

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

S. Parameter estimates must incorporate a degree of conservatism that is appropriate for the overall robustness of the quantification process.

In estimating values of PD, LGD, and EAD should be as precise and accurate as possible. However, estimates of PD, LGD and EAD are statistics, and thus inherently subject to uncertainty and potential error. It is often possible to be reasonably confident that a risk component or other parameter lies within a particular range, but greater precision is difficult to achieve. Aspects of the ratings quantification process that are apt to introduce uncertainty and potential error include the following:

The estimation of coefficients of particular variables in a regression-based statistical default or severity model.

- The calculation of average default or loss rates for particular categories of credits in external default databases.
- The mapping between portfolio obligors or facilities and reference data when the set of common characteristics does not align exactly.

A general principle of the IRB approach is that a bank must adjust estimates conservatively in the presence of uncertainty or potential error. In many cases this corresponds to assigning a final parameter estimate that increases required capital relative to the best estimate produced through sound-practice estimation techniques. The extent of this conservative adjustment should be related to factors such as the relevance of the reference data, the quality of the mapping, the precision of the statistical estimates, and the amount of judgment used throughout the process. Margins of conservatism need not be added at each step; indeed, that could produce an excessively conservative result. The overall margin of conservatism should adequately account for all uncertainties and weaknesses; this is the general interpretation of requirements to incorporate appropriate degrees of conservatism. Improvements in the quantification process (use of better data, estimation techniques, and so on) may reduce the appropriate degree of conservatism over time.

Estimates of PD, LGD, EAD, or other parameters or coefficients should be presented with an accompanying sense of the statistical precision of the estimates; this facilitates an assessment of the appropriate degree of conservatism.

#### *B. Probability of Default (PD)*

##### *Data*

To estimate PD accurately, a bank must have a comprehensive reference data set with observations that are comparable to the bank's current portfolio of obligors. 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.

To ensure ongoing applicability of the reference data, a bank must assess the characteristics of its current obligors relative to the characteristics of obligors in the reference data. Such variables might include qualitative and quantitative obligor information, internal and external rating, rating dates, and line of business or geography. To this end, a bank must 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 must 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.

S. The sample for the reference data must be at least five years, and must include periods of economic stress during which default rates were relatively high.

To foster more robust estimation, banks should use longer time series when more than five years of data are available. However, the benefits of using a longer time series (longer than five years) may have to be weighed against a possible loss of data comparability. The older the reference data, the less similar they are likely to be to the bank's current portfolio; striking the correct balance is a matter of judgment. Reference obligors must not differ from the current portfolio obligors systematically in ways that seem likely to be related to obligor default risk. Otherwise, the derived PD estimates may not be applicable to the current portfolio.

Note that this principle does not simply restate the requirement for five years of data: periods of stress during which default rates are relatively high must be included in the data sample. Exclusion of such periods biases PD

estimates downward and unjustifiably lowers regulatory capital requirements.

*Example.* A bank's reference data set covers the years 1987 through 2001. Each year includes identical data elements, and each year is similarly populated. For its grade PD estimates, the bank relies upon data from a sub-sample covering 1992 through 2001. The bank provides no justification for dropping the years from 1987 through 1991. The bank contends that it is not necessary to include those data, as the reference sample they use for estimation satisfies the five-year requirement. This practice is not consistent with the standard because the bank has not supported its decision to ignore available data. The fact that the excluded years include a recession would raise particular concerns.

S. The definition of default within the reference data must be reasonably consistent with the IRB definition of default.

Regardless of the source of the reference data, a bank must apply the same default definition throughout the quantification processes. This fosters consistent estimation across parameters and reduces the potential for undesired bias. In addition, consistent application of the same definition across banks will permit true horizontal analysis by supervisors and engaged market participants.

This standard applies to both internal and external reference data. For internal data, a bank's default definition is expected to be consistent with the IRB definition going forward. Banks will be expected to make appropriate adjustments to their data systems such that all defaults as defined for IRB are captured by the time a bank fully implements its IRB system. For any historical or external data that do not fully comply with the IRB definition of default, a bank must make conservative adjustments to reflect such discrepancies. Larger discrepancies require larger adjustments for conservatism.

*Example.* To identify defaults in its historical data, a bank applies a consistent definition of "placed on nonaccrual." This definition is used in the bank's quantification exercises to estimate PD, LGD, and EAD. The bank recognizes that use of the nonaccrual definition fails to capture certain defaults as identified in the IRB rules. Specifically, the bank indicates that the following kinds of defaulted facilities would not have been placed on nonaccrual: (1) Credit obligations that were sold at a material credit-related economic loss, and (2) distressed restructurings. To be consistent with the standard, the bank must make a well-supported adjustment to its grade PD estimates to reflect the difference in the default definitions.

##### *Estimation*

Estimation of PD is the process by which characteristics of the reference