

II. Internal Ratings-Based Approach to Credit Risk (IRB Approach)

A. Overview

- (A) Banks that have received supervisory approval to use the Internal Ratings-Based Approach (IRB approach) shall estimate risk components in determining the capital adequacy requirement for credit risks in accordance with the processes and criteria specified herein.
- (B) The so-called minimum capital is based on measure of unexpected losses (UL) on credit risk under the IRB framework. The treatment of expected losses (EL) is outlined in Part 6 hereunder.
- (C) Under the IRB framework, the capital requirement for each asset class contains three elements:
1. Risk components: The measures of risk components, including probability of default (PD), loss given default (LGD), exposure at default (EAD), and effective maturity (M or maturity)³³ that are estimated by the bank on its own or the supervisory values.
 2. Risk-weight function: This is the formula used to convert risk components into risk-weighted assets, and based on which, to determine regulatory capital.
 3. Minimum requirements: Banks that adopt the IRB approach for measuring the risk components of specific asset must meet the minimum requirements.
- (D) For other exposures not specified in the rules herein, a 100% risk weight applies in estimating the capital requirements for UL, except when a 0% risk weight applies under the standardized approach.
- (E) In the year prior to adopting the IRB approach, banks must calculate capital adequacy requirements using both the IRB approach and the original approach³⁴.
- (F) In the initial period of IRB approach implementation, banks must observe the capital floor requirements below:
1. Capital floor: capital floor is derived by applying an adjustment factor to the following amount:
 - (1) 8% of total risk-weighted assets calculated according to the applicable rules for the calculation of capital adequacy ratio prior to the adoption of IRB approach;
 - (2) plus Tier 1 and Tier 2 capital deductions; and
 - (3) less operating reserve and loan loss provision that are eligible for inclusion in Tier 2 capital pursuant to the Regulations Governing the Capital Adequacy Ratio of Banks.
 2. The adjustment factors for each year are as follows³⁵:
 - (1) For banks adopting foundation IRB (FIRB) approach³⁶, the adjustment factor is 95% in the

³³ Effective maturity needs not be estimated for retail exposures.

³⁴ Parallel calculation needs to be conducted for two years if the advanced approach is adopted.

³⁵ The supervisory authority may extend the application of capital floor in view of the actual status of respective banks.

first year of implementation, 90% in the second year of implementation, and 80% in the third year of implementation.

- (2) For banks adopting advanced IRB (AIRB) approach, the adjustment factor is 90% in the first year of implementation, and 80% in the second year of implementation.
3. If the floor amount is larger than the result of the following calculation, banks are required to add 12.5 times the difference to risk-weighted assets.
 - (1) 8% of total risk-weighted assets calculated according to the applicable rules for the calculation of capital adequacy ratio prior to the adoption of IRB approach;
 - (2) plus Tier 1 and Tier 2 capital deductions; and
 - (3) less operating reserve and loan loss provision that are eligible for inclusion in Tier 2 capital pursuant to the Regulations Governing the Capital Adequacy Ratio of Banks.

B. Categorization of exposures

(A) General

1. Banks must categorize banking-book assets into broad classes of assets according to the categories and standards set forth herein.
2. Subject to the consent of the supervisory authority, banks may adjust their asset classification method and standards based on long-term consistent risk management and practical experience in the determination of minimum capital.

(B) Definition of corporate exposures

1. Corporate exposures

A corporate exposure is defined as a claim on an enterprise or juristic person. The term “enterprise and juristic person” includes corporation, partnership, proprietorship, commercial undertakings owned by central government, and non-profit proprietary institutions. An exposure to any of the entities described above meets the criteria for retail exposures may be categorized under retail exposure³⁷.

2. Specialized lending (SL) under the corporate exposures

Corporate exposures that possess all the following characteristics are categorized under special lending (SL) exposures:

- a. The exposure is typically to an entity (often a special purpose entity (SPE)) which was created specifically to finance and/or operate physical assets;
- b. The borrowing entity has little or no other material assets or activities, and therefore relies primarily on the income received from the asset being financed to repay the

³⁶ The foundation IRB here applies to retail exposures.

³⁷ Exposures to individuals that do not meet the criteria for retail exposures should be categorized under corporate exposure.

obligation;

- c. The terms of the finance give the bank a substantial degree of control over the asset and the income that it generates.

If the primary source of repayment comes from an obligor with solid and diversified operation, good reputation and repayment contract protection, or if the source of repayment relies on the good financial condition and debt paying ability of the obligor, instead of relying excessively on the pledged asset, the lending should be categorized under general corporate exposure.

By the nature of lending, specialized lending can be classified into project finance, object finance, commodities finance, income-producing real estate, and high-volatility commercial real estate.

(1) Project finance

Project finance (PF) is a type of financing in which revenues generated by a single project serve both as security for the exposure and the source of repayment. It is usually for large, complex and expensive installations that might include, for example, power plants, chemical processing plants, mines, transportation infrastructure, environment, and telecommunications infrastructure. The purpose of financing includes construction, expansion, improvement or refinancing.

(2) Object finance

Object finance (OF) is refers to financing the acquisition of physical assets, such as ships, aircraft, satellites, railcars, and fleets, where the financed assets are pledged or assigned to the lender and the repayment is dependent on the cash flows generated by the specific assets. A primary source of these cash flows might be rental or lease contracts with one or several third parties.

(3) Commodities finance

Commodities finance (CF) refers to financing reserves, inventories, or receivables of exchange-traded commodities (e.g. crude oil, metals, or crops), where the exposure will be repaid from the proceeds of the sale of the commodity and the borrower has no other activities and no other material assets. The purpose of commodities finance is to enhance the credit quality of the borrower. The exposure's rating reflects its self-liquidating nature and liquidity, and the soundness of the transaction structure rather than the credit quality of the borrower.

(4) Income-producing real estate

Income-producing real estate (IPRE) refers to a financing commercial real estate (e.g. office buildings to let, retail space, residential apartments and buildings, industrial or warehouse space, and hotels). The borrower may be a special-purpose entity, or an operating company focused on real estate construction or holdings. The borrower may have sources of revenue other than real estate, but the source of repayment depends primarily on the cash flows generated from the rental or sale of the asset.

(5) High-volatility commercial real estate

High-volatility commercial real estate (HVCRE) lending meets the following criteria:

- a. The source of repayment of the real estate is cash flows generated from the rental or sale of the asset, but the volatility of the default rate is higher (that is, at origination of the exposure either the rental or sale of the property and the source of repayment are substantially uncertain; and
- b. Loans financing the land acquisition, development and construction (ADC) phases of a project.

(C) Definition of sovereign exposures

The counterparts of sovereign exposures include sovereigns (including regional governments), central banks, and claims on multilateral development banks (MDBs) that meet the criteria for a 0% risk weight, as well as International Monetary Fund, and PSEs³⁸.

(D) Definition of bank exposures

The counterparts of bank exposures include banks, bills finance companies, investment trust companies, credit cooperatives, credit departments of farmers' associations and fishermen's associations, financial holding companies, and MDBs that do not meet the criteria for a 0% risk weight under the standardized approach.

(E) Definition of retail exposures

1. General criteria

An exposure is categorized as a retail exposure if it meets all of the following criteria:

(1) Small-sum exposures to individuals or small and medium-sized enterprises (SMEs)

- a. Exposures to individuals: such as revolving credits and lines of credit (e.g. credit cards, overdrafts, and retail facilities secured by financial instruments) as well as personal term loans and leases (e.g. installment loans, auto loans and leases, student and educational loans, and personal finance), and residential mortgage loans. All exposures of a bank to an individual (excluding residential mortgage loan and qualifying revolving exposure) shall not exceed NT\$10 million. However the supervisory authority may adjust the aforesaid exposure threshold on a case-by-case basis in line with its risk management practice.
- b. Small-sum exposures to SMEs³⁹: All exposures of a bank to a SME (excluding residential mortgage loan and qualifying revolving exposure) shall not exceed NT\$40 million. However the supervisory authority may adjust the aforesaid exposure threshold on a case-by-case basis in line with its risk management practice.

(2) Large number of exposures managed on a pooled basis

³⁸ Commercial undertakings owned by central government should be categorized under corporate exposures. SME means a business that meets the definition for small and medium-sized enterprise provided in paragraph 2, Article 2 of the SME Development Act. A bank must obtain supervisory approval if it intends to adopt other definition for SME.

The exposure must be one of a large pool of exposures, which are managed by the bank on a pooled basis. There should be consistent requirement for the number of exposures within a pool for exposures in that pool to be treated as retail.

- (3) The total exposure to a single counterpart shall not exceed 0.2% of the aggregate retail exposure.

2. Classification of retail exposures

Within the retail asset class category, banks are required to identify three sub-classes of exposures: residential mortgage loan, qualifying revolving retail exposures, and other retail exposures.

(1) Residential mortgage loans

Loans to individuals secured by residential properties (including first and subsequent liens, term loans and revolving home equity lines of credit) are treated as residential mortgage loans regardless of exposure size. However, banks must establish explicit lending policy that stipulates the cap per loan, the maximum number of exposures to a single borrower, and loan-to-value ratio, etc.

(2) Qualifying revolving retail exposures

Qualifying revolving retail exposures must meet the following criteria:

- a. The exposures are revolving, unsecured, and uncommitted.
- b. The maximum exposure to a single individual is NT\$4 million.
- c. banks are able to demonstrate to the supervisory authority that the portfolio exhibits low volatility of loss rates (standard deviation of loss rate \div average loss rate) relative to that of other retail exposures (especially within the low PD bands). Data on loss rates for the portfolio of qualifying revolving retail exposure should be retained to facilitate analysis of the volatility of loss rates.

(3) Other retail exposures

Other retail exposures refer to retail exposures that meet the general criteria, but do not fall under residential mortgage loans or qualifying revolving retail exposures. This sub-class of exposures includes small-sum exposures to individuals and SMEs where the exposure to an individual does not exceed NT\$10 million, and the exposure to one single SME does not exceed NT\$40 million. Exposures exceeding those thresholds are treated as corporate exposure.

(F) Definition of equity exposures

Equity securities in the banking book that are not required for direct capital deduction under the standardized approach to credit risk are categorized as equity exposures⁴⁰. An equity exposure

⁴⁰ Equity exposures are defined on the basis of the economic substance of the instrument. They include both direct and indirect ownership interests, whether voting or non-voting, in the assets and income of an enterprise. Indirect equity interests include holdings of derivative instruments tied to equity interests and holdings in corporations, partnerships, limited liability companies or other types of enterprises that are engaged principally in the business of investing in equity instruments.

must meet all of the following criteria:

1. It is irredeemable in the sense that the return of invested funds can be achieved only by the sale of the investment or sale of the rights to the investment or by the liquidation of the issuer;
2. It does not embody other rights and obligations on the part of the issuer; and
3. It conveys a residual claim on the assets or income of the issuer.

In addition, any of the following instruments must be categorized as an equity exposure:

1. An instrument with the same characteristics as those permitted as Tier 1 capital for banks.
2. An instrument that embodies an obligation on the part of the issuer and meets any of the following conditions:
 - (1) The issuer may defer indefinitely the settlement of the obligation;
 - (2) The obligation requires (or permits at the issuer's discretion) settlement by issuance of a fixed number of the issuer's equity shares;
 - (3) The obligation requires (or permits at the issuer's discretion) settlement by issuance of a variable number of the issuer's equity shares and any change in the value of the obligation is attributable in proportion to the change in the value of a fixed number of the issuer's equity shares⁴¹.
 - (4) The holder has the option to require that the obligation be settled in equity shares.

However if a bank has demonstrated that the equity (regardless whether the trade has executed or not) trades more like the debt of the issuer than like its equity, and has the supervisory consent, the bank can treat such exposure separately.

Debt obligations and other securities, partnerships, derivatives or other structured instruments with the intent of conveying the economic substance of equity ownership (including liabilities from which the return is linked to that of equities) are considered an equity holding⁴². Equity investments that are structured with the intent of conveying the economic substance of debt holdings or securitization exposures would not be considered an equity holding.

(G) Definition of eligible purchased receivables

Eligible purchased receivables are divided into retail and corporate receivables as defined below:

1. Retail receivables

⁴¹ For certain obligations that require or permit settlement by issuance of a variable number of the issuer's equity shares, the change in the monetary value of the obligation is equal to the change in the fair value of a fixed number of equity shares multiplied by a specified factor. Those obligations meet the conditions of item 3 if both the factor and the number of shares are fixed. For example, an issuer may be required to settle an obligation by issuing shares with a value equal to three times the fair value of 1,000 equity shares. That obligation is considered to be the same as an obligation that requires settlement by issuance of shares equal to the fair value of 3,000 equity shares.

⁴² Equities that are recorded as a loan but arise from a debt/equity swap made as part of debt payoff or restructuring are included in the definition of equity holdings. However, these instruments may not produce a lower capital charge than would apply if the holdings remained in the debt portfolio.

Purchased retail receivables should meet the criteria for retail exposures provided herein and be managed on a pooled basis, and meet the rules for purchased receivables and minimum requirements under the IRB approach.

2. Corporate receivables

Banks with purchased corporate receivables should assess the default risk of individual obligors according to the operational requirements for corporate exposures. However, the bank may use the top-down approach, provided that purchased receivables also comply with both the criteria for eligible purchased receivables and the minimum requirements of the top-down approach, and it is materially difficult for the bank to assess the default risk of individual obligors (e.g. the receivables are purchased under an asset-backed securitization framework, which makes it difficult for the bank to assess the default risk of individual obligors). Banks must have the supervisory approval to manage the purchased corporate receivables on a pool basis.

Purchased corporate receivables managed on a pool basis must also meet the following conditions in addition to the minimum requirements for top-down management:

- a. The receivables are purchased from unrelated, third party sellers, and not originated by the bank.
- b. The seller of the receivable and the obligor do not have a direct interest in each other (e.g. receivables between affiliated enterprise and receivables subject to contra-accounts between firms that buy and sell to each other are ineligible⁴³).
- c. The purchasing bank has a claim on all proceeds from the pool of receivables or a pro-rata interest in the proceeds⁴⁴.
- d. Exposure to a single transaction is capped at NT\$4 million. Exposures that exceed this threshold must be managed on an individual basis for the purpose of capital charge.

