

is to reduce the speed with which capital requirements increase as PDs increase, and to increase the speed with which EL dominates the total capital charge, thereby tending to reduce procyclicality in the application of the wholesale A-IRB capital formulas. The specific formula for determining the asset correlation parameter for all wholesale exposures except HVCRE exposures is as follows:

$$R = 0.12 * (1 - \text{EXP}(-50 * \text{PD})) + 0.24 * [1 - (1 - \text{EXP}(-50 * \text{PD}))]$$

Where:

R denotes asset correlation;

EXP(x) denotes the natural exponential function; and

PD denotes probability of default.

Capital Requirement With Assumed One-Year Maturity Adjustment

The second step in the calculation of the A-IRB capital requirement for a particular wholesale exposure is the calculation of the capital requirement that would apply to the exposure assuming a one-year effective remaining maturity. The specific formula to calculate this one-year-maturity capital requirement is as follows:

$$K_1 = \text{EAD} * \text{LGD} * N[(1 - R)^{0.5} * G(\text{PD}) + (R/(1 - R))^{0.5} * G(0.999)]$$

Where:

K_1 denotes the one-year-maturity capital requirement;

EAD denotes exposure at default;

LGD denotes loss given default;

N(x) denotes the standard normal cumulative distribution function;

R denotes asset correlation;

G(x) denotes the inverse of the standard normal cumulative distribution function; and ¹⁸

PD denotes probability of default.

There are several important aspects of this formula. First, it rises in a straight-line fashion with increases in EAD, meaning that a doubling of the exposure amount would result in a doubling of the capital requirement. It also rises in a straight-line fashion with increases in LGD, which similarly implies that a loan with an LGD estimate twice that of an otherwise identical loan would have twice the capital requirement of the other loan. This also implies that as LGD or EAD estimates approach zero, the capital requirement would likewise approach zero. The remainder of the formula is a function of PD, asset correlation (R), which is itself a function of PD, and the target loss percentile amount of 99.9 percent discussed earlier.

Maturity Adjustment

The third stage in the calculation of the A-IRB capital requirement for a particular wholesale exposure is the application of a maturity adjustment to reflect the exposure's actual effective remaining maturity (M). The A-IRB maturity adjustment multiplies the one-year-maturity capital requirement (K_1) by a factor that depends on both M and PD. The fact that the A-IRB maturity adjustment

depends on PD reflects the Agencies' view that there is a greater proportional need for maturity adjustments for high-quality exposures (those with low PDs) because there is a greater potential for such exposures to deteriorate in credit quality than for exposures whose credit quality is lower. The specific formula for applying the maturity adjustment and generating the A-IRB capital requirement is as follows:

$$K = K_1 * [1 + (M - 2.5) * b] / [(1 - 1.5 * b)],$$

where $b = (0.08451 - 0.05898 * \text{LN}(\text{PD}))^2$

and:

K denotes the A-IRB capital requirement;
 K_1 denotes the one-year-maturity capital requirement;

M denotes effective remaining maturity;
LN(x) denotes the natural logarithm; and
PD denotes probability of default.

In this formula, the value "b" effectively determines the slope of the maturity adjustment and is itself a function of PD. Note that if M is set equal to one, the maturity adjustment also equals one and K will therefore equal K_1 .

To provide a more concrete sense of the range of capital requirements under the wholesale A-IRB framework, the following table presents the A-IRB capital requirements (K) for a range of values of both PD and M. In this table LGD is assumed to equal 45 percent. For comparison purposes, the general risk-based capital rules assign a capital requirement of 8 percent for most commercial loans.

CAPITAL REQUIREMENTS

[In percentage points]

PD	Effective remaining maturity (M)			
	1 month	1 year	3 years	5 years
0.05 percent	0.50	0.92	1.83	2.74
0.10 percent	1.00	1.54	2.71	3.88
0.25 percent	2.17	2.89	4.44	5.99
0.50 percent	3.57	4.40	6.21	8.03
1.00 percent	5.41	6.31	8.29	10.27
2.00 percent	7.65	8.56	10.56	12.56
5.00 percent	11.91	12.80	14.75	16.69
10.00 percent	17.67	18.56	20.50	22.45
20.00 percent	26.01	26.84	28.65	30.47

The impact of the A-IRB capital formulas on minimum risk-based capital requirements for wholesale exposures would, of course, depend on the actual values of PD, LGD, EAD, and M that banking organizations would use as inputs to the wholesale formulas. Subject to the caveats noted earlier, evidence from QIS3 suggested an average reduction in credit risk capital requirements for corporate exposures of about 26 percent for twenty large U.S. banking organizations.

SME Adjustment

For loans to SMEs not eligible for retail A-IRB treatment, the proposed calculation of the A-IRB capital requirement has one additional element—a downward adjustment based on borrower size (S). This adjustment would effectively lower the A-IRB capital requirement on wholesale exposures to SMEs with annual sales (or total assets) of less than \$50 million. The Agencies believe the measure of borrower size should be based on annual sales (rather than total assets), unless the banking organization can

demonstrate that it would be more appropriate for the banking organization to use the total assets of the borrower as its measure of borrower size. The borrower size adjustment would be made to the asset correlation parameter (R), as shown in the following formula:

$$R_{\text{SME}} = R - 0.04 * [1 - (S - 5)/45]$$

Where

R_{SME} denotes the size-adjusted asset correlation;

R denotes asset correlation; and

¹⁸ The N(x) and G(x) functions are widely used in statistics and are commonly available in computer

spreadsheet programs. A description of these functions may be found in the Help function of

most spreadsheet programs or in basic statistical textbooks.