

recovery risk dictates that application of a zero percent LGD is not acceptable.

S. IRB institutions that aggregate LGD estimates for severity grades from individual exposures within those grades must have a clear policy governing the aggregation process.

Banks with discrete severity grades compute a single estimate of LGD for a representative exposure within each of those grades. If a bank with a discrete scale of severity grades maps those grades to the reference data using grade mapping, there will be a single estimate of LGD for each grade, and the bank does not need to aggregate further. However, if the bank maps at the individual transaction level, the bank may then choose to aggregate those individual LGD estimates to the grade level and use the grade LGD in capital calculations. Because different methods of aggregation are possible, a bank must have a clear policy regarding how aggregation should be accomplished; in general, simple averaging is preferred. (This standard is irrelevant for banks that choose to assign LGD estimates directly to individual exposures rather than grades, because aggregation is not required in that case.)

S. An IRB institution must have a policy describing how it combines multiple sets of reference data.

Multiple data sets may produce superior estimates of loss severity, if the results are appropriately combined. Combining such sets differently usually produces different estimates of LGD. As a matter of internal policy, a bank should investigate alternative combinations, and document the impact on the estimates. If the results are highly sensitive to the manner in which different data sources are combined, the bank must choose conservatively among the alternatives.

#### *D. Exposure at Default (EAD)*

Compared with PD and LGD quantification, EAD quantification is less advanced. As such, it is addressed in somewhat less detail in this guidance than are PD and LGD quantification. Banks should continue to innovate in the area EAD estimation, refining and improving practices in EAD measurement and prediction. Additional supervisory guidance will be provided as more data become available and estimation techniques evolve.

A bank must provide an estimate of expected EAD for each facility in its portfolio. EAD is defined as the bank's expected gross dollar exposure of the facility upon the obligor's default. For fixed exposures like term loans, EAD is equal to the current amount outstanding. For variable exposures

such as loan commitments or lines of credit, exposure is equal to current outstandings plus an estimate of additional drawings up to the time of default. This additional drawdown, identified as loan equivalent exposure (LEQ) in many institutions, is typically expressed as a percentage of the current total committed but undrawn amount. EAD can thus be represented as:

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

As it is the LEQ that must be estimated, LEQ is the focus of this guidance.

Even though EAD estimation is less sophisticated than PD and LGD estimation, a bank still develops EAD estimates by working through the four stages that produce the other types of quantification: The bank must use a reference data set; it must apply an estimation technique to produce an expected total dollar exposure at default for a facility with a given array of characteristics; it must map its current portfolio to the reference data; and, by applying the estimation model, it must generate an EAD estimate for each portfolio facility or facility-type, as the case may be.

#### *Data*

Like reference data sets used for LGD estimation, LEQ data sets contain only exposures to defaulting obligors. In many cases, the same reference data may be used for both LGD and LEQ. 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.

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

The reference data must contain variables that enable the bank to group the exposures to defaulted obligors in meaningful ways. Obligor and facility risk ratings are commonly believed to be significant characteristics for predicting additional drawdown. Since less empirical research has been done on

EAD estimation, little is known about other potential drivers of EAD. Among the many possibilities, banks may consider 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 exogenous.

Industry practice is likely to improve as banks extend their research to identify other meaningful drivers of EAD.

A bank must ensure continued applicability of the reference data to its current portfolio of facilities. The reference data must include the types of variable exposures found in a bank's current portfolio. The definitions of default and exposure in the reference data should be consistent with the IRB definition of default, and consistent with the definitions used for PD and LGD quantification. Established processes must be in place to ensure that reference data sets are updated when new data are available. All data sources, variables, and the overall processes governing data collection and maintenance must be fully documented, and that documentation should be readily available for review.

Seven years of data are required for EAD (or LEQ) estimation. The sample should include periods during which default rates were relatively high, and ideally cover a complete economic cycle.

#### *Estimation*

To derive LEQ estimates, characteristics of the reference data are related to additional drawings preceding a default event. The estimation process must be capable of producing a plausible estimate of LEQ to support the EAD calculation for each facility. Two broad types of estimation methods are used in practice, the cohort method and the fixed-horizon method.

Under the cohort method, a bank groups defaults into discrete calendar periods (such as a year or a quarter). The bank then estimates the relationship between the drivers as of the start of that calendar period, and EAD or LEQ for each exposure to a defaulter. For each exposure category (that is, for each combination of exposure drivers identified by the bank), the LEQ estimate is calculated as the mean additional drawing for facilities in that category. To combine results for multiple periods into a single long-run average, the period-by-period means should be weighted by the proportion of defaults occurring in each period.

Under the fixed-horizon method, for each exposure to a defaulted obligor the