Cash flows from the purchased corporate receivables are the primary protection against default risk. A bank may adopt the top-down approach to manage purchased receivables so long as the bank meets the relevant operational requirements, regardless whether the bank has recourse to the receivables or not.

C. Calculation of risk components under the foundation IRB (FIRB) approach and advanced IRB (AIRB) approach

(A) General requirements

Under the IRB approach, banks have the option to use the foundation IRB approach (called

⁴³ Contra-accounts involve a customer buying from and selling to the same firm. The risk is that debts may be settled through payments in kind rather than cash. Invoices between the companies may be offset against each other instead of being paid. This practice can defeat a security interest when challenged in court.

⁴⁴ Claims on tranches of the proceeds (first loss position, second loss position, etc.) would fall under the securitization treatment.

the “foundation approach” hereunder) or the advanced IRB approach (called the “advanced approach” hereunder). Under the foundation approach, banks must estimate their own probability of default (PD) and treat the other risk components according to the rules herein; under the advanced approach, banks must estimate their own probability of default (PD), loss given default (LGD), exposure at default (EAD), and effective maturity (M). No matter if a bank adopts the foundation approach or the advanced approach, the bank must use the risk weight formula provided herein for the calculation of risk-weighted assets.

(B) Application to different types of exposures

1. Corporate exposures

Under the foundation approach, banks must estimate their own PD for each class of obligors, while using the estimates provided by the supervisory authority for other risk components, including LGD, EAD and M⁴⁵. Under the advanced approach, banks must estimate their own risk components. For specialized lending, the treatment for SL exposures described below shall govern.

2. Specialized lending (SL) exposures under the corporate exposures

Banks must adopt the Supervisory Slotting Criteria Approach⁴⁶ to SL exposures if they do not meet the minimum requirements for the estimation of PD.

If a bank complies with the minimum requirements for risk components, the bank can choose the foundation approach or advanced approach for calculating the risk weight of SL exposures according to the rules for corporate exposures. However, banks should apply higher correlation for calculating the risk weight of high-volatility commercial real estate.

3. Sovereign and bank exposures

The rules for sovereign and bank exposures are the same as those for corporate exposures. Subject to supervisory approval, banks may calculate risk-weighted assets of those exposures according to the rules under the standardized approach if they do not have sufficient data for estimating risk components.

4. Retail exposures

For retail exposures, banks must estimate their own PD, LGD, and EAD.

5. Equity exposures

For equity exposures in the banking book, banks may adopt the PD/LGD approach or market-based approach.

6. Eligible purchased receivables

Banks have the option to adopt the foundation approach or the advanced approach to eligible corporate receivables. The same as retail exposures, banks may only apply advanced approach to eligible retail exposures.

⁴⁵ Under extraordinary circumstances, the supervisory authority has the discretion to require a FIRB bank to provide its own estimate of effective maturity.

⁴⁶ See Annex 2.

D. Implementation of the IRB approach

(A) Phased roll-out

Once a bank adopts an IRB approach, it should extend it across the entire banking group. However with supervisory approval, a bank may adopt a phased roll-out of the IRB approach in the following manner: (I) by asset class: phased roll-out across asset classes (or across individual sub-classes in the case of retail exposures); (II) by unit: phased roll-out across business units; (III) by risk component: move from the foundation approach to the advanced approach for certain risk components; and (IV) roll-out to newly purchased assets.

An IRB bank must produce a concrete implementation plan for the part of assets not yet included under the IRB approach. The bank should describe how its phased rollout plan is not motivated by a desire to reduce its capital requirements through the use of different approaches. The plan and description must be approved by the supervisory authority.

Subject to supervisory approval, some exposures in non-significant business units as well as asset classes may be excluded from the IRB approach and have capital requirements estimated using the standardized approach. However, the total capital charge for such exposures shall not exceed 15% of the capital requirements for credit risk; exposures to sovereigns, banks, and insurance companies that are exempted provisionally from the IRB approach as approved by the supervisory authority⁴⁷ are not included in the calculation of the 15% cap described above. The supervisory authority may require additional capital for those exposures.

Once a bank has adopted the IRB approach for corporate or retail asset classes, it will be required to adopt the IRB approach for its equity exposures at the same time, subject to materiality.

Once a bank has adopted the general IRB approach for corporate exposures, it will be required to adopt the IRB approach for the SL sub-classes within the corporate exposure class. A bank should not move to the advanced approach for high-volatility commercial real estate without first doing so for incoming-producing real estate.

A bank may, with supervisory approval, switch to the standardized approach or foundation approach in extraordinary circumstances (e.g. having lost a great fraction of the bank's credit related business).

(B) Transitional arrangement

For FIRB banks, the transitional period lasts from 2007 to 2009; for AIRB banks, the transitional period lasts from 2008 to 2010.

1. Corporate, sovereign, bank and retail exposures

The following minimum requirements may be relaxed during the transitional period:

(1) For corporate, sovereign, and bank exposures under the foundation approach, banks must

⁴⁷ For exposures to sovereigns, banks and insurance companies, bank should have a robust plan in place to include those exposures in the IRB approach within 10 years.

use at least five years of data to estimate the PD.

- (2) For retail exposures, banks must use at least five years of data to estimate risk components.
- (3) For corporate, sovereign, bank, and retail exposures, a bank must demonstrate it has been using a rating system that meets the minimum requirements for at least three years prior to qualification.
- (4) The aforementioned transitional arrangements also apply to the PD/LGD approach to equity. There are no transitional arrangements for the market-based approach to equity. Under these transitional arrangements banks are required to have a minimum of two years of data at the implementation of this framework in 2007. This requirement will increase by one year for each of three years of transition.

The LGD for retail exposures secured by residential properties may not be set below 10%⁴⁸ during the transitional period.

2. Equity exposures

With 10 years following the publication of the IRB approach, particular equity investments held at the time of publication may be exempted from the IRB treatment, subject to the supervisory approval. The exempted position includes only the number of shares held at the time of publication and any additional arising directly as a result of owning those holdings (excluding the shares that increase the proportional share of ownership in a portfolio company). In addition, positions eligible for IRB exemption shall not exceed 10% of Tier 1 capital plus Tier 2 capital.

If an acquisition increases the proportional share of ownership in a specific holding (e.g. due to a change of ownership initiated by the investing company subsequent to the publication of this framework), the exceeding part of the holding is not subject to the exemption. Nor will the exemption apply to holdings that were originally subject to the exemption, but have been sold and then bought back.

Equity holdings covered by the exemption provisions in the preceding paragraph will be subject to the capital requirements of the standardized approach during the IRB exemption period.

E. Risk-weighted assets and calculation of capital charge

(A) Corporate exposures (same for sovereign and bank exposures)

1. Formula for derivation of risk-weighted assets

The risk-weighted assets for normal (non-defaulted) exposures are calculated using the

⁴⁸ The 10% LGD floor does not apply to exposure portfolio guaranteed by sovereign. Moreover, the existence of the floor does not imply any waiver of the requirements of LGD estimation laid out in minimum requirements.

following formulas^{49 50}:

$$\text{Correlation (R)} = 0.12 \times \left[\frac{1 - e^{(-50 \times PD)}}{1 - e^{-50}} \right] + 0.24 \left[1 - \left(\frac{1 - e^{(-50 \times PD)}}{1 - e^{-50}} \right) \right]$$

$$\text{Maturity adjustment (b)} = [0.11852 - 0.05478 \times \ln(PD)]^2$$

$$\begin{aligned} \text{Capital requirement (K)}^{51} = & \left[LGD \times N \left[(1 - R)^{-0.5} \times G(PD) + \left(\frac{R}{1 - R} \right)^{0.5} \times G(0.999) \right] - PD \times LGD \right] \\ & \times (1 - 1.5 \times b)^{-1} \times [1 + (M - 2.5) \times b] \end{aligned}$$

$$\text{Risk-weighted assets (RWA)} = K \times 12.50 \times \text{EAD}$$

The capital requirement (K) for a defaulted exposure is equal to the greater of zero and the difference between its LGD (has taken into account additional unexpected loss during the recovery period) and expected loss (the bank's best estimate under then economic conditions and characteristics of the facility). The capital requirement is zero if the difference is negative.

2. Firm-size adjustment for corporate exposures

Under the IRB approach, banks will be permitted to deduct firm-size adjustment ($0.04 \times (1 - (S - 200)/1800)$) from the correlation for corporate exposures where the reported sales for the consolidated group of which the counterpart is a part is less than NT\$2 billion). S is expressed as total annual sales in millions of NTD with values of S falling in the range of NT\$ 200 million and NT\$2 billion. Reported sales of less than NT\$200 million will be treated as if they were equivalent to NT\$200 million for the purposes of the firm-size adjustment.

$$\text{Correlation (R)} = 0.12 \times \left[\frac{1 - e^{(-50 \times PD)}}{1 - e^{-50}} \right] + 0.24 \times \left[1 - \left(\frac{1 - e^{(-50 \times PD)}}{1 - e^{-50}} \right) \right] - 0.04 \times \left[1 - \left(\frac{S - 200}{1800} \right) \right]$$

⁴⁹ ln denotes natural logarithm.

⁵⁰ N(x) denotes the cumulative distribution function for a standard normal random variable (i.e. the probability that a normal random variable with mean zero and variance of one is less than or equal to x). G(z) denotes the N(x) = z). The normal cumulative distribution function and the inverse of the normal cumulative distribution function are, for example, available in Excel as the functions NORMSDIST and NORMSINV.

⁵¹ If this calculation results in a negative capital charge for any individual sovereign exposure, banks should apply a zero capital charge for that exposure.

When data on the total sales of the consolidated group are not available or apparently unreasonable, banks are allowed to total assets of the consolidated group for total sales in calculating the firm-size adjustment.

3. Risk weights for specialized lending

- (1) Risk weights for project finance, object finance, commodities finance, income-producing real estate (IPRE)

Banks that do not meet the minimum requirements for the estimation of PD under the corporate IRB approach will be required to map their SL exposures into five supervisory categories according to the supervisory slotting criteria approach (see annex attached). Each supervisory category corresponds to an unexpected loss (UL) risk weight and mapped to an external credit rating as illustrated below:

Supervisory categories and UL risk weights for other SL exposures and mapping to external ratings

Supervisory category	Strong	Good	Satisfactory	Weak	Default
Risk weight	70%	90%	115%	250%	0%
External rating	BBB- or better	BB+ to BB	BB- to B+	B to C-	N/A

With the exceptions to IPRE, banks, with supervisory approval, may assign preferential risk weights of 50% to “strong” exposures, and 70% to “good” exposures, provided they have a remaining maturity of less than 2.5 years or the bank’s risk assessment method or the obligor’s rating from eligible external assessment institution is superior to that specified in the slotting criteria for the relevant risk category.

Banks that meet the requirements for the estimation of risk components will be able to use the foundation approach or the advanced approach for the corporate asset class to derive risk weights for SL subclasses.

- (2) Risk weights for high-volatility commercial real estate (HVCRE)

For banks that do not meet the IRB requirements for estimation of risk components, or if the supervisory authority does not approve the bank’s use of foundation or advanced approaches to HVCRE, the bank must map its HVCRE exposures into five supervisory categories according to the supervisory slotting criteria approach (the mapping criteria are the same as those for IPRE). Each supervisory category corresponds to an unexpected loss (UL) risk weight and mapped to an external credit rating as illustrated below:

Supervisory categories and UL risk weights for HVCRE and mapping to external ratings

Supervisory category	Strong	Good	Satisfactory	Weak	Default
Risk weight	95%	120%	140%	250%	0%

External rating	BBB- or better	BB+ to BB	BB- to B+	B to C-	N/A
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Banks that meet the minimum requirements for estimating risk components for their HVCRE exposures must apply the following correlation to the formula for derivation of risk-weighted assets for corporate exposures as described above:

$$\text{Correlation (R)} = 0.12 \times \left[\frac{1 - e^{(-50 \times PD)}}{1 - e^{-50}} \right] + 0.30 \times \left[1 - \left(\frac{1 - e^{(-50 \times PD)}}{1 - e^{-50}} \right) \right]$$

4. Calculation of risk-weighted assets for exposures subject to the double default framework

- (1) Under the double default framework, the capital requirement (K_{DD}) for a hedged exposure subject to the double default treatment is calculated by multiplying K_0 (see formula below) by a multiplier depending on the PD of the protection provider (PD_g):

$$K_{DD} = K_0 \cdot (0.15 + 160 \cdot PD_g)$$

- K_0 is calculated in the same way as a capital requirement for an unhedged corporate exposure (as shown in II. E (A) 1 & 2), but using different parameters for LGD and the maturity adjustment:

$$K_0 = LGD_g \cdot \left\{ N \left[\frac{G(PD_o) + \sqrt{\rho_{os}} \cdot G(0.999)}{\sqrt{1 - \rho_{os}}} \right] - PD_o \right\} \cdot \frac{1 + (M - 2.5) \cdot b}{1 - 1.5 \cdot b}$$

- PD_o and PD_g are respectively the probabilities of default of the obligor and guarantor, both subject to the minimum threshold for PD floor.
- ρ_{os} is calculated according to the formula for correlation (R) in paragraph 272 (or, if applicable, paragraph 273), where $PD = PD_o$ and LGD_g is the LGD of a direct exposure to the guarantor.
- The LGD associated with an unhedged facility to the guarantor or the obligor depends on, in the event both the guarantor and the obligor default during the life of the hedged transaction, the amount recoverable estimated based on available evidence on the financial condition of the guarantor or obligor and the structure of the guarantee. In estimating the LGD of collateral provided by the obligor or the credit protector, there may be no consideration of double recovery in the LGD estimate.
- The maturity adjustment coefficient (b) is calculated according to the rules for maturity adjustment for corporate exposures described above, with PD being the minimum of PD_o and PD_g ; M being the effective maturity of the hedged exposure, which may not be below the one-year threshold under the double default framework.

