function.

Combining equations (3) and (4) yields the following expression for an exposure's ULEL calculation as a function of the exposure's PD and CLGD

$$\text{ULEL} = \Phi\left(\frac{\Phi^{-1}(\text{PD}) + \sqrt{\rho}\cdot\Phi^{-1}(0.999)}{\sqrt{1-\rho}}\right)\cdot \text{CLGD}. \tag{5}$$

This formula forms the core of the IRB risk-weight functions that appear in the Framework Document.[5]

In contrast to the treatment of PDs, the IRB risk-weight formulas do not contain explicit mapping functions for deriving conditional LGDs from bank-reported expected LGDs. Instead, IRB banks are allowed to directly estimate parameters intended to approximate conditional LGDs. These estimates enter the capital formulas directly. In theory, conditional LGDs should reflect expected loss severities given the same severe adverse draw of the systematic risk factor used to derive conditional PDs. However, it is generally recognised that quantifying and validating this conceptual target is not operationally feasible given the current state of practice in this area. Consequently, the Framework Document requires that IRB banks report what are loosely called "downturn LGDs." As described in the body of this note, these downturn LGDs are designed to reflect systematic variation in recovery rates, but they are not explicitly tied to the 99.9th percentile systematic risk-factor draw used to derive conditional PDs.

An understanding of the relationship between ELGDs and CLGDs can provide insights into the characteristics of downturn LGDs. The expected LGD for an exposure is defined as

$$\text{ELGD} = \text{E}\left[\text{L} \mid \text{D} = 1\right] \tag{6}$$

and the conditional LGD is defined as

$$\text{CLGD} = \text{E}\left[\text{L} \mid \text{D} = 1, \text{X} = x_{99.9}\right]. \tag{7}$$

If loss severities are positively correlated with default rates then the CLGD should never be less than the ELGD for the same exposure. The extent to which CLGD exceeds ELGD for a particular exposure depends on the sensitivity of both default and loss severity to the systematic risk factor X. In those cases where systematic risk leads to significant cyclical variation in recovery rates, CLGD may be quite a bit greater than ELGD. On the other hand if systematic risk does not affect recovery rates for a particular class of exposures (i.e. recovery rates are stable over a credit cycle), then we can expect CLGD and ELGD to be the same. All else equal, when defaults are highly correlated with X (i.e., the AVC is high) the expected LGD will lie closer to the conditional LGD. This is because defaults are more likely to be observed during cyclical downturns, which tends to drive up the ELGD.

Though the downturn LGDs described in the Framework Document are only approximations to CLGDs, it is reasonable to expect bank-estimated downturn LGDs to have similar properties to CLGDs. For example, one could reasonably expect to see downturn LGDs lie closer to long-run default-weighted average LGDs in cases where there is believed to be little systematic risk in recovery rates and/or where default correlations are particularly high. In contrast, downturn LGDs may significantly exceed long-run averages in cases where systematic risk in recovery rates is believed to be an important driver of credit losses.

[5] The IRB risk-weight formulas are a bit more complicated than equation (5) because they provide for separate calculations of expected and unexpected loss and, in some cases, include an adjustment for maturity.

As with PDs, empirically-calibrated mapping functions relating ELGD and CLGD provides one approach to quantifying conditional or downturn LGDs. Because they do not reflect explicit assumptions about economic downturn conditions or a realised value of the systematic risk factor, ELGDs may be relatively easy to estimate from available data. For example, a long-run default-weighted average of observed loss severities among homogeneous defaulted assets can provide a consistent estimator of ELGD. Given an estimate of ELGD, a mapping function similar to (4) could be used to infer an estimate of CLGD.