- (2) The risk-weighted asset amount is calculated in the same way as for unhedged exposures

as shown below:

$$RWA_{DD} = K_{DD} \cdot 12.5 \cdot EADg$$

5. Risk components

(1) Probability of default (PD)

For corporate and bank exposures, the PD is the one-year PD associated with the internal borrower grade to which that exposure is assigned, which may not be lower than 0.03%. For sovereign exposures, the PD is the one-year PD associated with the internal borrower grade to which that exposure is assigned. The PD of borrowers assigned to a default grade in accordance with the definition of default provided herein is 100%.

(2) Loss given default (LGD)

Under the IRB framework, an estimate of LGD for each corporate, sovereign and bank exposure is derived based on the applicable capital charge approach (foundation approach or advanced approach) as described below:

a. LGD under the foundation approach

Under the foundation approach, senior claims on corporates, sovereigns and banks not secured by eligible collateral are uniformly assigned a 45% LGD; all subordinated claims on corporates, sovereigns and banks are uniformly assigned a 75% LGD⁵².

Eligible collateral under the foundation approach includes the eligible financial collateral recognized in the standardized approach and eligible collateral recognized under the IRB approach, including receivables, specified commercial and residential real estate (CRE/RRE) that meet the minimum requirements, and other collateral with liquidity and open market value (e.g. transportation equipment).

The methodology for the recognition of eligible financial collateral is the same as that outlined in the comprehensive approach to collateral in the standardized approach. The simple approach to collateral presented in the standardized approach will not be available to banks adopting the IRB approach.

(a) Following the comprehensive approach, the LGD* applicable to a collateralized transaction can be expressed as follows:

$$LGD^* = LGD \times (E^* / E)$$

⁵² A subordinated loan is a facility that is expressly subordinated to another facility. A bank must demonstrate to the supervisory authority that the claim on a specific facility is free of any apparently unfavorable condition for recourse. Otherwise, supervisory authority has the discretion to require the bank to assign a 75% LGD to the claim.

- LGD is that of the senior unsecured exposure before recognition of collateral (45%);
- E is the current value of the exposure;
- E* is the exposure value after risk mitigation ⁵³. Banks may calculate E* using any of the ways specified under the comprehensive approach for collateralized transactions.

- (b) Where repo-style transactions are subject to a master netting agreement, a bank may recognize the effect of risk mitigation only if the transactions satisfy the criteria for master netting agreement provided under the standardized approach. The bank must calculate the mitigated E* in accordance with the provisions of the standardized approach and equate this to EAD. The impact of collateral on these transactions may not be reflected through an adjustment to LGD.
- (c) As in the standardized approach, for repo-style transactions where the conditions for zero haircut are met, and in addition, the counterparty is a core market participant as specified, banks may choose not to apply the haircuts specified under the comprehensive approach, but instead to apply a zero haircut.

Under the foundation approach, the methodology for determining the LGD for corporate exposures secured by eligible IRB collateral is as follows

- Where ratio of the current value of the collateral (C) to the current value of the exposure (E) is below a threshold level of C* (i.e. the required minimum collateralization level for the exposure), the exposure will be assigned appropriate LGD for unsecured exposures.
- Where ratio of the current value of the collateral (C) to the current value of the exposure (E) exceeds C** (i.e. the required level of over-collateralization for full LGD recognition, the exposure would be assigned an LGD according to the following table.

The following table illustrates senior exposures, the minimum collateralization level, and applicable LGD:

LGD applicable to secured portion of senior exposures

	LGD	Minimum required collateralization ratio	Required level of over-collateralization for full

⁵³ This principle applies to the calculation of LGD* only. Unless there are special provisions, banks must treat the collateral as uncollateralized in the calculation of EAD.

		(C*)	collateral recognition (C**)
Eligible financial receivables	0%	0%	N/A
Receivables	35%	0%	125%
CRE/RRE	35%	30%	140%
Other collateral ⁵⁴	40%	30%	140%

- Senior exposures are to be divided into fully collateralized and uncollateralized portions.
- The part of the exposure considered to be fully collateralized, i.e. C/C**, receives the LGD associated with the type of collateral.
- The remaining part of the exposure is regarded as unsecured and receives an LGD of 45% for senior exposures and 75% LGD for subordinate exposures.

Where a bank has taken both financial collateral and other eligible IRB collateral, the methodology for determining the LGD of a transaction under the foundation approach should be consistent with the treatment in the standardized approach and based on the following principles:

- In the case where a bank has obtained multiple forms of collateral for an exposure, it will be required to subdivide the exposure (after the haircut for eligible financial collateral) into portions each covered by only one collateral. That is, the bank must divide the exposure into the portion covered by eligible financial collateral, the portion covered by receivables, the portion covered by CRE/RRE collateral, and a portion covered by other collateral, with the remaining portion as unsecured.
- Where the ratio of the sum of the value of CRE/RRE and eligible collateral in the form of transportation equipment to the mitigated exposure (after recognizing the effect of eligible financial collateral and receivables collateral) is below the associated threshold level (i.e. the minimum collateralization level of the exposure), the exposure would receive the appropriate unsecured LGD value.
- The risk-weighted assets for each fully secured portion of exposure must be calculated separately.

b. LGD under the advanced approach

Under the advanced approach, if a bank meets the minimum requirements, the supervisory authority may permit the bank to use their own internal estimates of LGD for corporate, sovereign and bank exposures.

c. Treatment of repo-style transactions

⁵⁴ Other collateral excludes physical assets obtained by the bank as a result of a loan default.

For capital charge purposes, if a bank intends to recognize the effects of master netting agreements on repo-style transactions, the bank must comply with the requirements for master netting agreement under the standardized approach, calculate the mitigated E^* according to the rules under the standardized approach, and use E^* as the EAD. For banks using the advanced approach, own LGD estimates would be permitted for the mitigated exposure (E^*).

d. Treatment of guarantees and credit derivatives

Under the IRB approach, the methods for recognizing the RCM effect of guarantees and credit derivatives vary for the foundation approach and the advanced approach. Under either approach, unless the requirements for double default calculation are satisfied, the adjusted risk weight after risk mitigation must not be less than that of a direct exposure to the protection provider. If the application of the aforesaid provisions results in higher capital requirement, banks may choose not to recognize CRM effect.

(a) Recognition under the foundation approach

- i. For banks using the foundation approach for LGD, the approach to guarantees and credit derivatives closely follows the treatment under the standardized approach. But eligible guarantors that are internally rated and associated with a PD equivalent to an external rating of A- or better may also be recognized under the foundation approach. Facilities guaranteed by the SME Credit Guarantee Fund may be treated as other collateral to which the supervisory LGD applies, or the bank may apply to the supervisory authority for the use of advanced approach to LGD estimation. For tranching credit guarantee cases, the bank must apply to the supervisory authority for the use of advanced approach to LGD estimation before recognizing the effect of guarantee. Other minimum requirements shall follow the relevant rules under the standardized approach.
- ii. Eligible guarantees from eligible guarantors will be recognized as follows:
 - For the covered portion of the exposure, a risk weight is derived by taking:
 - the PD appropriate to the guarantor, or PD appropriate to the grade between the underlying obligor and the guarantor's grade if the bank deems a full substitution treatment is inappropriate; and
 - the risk-weight function appropriate to the type of guarantor
 - The bank may replace the LGD of the original transaction (in the absence of a guarantor) with the LGD after taking into account seniority and the effect of guarantee.
- iii The uncovered portion of the exposure is assigned the risk weight associated with the underlying obligor
- iv Where partial coverage exists, or where there is a currency mismatch between the underlying obligation and the credit protection, it is necessary to split the exposure into a covered and an uncovered amount. The treatment in the foundation approach follows that outlined in the standardized approach, and takes

into account whether the cover is proportional or tranching

(b) Recognition under the advanced approach

Banks using the advanced approach for estimating LGDs may reflect the risk mitigating effect of guarantees and credit derivatives through either adjusting PD or LGD estimates. Whether adjustments are done through PD or LGD, the approach must be applied in a consistent manner for a given guarantee or credit derivative type.

Banks using the advanced approach for estimating LGDs has the option to adopt the treatment under the foundation approach outlined above, or to make an adjustment to its LGD estimate of the exposure to reflect the presence of the guarantee or credit derivative. Under the premises that the minimum requirements for relevant risk mitigation are satisfied, there are no other limits to the range of eligible guarantors and credit derivatives protection providers under the advanced approach.

(c) Operational requirements for recognition of double default

i A bank using an IRB approach has the option to adopt the double default framework or use the substitution approach in determining the appropriate capital requirement for each eligible exposure. However, for exposures hedged by one of the following instruments and calculated based on the double default framework, the additional operational requirements set out in section ii below shall be satisfied.

- Single-name unfunded credit derivatives, e.g. credit default swaps, or single-name guarantees.
- First-to-default basket products - the double default treatment will be applied to the asset within the basket with the lowest risk-weighted amount.
- n^{th} -to-default basket products - the protection obtained is only eligible under the double default framework if eligible $(n-1)$ th default protection has also been obtained or where $(n-1)$ of the assets within the basket have already defaulted.

ii Additional operational requirements:

- The risk weight that is associated with the exposure prior to the application of the framework does not already factor in any aspect of the credit protection;
- The credit protection provider is a bank⁵⁵, investment firm or insurance company (but only those that are in the business of providing credit protection, including mono-lines, re-insurers, and non-sovereign credit export agencies⁵⁶), which are classified as a financial firm selling credit protection and meets the

⁵⁵This does not include PSEs and MDBs, even though claims on these may be treated as claims on banks according to section II. B. (D).

⁵⁶“Non-sovereign” means that credit protection in question does not include any explicit sovereign counter-guarantee.

following criteria:

- The firm is regulated in a manner equivalent to the capital adequacy rules provided herein (including rules for supervisory oversight, market discipline and transparency), or externally rated as at least investment grade by a credit rating agency recognized by the supervisory authority;
- The firm had an internal rating with a PD equivalent to or lower than that associated with an external A– rating at the time the credit protection was first provided or for any period of time thereafter; and
- The firm has an internal rating with a PD not higher than that associated with an external investment-grade rating;
- The underlying obligation is:
 - a corporate exposure (excluding specialized lending exposures for which the supervisory slotting criteria approach applies);
 - a claim on a PSE (excluding sovereign exposures); or
 - a loan extended to a small business and classified as a retail exposure;
- The underlying obligor is not:
 - a financial firm that provides credit protection; or
 - a member of the same group as the protection provider;
- The credit protection meets the minimum requirements for guarantees and credit derivatives under the standardized approach to credit risk;
- The bank has the right to receive payment from the credit protection provider without having to take legal action in order to pursue the counterparty for payment, and the bank ensures that the protection provider is willing to pay promptly if a credit event should occur;
- The credit protection absorbs all credit losses incurred on the hedged portion of an exposure that arise due to the credit events outlined in the contract;
- If the contractual payment provides for physical settlement, there must be legal certainty with respect to the deliverability of a loan, bond, or contingent liability. If a bank intends to deliver an obligation other than the underlying exposure, it must ensure that the deliverable obligation is sufficiently liquid so that the bank would have the ability to purchase it for delivery in accordance with the contract;
- The terms and conditions of credit protection arrangements must be legally confirmed in writing by both the credit protection provider and the bank;
- In the case of protection against dilution risk, the seller of purchased receivables must not be a member of the same group as the protection provider;
- Other than systemic risk factor, there is no high correlation between the creditworthiness of a protection provider and the obligor of the underlying exposure due to other common factors. The bank has a process to detect such

high-level correlation. For example, such high-level correlation would arise when a protection provider guarantees the debt of a supplier of goods or services and the supplier derives a high proportion of its income or revenue from the protection provider.

(3) Exposure at default (EAD)

The following provisions apply to both on and off-balance sheet positions. All exposures are measured as gross of specific provisions or partial write-offs. The EAD on drawn amounts should not be less than the sum of “any specific provisions and partial write-offs” plus “the amount by which a bank’s regulatory capital would be reduced if the exposure were fully written-off.”

a. Exposure measurement of on-balance sheet items

On-balance sheet netting of assets and liabilities will be recognized subject to the same conditions as under the standardized approach. Where currency or maturity mismatch occurs, the treatment of on-balance sheet netting exists also follows the standardized approach.

b. Exposure measurement for off-balance sheet items (with the exception of foreign exchange and interest rate, equity, and commodity-related derivatives)

For off-balance sheet items, exposure is calculated as the committed but undrawn amount multiplied by a credit conversion factor (CCF).

(a) There are two approaches for the estimation of CCFs: the foundation approach and the advanced approach.

(i) Estimation of CCF under the foundation approach

A CCF of 75% will be applied to commitments, Note Issuance Facilities (NIFs) and (Revolving Underwriting Facilities) RUFs regardless of the maturity of the underlying facility. The CCF for other transactions follows the treatment under the standardized approach. The amount to which the CCF is applied is the lower of the value of the unused committed credit line, and the value that reflects any constraint on the available facility (e.g. the existence of a ceiling on the lending amount which is related to a borrower’s reported cash flow). If the facility is constrained in this way, the bank must demonstrate to the supervisory authority that it has sufficient monitoring and control procedures in place. To those facilities which are uncommitted (i.e. unconditionally cancelable), or that effectively provide for automatic cancellation by the bank at any time based on the credit status of the borrower (e.g. when the customer’s creditworthiness deteriorates, the bank may cancel the credit extended directly without prior notice), a 0% CCF applies. In order to apply a 0% CCF for unconditionally and immediately cancelable corporate overdrafts and other facilities as described in the preceding paragraph, banks must demonstrate to the supervisory authority that

they actively monitor the financial condition of the borrower, and that their internal control systems are such that they could cancel the facility upon evidence of a deterioration in the credit quality of the borrower. Where a commitment is obtained on another off-balance sheet exposure, banks under the foundation approach are to apply the lower of the applicable CCFs.

(ii) Estimation of CCF under the advanced approach

Except for exposures subject to a 100% CCF in the foundation approach, banks which meet the minimum requirements for use of their own estimates of EAD will be allowed to use their own internal estimates of CCFs for different product types. Banks that did not take into account CCF in the estimation of EAD must reflect the potential loss on additional drawing prior to default in the estimation of LGD.

(b) A 100% CCF should be assigned to defaulted exposures in principle.

Notwithstanding the foregoing, if a bank can demonstrate that the possibility of transferring such exposure to on-balance sheet assets is immaterial, a FIRB bank may adopt the supervisory CCF value, while a AIRB bank may estimate its own CCF.

(c) Measurement of counterparty credit risk exposure

Under the IRB approach, measures of exposure for securities financing transactions (SFTs) and OTC derivatives that expose banks to counterparty credit risk will be calculated according to the rules set forth in Annex 3 -Treatment of Counterparty Credit Risk. The counterparty credit risk of failed trades and non-delivery-versus-payment (DvP) transactions are treated according to the rules set forth in Annex 4.

(4) Effective maturity (M)

a. Recognition under the foundation approach

For banks using the foundation approach for corporate exposures, the effective maturity (M) will be 2.5 years except for repo-style transactions where the effective maturity will be 6 months. Banks can also choose to estimate M for each facility on their own.

b. Recognition under the advanced approach (including own estimates)

Banks using the advanced approach must measure the effective maturity (M) for each transaction or facility. Except for short-term exposures with an original maturity of less than one year, banks should estimate M according to the following rules by taking the greater of one year and the remaining effective maturity. In all cases, M will be no greater than 5 years and no less than 1 year.

- For an instrument subject to the estimation of cash flows, effective maturity M is defined as: $M = \sum t \times CF_t / \sum CF_t$.
- Where CF_t denotes the cash flows (principal, interest payments and fees)

contractually payable by the borrower in period t .

- If a bank is unable to calculate the effective maturity as noted above, it is allowed to use a more conservative measure of M , for example, taking the maximum remaining time (in years) that the borrower is permitted to take to fully clear its contractual obligations (principal, interest, and fees) under the terms of loan agreement. Normally, this will correspond to the nominal maturity of the transaction.
- For derivatives subject to a master netting agreement, the weighted average maturity of the transactions should be used when applying the explicit maturity adjustment. In addition, the notional amount of each transaction should be used for weighting the maturity.

The minimum effective maturity of one year in the preceding paragraph does not apply to certain short-term exposures with an original maturity of less than one year; for such exposures, the maturity is calculated as the greater of one-day, and the effective maturity (M , consistent with the definition above). This provision applies to one-time short-term exposures. Thus exposures involving ongoing financing of the obligor by the bank are not eligible for the treatment hereof even if the original maturity under the new contract is less than one year.

One-time short-term exposures with an original maturity of one year that are eligible for the treatment described in the preceding paragraph include:

- (a) Commercial paper guarantees.
- (b) Call loans to banks (interbank loan)
- (c) Notes receivable.
- (d) Import letters of credit.
- (e) Export letters of credit.
- (f) Discount.
- (g) Overdrafts.
- (h) Import financing.
- (i) Export financing.
- (j) Receivable factoring.
- (k) Foreign exchange margin trading.
- (l) Derivative transactions.
- (m) Margin and short covering transactions.
- (n) Repo-style transactions (repo, reserve repo, and securities lending).
- (o) Other short-term transactions as permitted by the supervisory authority.

For repo-style transactions subject to a master netting agreement, the weighted average maturity of the transactions should be used when applying the maturity adjustment. A floor equal to five business days will apply to the average maturity of such type of transactions. Where more than one transaction type is contained in the master netting

agreement, a floor equal to the highest holding period will apply to the average. In addition, the notional amount of each transaction should be used for weighting the maturity.

The treatment of maturity mismatches under IRB is identical to that in the standardized approach.

(B) Retail exposures

The calculation of risk weight for normal (non-default) retail exposures includes three risk-weight functions for residential mortgage exposures, qualifying revolving retail exposures, and other retail exposures respectively.

The capital requirement (K) for a defaulted exposure is equal to the greater of zero and the difference between its LGD (has taken into account additional unexpected loss during the recovery period) and expected loss (the bank's best estimate under then economic conditions and characteristics of the facility). The capital requirement is zero if the difference is negative.

1. Risk-weight function for residential mortgage exposures

For residential mortgage loans meeting the retail exposure criteria that are not in default and are secured or partly secured⁵⁷, the risk weights will be assigned based on the following formula:

$$\text{Correlation (R)} = 0.15$$

$$\text{Capital requirement (K)} = LGD \times N \left[(1 - R)^{-0.5} \times G(PD) + \left(\frac{R}{1 - R} \right)^{0.5} \times G(0.999) \right] - PD \times LGD$$

$$\text{Risk-weighted assets (RWA)} = K \times 12.5 \times EAD$$

2. Risk-weight function for qualifying revolving retail exposures

For qualifying revolving retail exposures meeting the retail exposure criteria that are not in default, the risk weights are defined based on the following formula:

$$\text{Correlation (R)} = 0.04$$

$$\text{Capital requirement (K)} = LGD \times N \left[(1 - R)^{-0.5} \times G(PD) + \left(\frac{R}{1 - R} \right)^{0.5} \times G(0.999) \right] - PD \times LGD$$

$$\text{Risk-weighted assets (RWA)} = K \times 12.50 \times EAD$$

3. Risk-weight function for other retail exposures

For other retail exposures that are not in default, the risk weights are defined based on the following formula:

⁵⁷ This means that risk weights for residential mortgages also apply to the unsecured portion of such residential mortgages.

$$\text{Correlation (R)} = 0.03 \times \left(\frac{1 - e^{(-35 \times PD)}}{1 - e^{-35}} \right) + 0.16 \times \left[1 - \left(\frac{1 - e^{(-35 \times PD)}}{1 - e^{-35}} \right) \right]$$

$$\text{Capital requirement (K)} = LGD \times N \left[(1 - R)^{-0.5} \times G(PD) + \left(\frac{R}{1 - R} \right)^{0.5} \times G(0.999) \right] - PD \times LGD$$

$$\text{Risk-weighted assets (RWA)} = K \times 12.50 \times \text{EAD}$$

4. Risk components

(1) Probability of default (PD) and loss given default (LGD)

For each identified pool of retail exposures, banks are expected to meet the minimum requirements and provide an estimate of the PD and LGD associated with the pool.

Additionally, the PD for retail exposures is the one-year PD associated with the internal borrower grade to which the pool of retail exposures is assigned, which should not be lower than 0.03%.

(2) Recognition of guarantees and credit derivatives

Subject to the minimum requirements, banks may reflect the risk mitigation effects of guarantees and credit derivatives in support of an individual obligation or a pool of exposures through an adjustment of either the PD or LGD estimate. Whether adjustments are done through PD or LGD, they must be done in a consistent manner on a long-term basis.

When a bank undertakes risk mitigation adjustment, it must satisfy the requirements for double default calculation, and the adjusted risk weight after risk mitigation must not be less than that of a direct exposure to the protection provider. If the application of the aforesaid provisions results in higher capital requirement, banks may choose not to recognize CRM effect.

To recognize the risk mitigation effect of credit insurance, the credit insurance policy must be one approved by the insurance authority.

(3) Exposure at default (EAD)

The following provisions apply to both on and off-balance sheet retail exposures. All exposures are measured as gross of specific provisions or partial write-offs. The EAD on drawn amounts should not be less than the sum of “any specific provisions and partial write-offs” plus “the amount by which a bank’s regulatory capital would be reduced if the exposure were fully written-off.”

On-balance sheet netting of assets and liabilities for retail customers will be recognized subject to the same conditions as under the standardized approach. For off-balance sheet exposures, banks may use own CCF estimates for the calculation of EAD, provided the general operational requirements for own estimation of EAD and specific requirements for retail exposures under the IRB approach are met.

For retail exposures with uncertain future drawdown (e.g. credit cards), banks must take into account their history and expectation of additional drawings prior to default in their overall calibration of loss estimates. Banks have the option to reflect the likelihood of additional drawings prior to default in EAD estimates or LGD estimates.

When a bank adopting IRB approach only securitizes the drawn balances of retail facilities, the bank must ensure that it continues to hold required capital against the seller's interest of undrawn balances using the IRB approach to credit risk. This means that for such facilities, banks must reflect the impact of CCFs in their EAD estimates rather than in the LGD estimates. For determining the EAD associated with the seller's interest in the undrawn lines, the undrawn balances of securitized exposures would 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. The investors' share of undrawn balances related to the securitized exposures is subject to the capital treatment in early amortization provisions for securitization.

Banks adopting the IRB approach are not permitted to use their internal assessment of credit equivalent amounts if foreign exchange and interest rate commitments exist in the retail portfolio. Instead, the rules for calculating credit equivalent amounts in the standardized approach shall apply.

(C) Equity Exposures

1. Risk-weighted assets for equity exposures

Banking book equity exposures relating to capital deduction are subject to the provisions in the standardized approach to credit risk. There are two approaches in the IRB framework for calculating the risk-weighted assets for undeducted positions: the market-based approach (an internal models method), and the PD/LGD approach. Banks must apply either approach on a consistent basis and explain to the supervisory authority the reason for choosing a particular approach and that the choice is not based on capital arbitrage considerations. Banks will implement the chosen approach after receiving supervisory approval.

(1) Market-based approach (internal models approach)

Under the market-based approach, the bank's minimum capital requirement for equity holdings is derived using the value-at-risk models. That is, under the 99th percentile, one-tailed confidence interval, maximum potential loss or the minimum capital requirement is estimated based on the difference between quarterly returns and an appropriate risk-free rate computed over a long-term sample period. For publicly traded equity holdings, capital charges calculated under the internal models method may be no less than the capital charges that would be calculated under the standardized approach using a 200% risk weight; for non-publicly traded equity holdings, a 300% risk weight applies to the calculation of minimum capital. These minimum capital charges would be

calculated separately and minimum risk weights are to apply at the individual exposure level rather than at the portfolio level.

The minimum capital charge derived above should be converted into risk-weighted assets (i.e. minimum capital charge multiplied by 12.5) to be incorporated into the calculation of overall capital ratio.

Banks are permitted to recognize the risk mitigation effect of guarantees but not collateral obtained on an equity position when the capital requirement is determined through use of the market-based approach.

(2) PD/LGD approach

The minimum requirements and methodology for the PD/LGD approach for equity exposures (including equity of invested companies that are included in the retail asset class and hedged positions) are the same as those for the foundation approach for corporate exposures subject to the following specifications⁵⁸:

- The bank's estimate of the PD of a corporate entity in which it holds an equity position must be consistent with the bank's estimate of the PD of the same corporate entity where the bank holds debt.⁵⁹ If a bank does not hold debt of the company in whose equity it has invested, a 1.5 scaling factor will be applied to the risk weights derived from the corporate risk-weight function to reflect the lack of sufficient information on PD estimation. If, however, the bank is able to demonstrate to the supervisory authority that it can grasp default and related credit information on the corporate entity in whose equity it has invested through other means (e.g. obtaining such information from the inquiry system of Joint Credit Information Center), and it has complied with other requirements, the bank may be exempted from the 1.5 scaling factor requirement.
- An LGD of 90% is applied in the calculation of risk weights for equity exposures; hedged position having a five-year maturity is subject to the same treatment.

Under the PD/LGD approach, banks must set the minimum and maximum risk weights according to the following rules. That is, if the EL associated with the equity exposure multiplied by 12.5 times plus the risk weights calculated above is smaller (or higher) than the following minimum (or maximum) risk weights, the minimum (or maximum) risk weights must be applied to the calculation of capital charge.

- a. A minimum risk weight of 100% applies for the following types of equities:
 - Public equities where the investment is part of a long-term customer relationship (holding for at least five years), and not for realizing capital gains, and lending and other general banking relationships with the portfolio company allow the bank to gain access to sufficient information for assessing the probability of default.

⁵⁸There is no advanced approach for equity exposures, given the 90% LGD assumption.

⁵⁹ In practice, if there is both an equity exposure and an IRB credit exposure to the same counterparty, a default on the credit exposure would thus trigger a simultaneous default for regulatory purposes on the equity exposure.

- Private equities where the returns on the investment are based on regular and periodic cash flows not derived from capital gains and there is no expectation of future capital gain or of realizing any existing gain.
 - b. For all other equity positions, including net short positions after offset of longs and shorts, and single short position on an equity, where the absolute value is taken and treated as a long position for capital charge purposes, capital charges calculated under the PD/LGD approach may be no less than the capital charges that would be calculated under the standardized approach using a 200% risk weight for publicly traded equity holdings; and no less than the capital charges that would be calculated under the standardized approach using a 300% risk weight for other non-publicly traded equity holdings.
 - c. The maximum risk weight for the PD/LGD approach for equity exposures (including EL) is 1250%. If a bank assumes the sum of its equity exposures represents its EL amount, the bank may deduct the entire equity exposure from the capital with 50% from Tier 1 capital and 50% from Tier 2 capital.
- (3) Exclusions to the market-based and PD/LGD approaches

Equity holdings in entities whose debt obligations qualify for a zero risk weight under the standardized approach to credit risk can be excluded from the IRB approaches to equity and subject to a zero risk weight (including those publicly sponsored entities where a zero risk weight can be applied).

Banks may exclude the equity exposures with average balance not reaching the materiality threshold from the IRB treatment. The equity exposures of a bank are considered material if their aggregate value is less than 10% of bank's Tier 1 plus Tier 2 capital. This materiality threshold is lowered to 5% of a bank's Tier 1 plus Tier 2 capital if the equity portfolio consists of less than 10 individual holdings. Equity holdings not reaching the materiality threshold may be subject to standardized approach for capital charge.

2. Risk components: EAD

The measure of an equity exposure is based is the fair value presented in the financial statements according to the prevailing accounting standards or cost.

Holdings in funds containing both equity investments and other non-equity types of investments can be either treated, in a consistent manner, as a single investment based on the fund's holdings or, where possible, as separate and distinct investments in the fund's component holdings based on a look-through approach for the calculation of applicable risk weights for each type of investment.

For holdings in equity funds where only the investment mandate is known and the mandate is clear and specific, the fund can be treated as a single investment. However, the minimum capital charge should be estimated based on the investment already made by the fund. For this purpose, it is assumed that the fund invests to the maximum extent allowed under its

mandate, in the asset classes attracting the highest risk weight, and then continues making investments in descending order until the maximum total investment level is reached.

(D) Purchased receivables

1. Risk-weighted assets for default risk

For receivables that can be clearly distinguished into different asset classes, the IRB risk weight for default risk is based on the risk-weight function applicable to that particular exposure type, as long as the bank can meet the qualification standards for this particular risk-weight function and the minimum requirements for calculation of risk weights. If a bank is unable to meet those requirements, it should adopt a conservative approach using the risk weight function resulting in the highest capital requirement.

(1) Purchased retail receivables

For purchased retail receivables, a bank must meet the minimum requirements concerning risk quantification standards for retail exposures but can use external and internal reference data to estimate the PDs and LGDs. The estimates for PD and LGD (or EL) must be calculated for the receivables on a stand-alone basis; that is, without regard to any assumption of recourse or guarantees from the seller or other parties.

(2) Purchased corporate receivables

For purchased corporate receivables, the purchasing bank is expected to apply the minimum requirements concerning risk quantification standards under the IRB approach for individual management (bottom-up) approach. However, for eligible purchased corporate receivables, and subject to supervisory permission, a bank may employ the following top-down management procedure for calculating IRB risk weights for default risk:

- The purchasing bank will estimate the pool's one-year EL for default risk, expressed in percentage of the exposure amount (the total EAD amount to the bank by all obligors in the receivables pool). The estimated EL must be calculated for the receivables on a stand-alone basis; that is, without regard to any assumption of recourse or guarantees from the seller or other parties.
- The EL estimate for the pool of receivables obtained is substituted in the risk-weight function for corporate exposures for calculating the risk weight for default risk⁶⁰. Based on the following provisions of the foundation approach and advanced approach, the precise calculation of risk weights for default risk depends on the bank's ability to decompose EL into its PD and LGD components in a reliable manner. Banks can use external and internal data to estimate PDs and LGDs. However, banks that use the foundation approach for corporate exposures are not

⁶⁰The firm-size adjustment will be the weighted average by individual exposure of the pool of purchased corporate receivables. If the bank does not have the information to calculate the average size of the pool, the firm-size adjustment will not apply.

allowed to use the advanced approach for calculating the risk weights of purchased corporate exposures.

a. Foundation approach treatment

If the purchasing bank is unable to decompose EL into its PD and LGD components in a reliable manner, the risk weight is determined from the corporate risk-weight function using the following specifications: if the bank can demonstrate that the exposures are exclusively senior claims to corporate borrowers, an LGD of 45% can be used. PD will be calculated by dividing the EL using this LGD. EAD will be calculated as the outstanding amount minus the capital charge for dilution prior to credit risk mitigation ($K_{Dilution}$). Otherwise, PD is the bank's estimate of EL; LGD will be 100%; and EAD is the amount outstanding minus $K_{Dilution}$. EAD for a revolving purchase facility is the sum of the current amount of receivables purchased plus 75% of any undrawn purchase commitments minus $K_{Dilution}$. If the purchasing bank is able to estimate PD in a reliable manner, the risk weight is determined from the corporate risk-weight functions according to the specifications for LGD, M and the treatment of guarantees under the foundation approach.

b. Advanced approach treatment

If the purchasing bank can estimate either the pool's default-weighted average loss rates given default or average PD in a reliable manner, the bank may estimate the other parameter based on an estimate of the expected long-run loss rate. The bank may (i) use an appropriate PD estimate to estimate the long-run default-weighted average LGD, or (ii) use a long-run default-weighted average LGD to estimate the appropriate PD. In either case, the LGD used for the IRB capital calculation for purchased receivables cannot be less than the long-run default-weighted average LGD and must be consistent with the concepts for estimating LGD based on the risk qualification standards in the minimum requirements. The bank can use own estimated PD and LGD as inputs to the corporate risk-weight function for calculating the risk weight for the purchased receivables. Similar to the foundation IRB treatment, EAD will be the amount outstanding minus $K_{dilution}$. EAD for a revolving purchase facility will be the sum of the current amount of receivables purchased plus 75% of any undrawn purchase commitments minus $K_{dilution}$ (thus, banks using the advanced approach will not be permitted to use their internal EAD estimates for undrawn purchase commitments).

For drawn amounts, the effective maturity (M) will equal the pool's exposure-weighted average effective maturity (as defined for the risk components of corporate exposures). The M for drawn amounts will also be used for undrawn amounts under a committed purchase facility provided the facility contains effective covenants, early amortization triggers, or other features that protect the purchasing bank against a significant deterioration in the quality of the future receivables. In the

absence of such effective protections, the M for undrawn amounts will be calculated as the sum of (a) the longest-dated potential receivable under the purchase agreement and (b) the remaining maturity of the purchase facility.

2. Risk-weighted assets for dilution risk

Dilution refers to the possibility that the receivable amount is reduced through cash or non-cash allowance or return to the receivable's obligor⁶¹. For both corporate and retail receivables, unless the bank can demonstrate to the supervisory authority that the dilution risk for the purchasing bank is immaterial, the purchasing bank must observe the following with regard to the treatment of dilution risk: at the level of either the pool as a whole (top-down approach) or the individual receivables making up the pool (bottom-up approach), the purchasing bank will estimate the one-year EL for dilution risk, expressed in percentage of the receivables amount. Banks can use external and internal data to estimate EL. As with the treatments of default risk, this estimate must be computed on a stand-alone basis; that is, under the assumption of no recourse or other support from the seller or third-party guarantors. For the purpose of calculating risk weights for dilution risk, the corporate risk-weight function must adopt PD=EL and 100% LGD. An appropriate maturity treatment applies when determining the capital requirement for dilution risk. If a bank can demonstrate that the dilution risk is appropriately monitored and managed to be resolved within one year, the supervisory authority may allow the bank to apply a one-year maturity (M).

The treatment of risk-weighted assets for dilution risk described above applies regardless of whether the underlying receivables are corporate or retail exposures, and regardless of whether the risk weights for default risk are computed based on individual receivables (bottom-up approach) using the standard IRB treatments or at the level of a pool (top-down approach) for corporate receivables.

3. Treatment of purchase price discounts for receivables

If the purchase price of receivables includes a discount (the purchase price actually paid is less than the future collection of the receivable) as a protection for default and dilution losses, the portion of such a purchase price discount that will be refunded to the seller may be treated as seller-provided first loss protection under the IRB securitization framework. The nonrefundable purchase price discounts for receivables do not affect the calculation EL provision and special provision calculation or the calculation of risk-weighted assets.

When collateral or partial guarantees obtained on purchased receivables provide first loss protection (i.e. credit risk mitigant), and these mitigants cover default losses and dilution losses, they may be treated as first loss protection under the IRB securitization framework.

⁶¹ Examples include return or allowances of goods sold arising from disputes regarding product quality, possible debts of the borrower (obligee of the receivables, i.e. the seller) to a receivables obligor (the buyer), and any payment or promotional discounts offered by the borrower (e.g. a credit for cash payments within 30 days).

When the same mitigant covers both default and dilution risk, banks using the Supervisory Formula⁶² must calculate an exposure-weighted LGD according to the relevant provisions in asset securitization.

4. Recognition of credit risk mitigation (CRM) effect

Credit risk mitigation will be treated generally the same as set forth for the calculation LGD for corporate exposures. Regardless of whether the guarantee covers default risk, dilution risk, or both, a guarantee provided by the seller or a third party will be treated using the existing IRB rules for guarantees.

- If the guarantee covers both the pool's default risk and dilution risk, the bank will substitute the pool's total risk weight for default and dilution risk with a more favorable risk weight assigned for an exposure to the guarantor.
- If the guarantee covers only default risk or dilution risk, but not both, the bank will substitute the pool's risk weight for the corresponding risk component (default or dilution) with a more favorable risk weight assigned for an exposure to the guarantor. The capital requirement for the other component will then be added.
- If a guarantee covers only a portion of the default and/or dilution risk, the uncovered portion of the default and/or dilution risk will be treated according to the existing CRM rules for proportional or partial mitigation.

If the operational requirements for the recognition of double default are met, banks may also calculate the risk-weighted asset amount for dilution risk using the double default framework with PD of the obligor being equal to the estimated EL and LGDg being equal to 100%, and effective maturity being set according to the provisions for dilution risk.

F. Treatment of expected losses and recognition of loss provisions

(A) Calculation of expected losses

Total EL amount is defined as EL (PD×LGD) multiplied by EAD. But this total EL amount excludes the EL amount associated with equity exposures under the PD/LGD approach and securitization exposures.

1. Expected loss for exposures (other than specialized lending (SL) subject to the supervisory slotting criteria)

The EL for exposures not in default and not treated as hedged exposures under the double default treatment under the IRB approach is PD x LGD. For exposures that are in default, banks must use their best estimate of EL based on then economic situation and characteristics of the facility. Banks on the foundation approach must use the supervisory LGD. For SL exposures subject to the supervisory slotting criteria, EL is calculated as described below. For equity exposures subject to the PD/LGD approach, the EL is calculated

⁶² Refers to the supervisory formula for capital charge provided in the asset securitization framework.

as PD x LGD unless the situation of applicable maximum or minimum risk weight as described above applies. Securitization exposures are not included in the calculation of total EL and loss provision. For all other exposures (including hedged exposures under the double default treatment), the EL is zero.

2. Expected loss for SL exposures subject to the supervisory slotting criteria

For SL exposures subject to the supervisory slotting criteria, the EL amount is determined by the risk-weighted assets produced from the appropriate risk weights, as specified below, multiplied by EAD, and then multiplied by 8%.

Risk weights for SL exposures (other than HVCRE):

Strong	Good	Satisfactory	Weak	Default
5%	10%	35%	100%	625%

Subject to supervisory consent, banks may reduce EL risk weight of 50% and 70% applicable respectively to SL exposures falling into the “strong” and “good” categories to 0% and 5% respectively.

Risk weights for HVCRE exposures:

Strong	Good	Satisfactory	Weak	Default
5%	5%	35%	100%	625%

(B) Calculation of loss provisions

1. Exposures subject to IRB approach

Total loss provisions are defined as the sum of operating reserves, loan loss provisions, and partial write-offs that are attributed to exposures treated under the IRB approach. In addition, total loss provisions may include any discounts on defaulted assets, but exclude loan loss provisions set aside against equity exposures subject to the PD/LGD approach and securitization exposures.

2. Portion of exposures subject to the standardized approach to credit risk

Banks using the standardized approach for a portion of their credit risk exposures, regardless whether it is on a transitional basis, due to temporary exclusion or immateriality of assets, must classify the operating reserves and loan loss provisions set aside for the general expected loss of assets into the portion under standardized treatment or the portion under IRB treatment according to the methods outlined below:

- (1) Banks should attribute operating reserves and loan loss provisions on a pro rata basis according to the proportion of credit risk-weighted assets subject to the standardized and IRB approaches. However, when either the standardized or IRB approach is used principally for determining credit risk-weighted assets, operating reserves and loan loss provisions for exposures using the standardized approach may be allocated to the

standardized treatment. Similarly, operating reserves and loan loss provisions for exposures using the IRB approach may be attributed to the total eligible IRB provisions.

- (2) Banks using both the standardized and IRB approaches may adopt the following method for allocation: priority is given to allocating the operating reserves and loss provisions for recognition in capital under the IRB approach, and to the advanced approach if both advanced approach and foundation approach are available. Banks will need to obtain prior approval from the supervisory authority if they intend to use such allocation method.

(C) Treatment of EL and loss provisions

Banks using the IRB approach must compare the total amount of total loss provisions with the total EL amount as calculated within the IRB approach ⁶³. Where the calculated total EL amount is lower than the total loss provisions set aside by the bank, and it is assured that the EL fully reflects the conditions in the market and the actual condition of the defaulted asset, the difference (excess provisions) may be included in Tier 2 capital, up to 0.6% of the total risk-weighted asset amount for credit risk. If the total EL is higher than the total loss provision set aside by the bank, the excess portion needs to be deducted 50% from Tier 1 and 50% from Tier 2 capital.

The EL amount for equity exposures under the PD/LGD approach is deducted 50% from Tier 1 and 50% from Tier 2 capital without attributing to the total EL amount (the deduction is capped at the amount of equity exposures). Loss provisions for equity exposures under the PD/LGD approach will not be used in the total provision calculation. The EL and loss provisions related to securitization exposures will not be included in the calculation of total EL and total loss provisions.

G. Minimum requirements for IRB approach - common requirements

The minimum requirements for banks using the IRB approach include: (1) compliance with minimum requirements, (2) rating system design for meaningful differentiation of risks, (3) integrity and fairness of the rating process, (4) risk quantification, (5) validation of rating results, (6) actual application of internal ratings, and (7) corporate governance and monitoring as described below:

(A) Compliance with minimum requirements

1. The bank's risk estimation systems and processes should provide for a meaningful

⁶³ Banks using both standardized and IRB approaches may include the portion of operating reserves and loan loss provisions in excess of the EL set aside under the standardized treatment in Tier 2 capital, up to 1.25% of the total risk-weighted asset amount.

assessment of borrower and transaction characteristics; a meaningful differentiation of risk; and are applied practically to risk management and business operations.

2. Unless it is otherwise noted, the minimum requirements should apply to the internal rating process for all asset classes and the process of assigning retail exposures to pools of homogenous exposures.
3. Banks that adopt the IRB approach must demonstrate to the supervisory authority that they meet the minimum requirements at the outset and on an ongoing basis.
4. If a bank is not in complete compliance with all the minimum requirements, the bank must produce a concrete and feasible remedial plan, seek the supervisory approval, and rigorously implement the plan; or the bank must demonstrate that the effect of such non-compliance does not affect the integrity and validity of the bank's risk management. For the duration of the non-compliance, the supervisory authority will, in view of the execution of the remedial plan, and the impact of non-compliance on the overall risk management, take appropriate supervisory actions (e.g. raising the minimum capital requirement), or revoke the bank's qualification for IRB treatment.

(B) Rating system design for meaningful differentiation of risks

The "rating system" aims to support the works of risk assessment, assignment of ratings, and quantification of risk components, including the methods, processes, controls, and data collection and information systems for such works. Within each asset class, a bank may adopt multiple rating methodologies and systems for customers or transactions of different characteristics to accurately reflect the credit grades appropriate to obligors of different characteristics. Meaningful differentiation of risks means the rating results are able to capture fully risks of varying levels and characteristics. Banks should fully document the rationale for rating system design and methodologies (objectives, development process and maintenance method) and demonstrate to the supervisory authority that the rating systems and methods utilized are for producing meaningful risk differentiation and not for minimizing the capital requirements.

1. Rating dimensions

(1) Standards for corporate, sovereign, and bank exposures

- a. A IRB rating system must carry out risk assessment from two separate dimensions - the risk of borrower default, and transaction-specific factors.
- b. Except for the following circumstances, separate exposures to the same borrower must be assigned to the same borrower grade:
 - In consideration of transfer risk, different borrower grades may be assigned to the same borrower for transactions denominated in different currencies; and
 - Borrower grade is reflected by the grade assigned to the guarantor of a facility.

- c. A bank must articulate in its credit policy the relationship between borrower grades in terms of the level of risk each grade implies, and the probability of default risk typical for borrowers assigned the grade and the criteria used to distinguish that level of credit risk so as to ensure that the measured risk and subsequent changes are consistent with the perceived risk and subsequent changes.
- d. Facility characteristics are the combination of various transaction-specific factors, such as collateral, seniority and product types. Banks using the foundation approach can calculate the risk components based on the EL estimate in combination with borrower and transaction-specific factors which are reflected in rating results, or the or adopting own PD estimate and supervisory LGD value.
- e. For banks using the advanced approach, facility ratings must reflect exclusively LGD. These ratings can reflect any and all factors that can influence LGD including, but not limited to, the type of collateral, product, industry, and purpose of facility. Borrower characteristics may be included in LGD estimation criteria only to the extent they are significantly predictive of LGD.
- f. The characteristics of SL exposures are highly correlated with borrower and transaction characteristics. Banks using the supervisory slotting criteria for the SL sub-class are exempt from this two-dimensional requirement for these exposures. Banks may satisfy the requirements through a single rating dimension that reflects EL.

(2) Standards for retail exposures

- a. Rating systems for retail exposures must capture both borrower and transaction characteristics. Banks must assign each exposure that falls within the definition of retail for IRB purposes into a particular pool and demonstrate exposures within the pool are homogenous so as to ensure accurate and consistent estimation of loss characteristics at pool level.
- b. In consideration of cost benefit, banks may, subject to supervisory consent, adopt a single-dimension rating of EL for non-core products on the basis of conservative characteristics or scenarios, such as long-term default average or economic downturn. Products that are originally estimated using the two-dimensional approach of PD and LGD may not be switched to EL approach, unless the bank demonstrates that the product is not a core business. The use of either approach should be applied on a consistent basis.
- c. Retail exposures within a pool should be sufficiently homogenous, meaning there is no significant difference among exposures within the pool in terms of loss level, major risk factors, and their degree of influence on the exposures.
- d. Banks must estimate PD, LGD, and EAD on a pool basis. Multiple pools may share identical PD, LGD and EAD estimates. The differentiation of pools of exposures

must consider the following risk characteristics:

- Borrower risk characteristics (e.g. borrower type, demographics such as age/occupation)
 - Transaction risk characteristics, including product and/or collateral types (e.g. loan to value, seasoning, guarantors; and seniority (first vs. second lien)). Banks must explicitly address cross-collateral provisions where present.
 - Delinquency of exposure: Banks are expected to separately identify exposures by the characteristics of delinquency and the extent of delinquency.
- e. Effect of retail exposure seasoning: The estimates of risk components for some exposures might increase rapidly some time after origination. Banks should demonstrate necessary steps have been taken against such effect to ensure that their estimation techniques are accurate or adopt more conservative estimates.

2. Rating structure

(1) Standards for corporate, sovereign, and bank exposures

- a. A bank must have a meaningful distribution of exposures across grades with no excessive concentrations. Banks must have a minimum of seven borrower grades for non-defaulted borrowers and one for those that have defaulted. Supervisory authority may require banks, which lend to borrowers of diverse credit quality, to have a greater number of borrower grades.
- b. Borrowers should be graded based on their risk characteristics and the established grading criteria. Banks should estimate PD representative of each grade, and define the degree of default risk typical for borrowers assigned the grade and the criteria used to distinguish that level of credit risk. Furthermore, grades further modified with “+” or “-” signs will only qualify as distinct grades if the bank has clearly defined and described the criteria for their assignment.
- c. Banks with loan portfolios concentrated in a particular segment (e.g. market segment or a range of default risk) must have enough grades within that range to reflect its risk characteristics and avoid undue concentrations of borrowers in particular grades⁶⁴.
- d. Although there is no specific minimum number of facility grades (minimum one grade) for estimating LGD based on facility status, a bank should demonstrate to the supervisory authority that the LGD estimates within the same grade are not significantly different. The bank should also have sufficient data to show that its grading is reasonable.
- e. Banks using the supervisory slotting criteria for the SL asset classes must have at least four grades for non-defaulted borrowers, and one for defaulted borrowers. The rating framework requirements for SL exposures that qualify for the foundation and

⁶⁴ For example, if the exposure amount of a certain grade (before netting) exceeds 30% of the total exposure, the exposures are considered over-concentrated.

advanced approaches are the same as those for general corporate exposures.

(2) Standards for retail exposures

- a. For each pool identified, banks must be able to measure the risk components (PD, LGD, and EAD) and the influence of risk factors to demonstrate the significant homogeneity among exposures within the pool. Banks must also demonstrate that there is a meaningful distribution (by borrowers and facility) of exposures across pools and there is no undue concentration in a single pool.
- b. Banks must ensure that the number and the amount exposures in a given pool is sufficient so as to allow for meaningful quantification and validation of risk estimations at the pool level.

3. Rating criteria and methods

(1) Rating criteria

- a. A bank must have specific rating definitions, processes and criteria for assigning exposures to grades within a rating system. The rating definitions and criteria must be both plausible and intuitive and must result in a meaningful differentiation of risk.
 - For borrowers and facilities with similar risk characteristics, the grade descriptions, procedures and criteria must be consistent across lines of business, departments and geographic locations. If inconsistency exists, the bank must understand its impact, and make appropriate adjustment where necessary.
 - Written rating definitions must be clear and detailed enough to allow other people, such as business personnel, auditors or examiners to understand the assignment of ratings so as to facilitate the assessment procedure (e.g. validation, and re-assignment).
 - The rating criteria must be consistent with the bank's internal lending and management procedures and its policies for handling troubled borrowers and facilities.
- b. Banks should take into account all relevant and current information in assigning ratings to borrowers and facilities. If there is insufficient information, the bank should be more conservative in the assignments of exposures to borrower and facility grades or pools. An external rating or modeling results can be the primary factor determining an internal rating assignment; however, the bank must ensure that it considers other relevant factors.

- (2) Criteria for internal rating of SL lending and mapping to supervisory rating categories**
- Banks using the supervisory slotting criteria for SL exposures must assign exposures to their internal rating grades based on their own criteria and then map then map these internal rating grades into the five supervisory rating categories. Banks must

demonstrate that their rating criteria and mapping process are consistent, and ensure that any overrides of their internal criteria do not affect the accuracy of the mapping process.

(3) Requirements for the application of rating method

- a. Banks can apply expert judgment or statistical model separately or simultaneously in assigning grades to borrowers and facilities. But expert judgment has its practical constraints in validation, and statistical model can also result in estimation errors as constrained by the integrity and relevancy of available data. In the rating method development stage, banks should document clearly in detail the factors, criteria and method used for rating and ensure that it is likely to apply the method on a consistent basis in the future.
- b. Banks must demonstrate that the design and development of their rating method has considered the following points:
 - The assessment method has good predictive power and errors are within reasonable range to allow accurate estimation of regulatory capital requirements. The variables that are input to the model can form a reasonable set of predictors and effective covers the range of borrowers or facilities to which the bank is exposed.
 - The accuracy, completeness and appropriateness of the data used in assessment.
 - The bank must ensure that the data used to build the model are representative of the population of the bank's actual borrowers or facilities.
 - The consistency between the basic assumptions of the rating model and practical environment is understood fully to suitability of the method used. There are specific ideas or effective solutions for discrepancy within acceptable range or the results of assessment are adjusted in a more conservative manner.
 - When combining model results with expert judgment, the bank must have written guidance describing how expert judgment and model results are to be combined.
 - The rating assignments are supplemented with human review and ongoing monitoring to ensure important variables outside the model are promptly taken into consideration so as to reduce errors associated with known model weaknesses and as important basis for improving the model's performance.
 - The bank must test the model validity regularly and specify the frequency and content for performing the validity testing procedures.

(4) Rating assignment horizon

- a. Although the time horizon used in PD estimation is one year, banks are expected to use a longer time horizon in estimation of PD.
- b. The rating system must be able to grasp the borrower's ability and willingness to

perform his debt obligations under adverse economic condition or unexpected events, and furthermore assess the long-term PD (or survival rate). Besides stress testing, banks can consider other alternatives for assessment. But the range of economic conditions that are considered when making assessments must be consistent with current conditions and those that are likely to occur over a business cycle within the respective industry/geographic region. If it is difficult to forecasting future events and the influence they will have on a particular borrower's financial condition, or if the data used are unable to reflect fully overall economic factors or unexpected events, the bank must take a conservative view of projected information

(C) Coverage and integrity of rating process

1. Coverage of ratings

- a. For corporate, sovereign, and bank exposures, each borrower and all recognized guarantors must be assigned a rating and each exposure must be associated with a facility rating as part of the loan approval process. Similarly, for retail, each exposure must be assigned to a pool as part of the loan approval process.
- b. Each separate legal entity to which the bank is exposed must be separately rated. A bank must have policies acceptable to the supervisory authority regarding the treatment of individual entities in a group enterprise group including circumstances under which the same rating may or may not be assigned to some or all related entities.

2. Integrity of rating process

(1) Quality elements for effective operation of the rating system

The operation of rating system must meet the following operational principles to ensure the functioning of risk management:

- a. **Independence:** Rating assignments and periodic rating reviews must be performed or approved by personnel that does not stand to benefit from the extension of credit so as to maintain the independence of the rating process and assignments. These operational processes must be documented in the bank's procedures and incorporated into bank risk management policies.
- b. **Transparency:** There should be clearly written documents that will allow other people (e.g. rating system reviewer, internal and external auditors or supervisory examiners) to evaluate whether the rating system has been operated according to its intended purposes. The rating standards should be clear and specific (particularly in the aspect of human judgment and non-quantified factors). The definition and identification of

factors should be clearly dealt with in consistence with empirical and economic perceptions and verified on an ongoing basis.

- c. Accountability: Banks should provide adequate instruments and resources to allow personnel responsible for rating assignments, approving credit ratings, producing parameter estimates, and monitoring the rating systems to effectively implement the rating system in a manner in compliance with the policies and ensure the effective operation of the rating system. The measures of personnel performance should be clear, specific and linked with the work targets, and documented in written policies.

(2) Overrides

Banks must clearly articulate guidelines for overrides, including the authorization and approval for overrides, the situations and the extent to which bank officers may override the outputs of the rating process, and the mechanism of continuing monitoring, and document the process and results of overrides to keep track of their outcome and effectiveness.

(3) Periodic review and prompt update

- a. For corporate, sovereign, and bank exposures, banks must refresh the ratings of borrowers and facilities at least on an annual basis. For retail exposures, banks must review the loss characteristics and delinquency status of each identified risk pool on at least an annual basis. It must also review the status of individual borrowers within each pool as a means of ensuring that exposures continue to be assigned to the correct pool. This requirement may be satisfied by review of a representative sample of exposures in the pool.
- b. Higher risk borrowers or facilities must be subject to more frequent review. Banks must initiate a new rating if material information on the borrower or facility comes to light.
- c. The bank must have an effective process to obtain and update relevant and material information on the borrower's financial condition, and on facility characteristics that affect LGDs and EADs (such as the condition of collateral). Upon receipt, the bank needs to update the borrower's rating in a timely fashion according to the established procedure.

3. Data maintenance

A bank must collect and store data on key borrower and facility characteristics to provide effective support to its internal credit risk measurement and management process. These data

should be sufficiently detailed to allow retrospective reallocation of obligors and facilities to grades, for example if increasing sophistication of the internal rating system suggests that finer segregation of portfolios can be achieved. Furthermore, banks must collect and retain data on aspects of their internal ratings as required under Pillar 3 in information disclosure.

The data collection, storing and processing of a bank must comply with the following operating principles to ensure the functioning of the rating system:

- **Relevancy:** The collected data must be highly relevant to the risk characteristics of the business.
- **Integrity:** The collected and stored data must be able to provide long-run and sufficient information to fully reflect the risk characteristics of all asset classes.
- **Accuracy:** The data needed must be clearly defined to make sure they continue to meet the needs of the rating operation in the collection and processing processes.

(1) Tracking of exposure life cycle

- a. Banks must collect, maintain and analyze data required for the analysis of the obligors and credit instruments across the entire loan period until it is cleared or settled.
- b. Banks should keep complete record and retain data on the risk characteristics of defaulted facilities, the time of default, the reasons and criteria used for determining default. If the accumulated data on default cases are not sufficient for the development of rating system or model, banks may utilize the external default data provided they can demonstrate the reasonableness of using the external default data.
- c. Banks must preserve rating histories on borrowers and qualified guarantors. The data on the ratings, the dates the ratings were assigned, the methodology, the person/model responsible, and the identity of borrowers and facilities that default, and the timing and circumstances of such defaults, must be retained.
- d. Banks using the advanced IRB approach must collect and preserve a complete history of data on the LGD and EAD estimates associated with each facility and the key data used to derive the estimate and the person/model responsible. Banks must also collect data on the estimated and realized LGDs and EADs associated with each defaulted facility. Banks that reflect the credit risk mitigating effects of guarantees/credit derivatives through LGD must retain data on the LGD of the facility before and after evaluation of the effects of the guarantee/credit derivative. Information about the components of loss or recovery for each defaulted exposure must be retained, such as amounts recovered, source of recovery (e.g. collateral, liquidation proceeds and guarantees), time period required for recovery, and administrative costs.

- e. Banks under the foundation approach which utilize supervisory estimates should as much as possible retain the relevant data (i.e. data on loss and recovery experience for corporate exposures under the foundation approach, data on specialized lending (SL) under the supervisory slotting criteria approach).

(2) Utilization and preservation of data in the rating process

- a. Banks should take into account in a timely manner all relevant information when assigning borrowers and facilities to grades. Where only limited data are available, or where the timeliness of data is constrained by the data characteristics or the execution ability of the management system, the bank must add a greater margin of conservatism in the grading of borrowers and facilities or allocation of exposures to pools.
- b. Banks must retain data generated in the rating process and after the use of data to facilitate validation and model adjustment/modification.
- c. Banks must retain historical data on the PDs, including the realized default rates associated with rating grades and ratings migration in order to track the predictive power of the borrower rating system.

(3) Data maintenance specific to corporate, sovereign, and bank exposures

Irrespective of whether a bank is using external, internal, or pooled data sources for its estimation of risk components, the length of the underlying historical observation period used must be at least five years for at least one source for PD, and at least seven years for LGD and EAD. If the available observation period spans a longer period for any source, and this data are relevant and material, this longer period must be used. If a bank can demonstrate to the supervisory authority that recent data are a better predictor for loss rates, the bank may assign different weights to different historical data.

(4) Data maintenance specific to retail exposures

- a. Irrespective of whether banks are using external, internal, or pooled data sources for their estimation of loss characteristics, the length of the underlying historical observation period used must be at least five years for one source for PD, LGD and EAD. If the available observation spans a longer period for any source, and these data are relevant, this longer period must be used. If a bank can demonstrate to the supervisory authority that recent data are a better predictor for loss rates, the bank may assign different weights to different historical data.

- b. Banks must retain data used in the process of allocating exposures to pools, including data on borrower and transaction risk characteristics used either directly or through use of a model, as well as data on delinquency. Banks must also retain data on the estimated PDs, LGDs and EADs, associated with pools of exposures. For defaulted exposures, banks must retain the rating data on the pools prior to default and the realized outcomes on LGD and EAD.

(D) Risk quantification

1. Taking into account long-run economic cycle

- (1) Risks quantification addresses the operational standards for estimations of PD, LGD, and EAD. All banks using the IRB approaches must estimate a PD for each internal borrower grade (for corporate, sovereign and bank exposures) or for each pool (for retail exposures).
- (2) PD estimates must be a long-run average of one-year default rates for borrowers in each grade. For corporate, sovereign and bank exposures, banks that do not meet the requirements for own estimates of EAD or LGD, must use the supervisory values. Banks using the advanced approach must estimate LGD and EAD in consideration of the long-run average. The estimation of the aforesaid risk components shall meet the minimum requirements.
- (3) Estimations of PD, LGD, and EAD must incorporate all relevant and available data, information and methods. A bank may utilize internal data and data from external sources (including pooled data). Where internal or external data is used, the bank must demonstrate that its estimates are representative of long run experience.
- (4) Estimates must be grounded in historical experience and empirical evidence, and any changes in lending practice or the process for pursuing recoveries over the observation period must be taken into account. A bank's estimates must promptly reflect the implications of technical advances and new information or data. Banks must review their estimates on a yearly basis or more frequently where necessary.
- (5) In the estimation of long-run average of risk components, a bank must consider the length of historical data, trend of long-run stability, and facility status, and realize that estimates of PDs, LGDs, and EADs are likely to involve unpredictable range of errors, and hence should adjust its estimates in a conservative manner. Banks are allowed some flexibility in application of the minimum requirements for data that are collected prior to

the implementation of the IRB approach. However the bank must demonstrate to the supervisory authority that appropriate adjustments have been made to maintain the accuracy of risk estimates. Data collected after the IRB implementation must conform to the minimum standards.

2. Requirements specific to PD estimation and derivation processes

(1) Corporate, sovereign, and bank exposures

- a. When estimating the average PD for each rating grade, banks should incorporate long-run experience and rating results. Banks may use one or more of the three techniques to derive PD, including historical default experience, mapping to external data, and average PD modeling. Banks must undertake necessary analysis of the techniques used to understand the limitations of information and techniques and make necessary adjustments.
- b. Historical default experience: A bank should use data on historical default experience as the primary basis for the estimation of PD. A bank must ensure that its estimation process is reflective of past rating guidelines or system and of any differences with the current system. Where only limited data are available that the impact of such difference cannot be ensured, the bank must add a greater margin of conservatism in its estimate of PD. Banks using external data must analyze the aforesaid difference, and demonstrate that external data are comparable to the internal data.
- c. Mapping to external data: Banks may map their internal grades to external grades (e.g. the scale used by an external credit assessment institution or similar institution) and then attribute the default rate observed for the external institution's grades to the bank's grades for the estimation of PD. This mapping process must be based on a comparison of the internal and external ratings of the same or similar borrowers before referring to the PD estimates provided by the external institution. Banks must also discern the difference between the internal and external rating criteria and the reasonableness of the difference, whether the default definitions used are consistent with those used by the internal criteria, and whether the external ratings are oriented to the risk of the borrower, but not the facility status. The process for deriving PD (e.g. use of median, averaging, etc.) must be consistently applied, and at the same time, consider the reasons for major discrepancy and possible impact.
- d. Average PD modeling: A bank is allowed to use a PD generated by a default prediction model for individual borrowers to calculate the average of PD of borrowers in a given grade. The use of such model must meet the minimum requirements.

(2) Retail exposures

- a. When assigning retail exposures to pools, banks must regard internal data as the primary source of information for estimating loss characteristics. Banks are permitted to use external data or statistical models for quantification provided the bank can demonstrate: (a) the bank's process of assigning exposures to a pool is similar to the process used by the external data source; and (b) the bank's internal risk profile is similar to the composition of the external data. In addition, banks must use all relevant and material data sources for comparison.
- b. Banks may use long-run average loss rate (EL) for deriving long-run average estimates of PD or default-weighted average LGD for retail exposures by: (a) using PD and EL estimates to derive LGD; or (b) using LGD and EL estimates to derive PD. In either case, the estimates must incorporate long-run average default and reflect conservative economic conditions.

3. Requirements specific to LGD estimation and derivation processes

- (1)** A bank must estimate an LGD for each facility by adopting: a. LGD that reflects economic downturn conditions; and b. the most conservative long-run default-weighted average LGD, and taking into account necessary adjustment to LGD when credit losses are substantially higher than the historical average. When cyclical variability causes great volatility in the LGD estimates for some exposures, the bank may use empirical data appropriate for economic downturn and adopt conservative assumptions and forecast methods for the estimation of LGD.
- (2)** The definition of default loss used in estimating LGD is economic loss. When measuring economic loss, all relevant factors should be taken into account, including material discount effects, material direct and indirect costs associated with collecting on the exposure, and empirical values on loss recoveries and associated costs. Banks must not simply measure the loss recorded in accounting records, but should also compare accounting and economic losses. The bank's own collection ability should be reflected in its LGD estimates, but adjustments to estimates for such ability must be conservative until the bank has sufficient internal empirical evidence to its collection capabilities.
- (3)** In the estimation of LGD, banks must incorporate appropriate discount effect in predicting the possible amount to be recovered. Such discount should consider the facility or product characteristics to reflect appropriately the risk and opportunity costs. If the determination of the discount rate is limited by the availability of product information

and the market environment, the bank may, subject to the consent of the supervisory authority, use a single or a composite index as the primary source of discount rate to lessen the complexity of calculation. However the bank must demonstrate to the supervisory authority the reasonableness of the estimation method used and that it is applied in a conservative manner.

- (4) In the estimation of LGD, the expected recovery period should consider the operating procedures for the primary sources of recoveries, the execution ability, and relevant regulations; when an exposure is not expected to be recovered, the LGD is 100%.
- (5) When considering the effect of collateral on LGD, the market volatility and liquidity of the collateral, maturity mismatch, currency mismatch, seniority and physical control of the collateral must be taken into account. In cases where there is a significant degree of dependence between the risk of the borrower and that of the collateral or collateral provider, or where their reactions towards economic changes are significantly homogenous, banks must reflect such adverse impact in their internal estimation approaches or treat the estimate conservatively. Bank's internal rules for the legal validity and management of collateral must meet the minimum requirements.
- (6) For each defaulted asset, the bank must also construct its best estimate of the expected loss on that asset based on current economic circumstances and facility status. Where the best estimate of expected loss is less than the sum of loan loss provisions and partial charge-offs on that asset, the bank is expected to justify its EL estimates. In estimating the LGD of defaulted assets, banks must recognize additional, unexpected losses during the recovery period in addition to the expected losses described above.

4. Requirements specific to EAD estimation and derivation processes

- (1) EAD is defined as the expected exposure of the facility upon default of the obligor. For on-balance sheet items, banks must estimate EAD at no less than the current drawn amount, subject to recognizing the effects of on-balance sheet netting. For off-balance sheet items, banks must estimate the possible additional drawdown for each facility in the event of default. Banks using the foundation approach will use the supervisory CCF as parameter, while banks using the advanced approach must estimate their own CCF.
- (2) Banks using the advanced approach must estimate long-run default-weighted average EAD for each facility with a margin of conservatism in a reasonable range. In cases where PD and EAD are highly dependent of each other or where their reactions towards economic changes are significantly homogenous, banks must reflect such adverse impact in their internal estimation approaches or treat the estimate conservatively. Moreover, for

exposures for which EAD estimates are volatile over the economic cycle, the bank may use empirical data appropriate for an economic downturn and adopt conservative assumptions and forecast methods for the estimation of EAD.

- (3) In the estimation of EAD, banks must pay due consideration to account monitoring, repayment policies and strategies, support of systems and processes, and effectiveness and timeliness of monitoring and early warning systems. The bank must also consider its ability to monitor on a daily basis changes in outstanding balance of borrowers in each grades and willingness to prevent further drawings in circumstances short of payment default, and drawdown of committed facility. For transactions that expose banks to counterparty credit risk, estimates of EAD must follow the treatment requirements set forth in the annex for counterparty credit risk and risk mitigants. For facilities with the possibility of additional draws prior to default but eligible for 0% CCF, banks must demonstrate that the facility meets the criteria of unconditionally cancelable without prior notice and has a good mechanism in place for their control.

5. Recognizing the risk mitigation effect of guarantees and credit derivatives

- (1) Banks using the advanced approach may reflect the risk mitigating effect of guarantees and credit derivatives by adjusting the PD or LGD estimate; banks using the foundation approach to LGD estimate does not have the option to utilize “LGD adjustment.”
- (2) For conditional guarantees (the guarantor may not be obliged to perform under specific conditions), banks approved to use internal estimate of LGD may recognize their guarantee effect provided they can reasonably justify the principles used for the recognition of risk mitigant.
- (3) Banks using the foundation approach to the treatment of derivatives and credit derivatives shall follow the requirements set forth in the section of “Standardized approach: C. Risk mitigant - (D) Guarantees and credit derivatives”, unless the internal rating of the eligible guarantor is comparable or better than an external rating of A- or better for a corporate (referring to probability of default); banks using the advanced approach to the treatment of derivatives and credit derivatives only need to meet the requirements set forth in the section of “Standardized approach: C. Risk mitigant - (D) Guarantees and credit derivatives - 2. Minimum requirements for eligible guaranteed and credit derivatives.”

(E) Validation of rating results

1. Review of rating design and process

- (1) Banks must have a robust system in place to validate the accuracy and consistency of rating systems, processes, and the estimation of all relevant risk components. A bank

must demonstrate to the supervisory authority that its internal validation process enables it to assess the construction and performance of internal rating and risk prediction systems meaningfully and consistently.

- (2) Banks must understand the assumptions and functions of all validation methods and evaluate the nature, quantities and risk characteristics of bank's portfolio for the selection of appropriate validation methods. Banks must adopt more conservative approach if the validation of internal estimates is not conducted according to the method just described.
- (3) Besides a robust validation process, banks must compare internal estimates with external data and analyze the sources of discrepancy as the basis for ongoing improvement and adjustment of the internal models with a margin of conservatism. External data used for analysis should cover a relevant observation period and be appropriate to the bank's portfolio.
- (4) Banks must demonstrate that the validation methods used do not vary systematically with the economic cycle. Changes in methods and data (both data sources and periods covered) must be clearly and thoroughly documented.
- (5) Banks should, through independent review, verify the design logic, the extent of link with actual business operations and the validity of its rating system (e.g. asking the rating personnel to see if the rating methods used strengthen the risk identification effect), understand the performance and monitoring of overrides (e.g. whether the frequency, factors and outcome of override improves estimate accuracy), or conduct parallel testing with identical information and cases to compare consistency in the outcome. Those activities can examine whether the rating criteria have been properly designed, and are particularly important when the rating assignments rely mainly on expert judgment.
- (6) Banks must clearly define the acceptable range and level of errors for different asset classes, and compare regularly the realized and own estimates of risk components for each grade to show whether the discrepancy falls within a reasonable range. Such analysis should cover the study of the qualitative factors and quantitative influence over a historical period. Banks should also clearly document the data and methods used for such analysis, and update the documentation at least once every year.
- (7) Banks must have well-articulated internal standards for situations where deviations in realized risk values from expectations become significant. These standards must take account of business cycles and similar systematic variability in default experiences. Where realized values continue to be higher than expected values, banks must revise

estimates upward to reflect truthfully their default and loss status.

- (8) Banks should rate the borrowers of non-defaulted exposures on a regular and ongoing basis, and preserve and accumulate the data used for rating the same borrower and the rating outcome in each period of time, and document and track the rating changes of each borrower over a long period of time. For borrowers whose rating record is interrupted or disappears, banks should document the situation and identify the reasons, and assess the impact if the rating record is interrupted due to the deterioration of the creditworthiness of the borrower.
- (9) Ongoing validation of the effectiveness of the rating system should be carried out in the rating process, including:
- The reasonableness and implementation of the uninterrupted monitoring system: conducting validation testing covering different dimensions, setting the testing frequencies and procedures, and documenting the test results.
 - Forward test: Comparing the discrepancy between the actual results and model forecast, analyzing the reasons for the discrepancy, and making necessary adjustment.
- (10) Banks using the foundation IRB approach should compare the realized LGDs and EADs to the supervisory values (the information on realized LGDs and EADs should come from the bank's assessment of economic capital).

2. Dimensions of validation and suggested validation methods

(1) Backtesting

Utilizing and establishing out-samples, including samples in different periods that were not covered in the model construction, samples in the same period that were not covered in the model construction, and samples covered in different periods that were covered in the model construction to understand the out-sample predictive power of the model.

(2) Benchmarking

Comparing the internal ratings assigned to individual obligor or facility with the outcome of other rating systems, analyzing the sources of discrepancy, and determining whether the discrepancy is reasonable. The sources of comparison include: market information (spread), third parties (e.g. external credit rating institution, external models, etc.), and internal outcomes (original rating system). The difference between benchmarking and backtesting is that the latter emphasizes the difference between different predictors, while the former focuses on the difference between the prediction and the actual outcome.

(3) Default predictive power (discriminative power)

Validating whether the rating model has adequate power to discriminate the credit status of borrowers and evaluating whether the modeling error is within reasonably acceptable range:

The suggested methods include (but are not limited to) the following:

- a. K-S Test
- b. ROC curve
- c. CAP curve
- d. Gini coefficient
- e. Power test
- f. Mann-Whitney U Test

(4) Rating stability

Analyzing 1. the effect of short-term economic downturn on the basis of long-term rating; 2. Grade migration resulting from change of rating method; and 3. is grade migration conforming to the basic assumptions of the model, or the manifestation of rating deficiencies, and whether the change of transition matrix is reasonable.

The suggested methods include (but are not limited to) the following:

- a. Analysis of the reasonableness of transition matrix change (rating maintenance ratio, massive movement of grades, etc.)
- b. Analysis of the reasonableness of rating reversion.
- c. Homogeneity analysis of transition matrix (SVD-singular value of the mobility, etc.)

(5) Grade homogeneity

Assessing the rating outcome to determine whether there is an adequate number of grades and whether exposures assigned to the same grade possess a certain extent of homogeneity so as to validate the reasonableness of grading.

The suggested methods include (but are not limited to) the following:

- a. CIER (condition information entropy ratio)
- b. Whether the accumulated PD vary monotonously across time and grades.

(6) Stress testing

Using trial calculation or scenario analysis to simulate possible variations of risk values and losses under economic distress or when material adverse events occur (see the section on stress testing).

(7) Rating calibration

Compare and confirm whether the risk values for each internal grade are reasonable. The comparison can be made against historical experience, external ratings and modeling, or other internal rating results; the objects of comparison may be risk components, expected

loss or unexpected loss; the comparison may cover single or multiple grades or all asset classes. The difference between calibration and benchmarking is that the former aims to determine whether the risk weights assigned to the same grade are consistent, while the latter aims to observe whether the rating outcome are consistent. The suggested methods for calibration include (but are not limited to) the following:

- a. Binomial test
- b. Granularity adjustment
- c. Moment matching

3. Documentation requirements for the assessment of capital adequacy

(1) Banks must document relevant details of the rating system design and operation, including:

- Rating system design: rating dimensions, portfolio segregation, rating structure, design background and logic for rating criteria, and match with current status. :
- Rating process: records on job responsibility, frequency of re-rating, data collection and management, exception management, and overrides.
- Monitoring mechanism: validation test results and actions taken.
- Rating change: reasons, change procedure, and records on continuing compliance with supervisory requirements.
- Definition of loss: Default and loss definitions to evidence that the definitions used comply with the definitions set forth in this framework and are consistently applied.
- Modeling methods: theories, assumptions, empirical process, data sources, reasonableness and validity testing methods; in addition, there should be complete records on material changes to the models and resulting changes following review.
- Model limitation: Clearly identify the situations under which the model cannot work effectively and response steps taken.

(2) The documentation should demonstrate banks' compliance with the rating standards and process, and minimum requirements. Banks should review the documentation regularly, and record any material revision to the rating guidelines and process to facilitate examination by the supervisory authority.

(3) If a bank uses a model obtained from a third-party vendor that claims proprietary technology, the satisfaction of documentation requirement can be the joint responsibility of the bank and the model's vendor.

4. Discrepancy analysis and overrides

When rating grades are assigned based on quantitative model and there is discrepancy between the actual grades assigned and the model estimates, banks must document the

situation as reference for ongoing improvement of the model parameters. If an examination of the discrepancy finds the error to be random, there is no need to adjust the model; if the error is systemic, the model must be adjusted or re-estimation must be performed. If the use of model is combined with expert judgment, banks should track or examine the performance of overrides periodically.

(F) Use of internal ratings

1. Banks using the IRB approach must apply their internal rating system in the dimensions of “management strategy”, “risk organization”, “risk management process”, and “risk management infrastructure”, and document the actual application in each of the dimensions.
2. A bank must apply its internal rating system consistently to: (1) credit approval, (2) limit setting, (3) credit risk reporting, (4) loss provision, and (5) calculation of regulatory capital.
3. If a bank’s ratings systems and estimates are designed and implemented exclusively for the purpose of qualifying for the IRB approach and used only to provide IRB inputs, the bank will not be approved for the use of IRB approach.
4. For other broad applications of the internal rating system on, such as the calculation of economic capital, risk tolerance, pricing, and performance evaluation, the supervisory authority may, within a certain extent, allow some difference between the internal estimates and the actual values used. Where there are such differences, a bank must document them and demonstrate their reasonableness to the supervisory authority.
5. A bank must have a credible track record in the use of internal ratings information. In the qualification review, a bank must demonstrate that it has been using the rating system for at least three years. A bank using the advanced approach must demonstrate that it has been estimating and employing LGDs and EADs in a manner that is broadly consistent with the minimum requirements for use of own estimates of LGDs and EADs for at least the three years prior to qualification. Improvements to a bank’s rating system will not render a bank non-compliant with the three-year requirement.

(G) Corporate governance and oversight

1. Corporate governance
All material aspects of the rating and estimation processes must be approved by the bank’s board of directors or a designated committee thereof and senior management. The responsibilities of the bank’s management and personnel are as follows:
(1) Board of directors: The board of directors must possess a general understanding of the

bank's risk rating and estimation processes, and detailed comprehension of its associated management reports.

- (2) Senior management: Senior management also must have a good understanding of the rating system's design and operation, and must approve material differences between established procedure and actual practice, and review and improve the internal rating operations regularly. Senior management must also understand fully related management reports and make use of them.
- (3) Risk control personnel: Management and staff in risk control function must ensure the effective operation of the internal rating system, test its validity, and discuss the performance of the rating process with general management.
- (4) General management: Management should ensure the proper functioning of the internal rating system.
- (5) Reporting mechanism: Reports on the results of internal rating and any material situations should be produced in consideration of the management authority and reporting frequency.

2. Risk control process

- (1) Banks must have an independent credit risk control unit that is responsible for the design or selection, implementation and performance of their internal rating systems. The unit must be functionally independent from the personnel and management functions responsible for originating exposures. Areas of responsibility must include:
 - Testing and monitoring internal grades;
 - Production and analysis of summary reports from the bank's rating system, to include historical default data sorted by rating at the time of default and one year prior to default, grade migration analyses, and monitoring of trends in key rating criteria;
 - Implementing procedures to verify that rating definitions are consistently applied across departments and geographic areas;
 - Reviewing and documenting any changes to the rating process, including the reasons for the changes; and
 - Reviewing the rating criteria to evaluate their risk predictive power. Changes to the rating process, criteria or individual rating parameters must be documented and retained for review by the supervisory authority.
- (2) A credit risk control unit must actively participate in the development, selection, implementation and validation of rating models. It must assume oversight and supervision responsibilities for any models used in the rating process, and ultimate responsibility for the ongoing review and alterations to rating models.

3. Internal and external audit

- (1) Internal audit or an equally independent function must review at least annually the bank's rating system and its operations, including the operations of the credit function and the estimation of PDs, LGDs and EADs. Areas of review include adherence to all applicable minimum requirements. Internal audit must document its findings. If deemed necessary, the supervisory authority may also require an external audit of the bank's rating assignment process and the reasonableness of the loss estimates.
- (2) Internal and external audit of the bank's internal rating system must cover primarily:
 - The design of rating system and model development;
 - Compliance with policies and processes (including the application of standards);
 - Examination of risk rating validation;
 - Consistency of ratings across industry / loan portfolios / geographic areas;
 - Overrides and policy exceptions; and
 - Proper maintenance of data.
- (3) Internal and external audit report on the internal rating system must include identification of errors and deficiencies, and suggestions for improvement.

H. Minimum requirements for IRB approach - specific requirements

(A) Requirements specific to estimating the risk components for qualifying purchased receivables

1. Any purchased receivables making use of the top-down method for default risk or dilution risk must meet following minimum requirements set forth in this section.
2. The purchasing bank will be required to group the receivables into sufficiently homogeneous pools so that accurate and consistent estimates of PD and LGD (or EL) for default losses and EL estimates of dilution losses can be determined. In addition, the process should reflect the seller's underwriting practices and the heterogeneity of its customers. In addition, the estimation of the aforementioned risk components must comply with the existing minimum requirements for retail exposures.
3. Estimation of risk components should reflect all information regarding the quality of the underlying receivables, including data for similar pools provided by the seller, by the purchasing bank, or by external sources. The purchasing bank must determine whether the data provided by the seller are consistent with expectations agreed upon by both parties (e.g. the type, volume and on-going quality of receivables purchased). Where such data are insufficient, the purchasing bank should obtain and rely upon more relevant data.
4. Banks must have proper legal certainty over the receivables (that is, in incidences of seller or servicer distress or bankruptcy, and incidences of legal dispute, the purchasing bank has full

ownership, control and enforcement ability of cash remittances from the receivables). The bank should also verify regularly that all payments made to the seller or servicer are forwarded completely to the bank and within the contractually agreed terms.

5. The purchasing bank must monitor both the quality of the receivables and the financial condition of the seller and servicer according to the following requirements:
 - The bank must (a) assess the correlation among the quality of the receivables and the financial condition of both the seller and servicer.
 - The bank have in place internal policies and procedures that provide adequate safeguards to protect against such contingencies, including the assignment of an internal risk rating for each seller and servicer.
 - The bank must have clear and effective policies and procedures for determining seller and servicer eligibility. The bank or its agent must conduct periodic reviews of sellers and servicers in order to verify the accuracy of reports from the seller/servicer, detect fraud or operational remissness, and verify the quality of the seller's credit policies and servicer's collection policies and procedures. The bank must also document the findings of these reviews.
 - The bank must assess the characteristics of the receivables pool, including (a) over-advances; (b) history of the seller's arrears, bad debts, and bad debt allowances; (c) payment terms, and (d) potential contra accounts.
 - The bank must have effective policies and procedures for monitoring on an aggregate basis single-obligor concentrations both within and across receivables pools.
 - The bank must receive timely and sufficiently detailed reports of receivables ageings and dilutions to ensure compliance with the bank's eligibility criteria and advancing policies governing purchased receivables, and to monitor and confirm the seller's terms of sale (e.g. invoice date ageing) and dilution.
6. The purchasing bank must establish an effective early warning system and program according to the following requirements and detect deterioration in the seller's financial condition and deterioration in the quality of the receivables at an early stage, and address the problems actively:
 - The bank should have clear and effective policies, procedures, and information systems to monitor (a) all contractual terms of the facility (including covenants, advancing formulas, concentration limits, and early trigger of amortization, etc.); and (b) the bank's internal policies governing advance rates and receivables eligibility. The bank's systems should track covenant violations and waivers as well as exceptions to established policies and procedures.

- To limit inappropriate draws, the bank should have effective policies and procedures for detecting, approving, monitoring, and correcting over-advances.
- The bank should have effective policies and procedures for dealing with financial deterioration of sellers or servicers and deterioration in the quality of receivable pools, including early termination triggers in revolving facilities and other covenant protections, the approach to dealing with covenant violations, and procedures for initiating legal actions and dealing with problem receivables.

7. The bank must have clear and effective policies and procedures governing the control of receivables, credit, and cash, which should include at least the following:

- (1) Internal policies must specify all material elements of the receivables purchasing, including the advancing rates, eligible collateral, necessary documentation, concentration limits, and cash inflow management. These elements should take appropriate account of all relevant factors, including the seller's/servicer's financial condition, risk concentrations, and status of the receivables and the quality of seller's customers.
- (2) Internal systems must ensure that funds are advanced for receivables that meet the internal guarantee criteria (such as servicer attestations, invoices, shipping documents, etc.).

8. Compliance with the bank's internal policies and procedures

- (1) The bank should have an effective internal process for assessing compliance with all major policies and procedures in the management of purchased receivables, including:
 - Regular independent audits of all receivable purchasing processes.
 - Verification of the separation of duties for the assessment of the seller/servicer and the assessment of the obligor with different units in charge of those activities.
- (2) To ensure the effective compliance with major policies and internal procedures, the bank should evaluate the qualifications, experience, staff include evaluations of back office operations, with particular focus on qualifications and experience of back-office personnel, and the staffing levels and supporting systems of the back office.

(B) Requirements specific to estimating the risk components for leasing:

1. Leases other than those that expose the bank to residual value risk will be subject to the same minimum requirements as those for collateral, and in addition, meet the following standards:
 - Robust risk management on the part of the lessor with respect to the location of the asset, the use of asset, its age, and planned depreciation;
 - A robust legal framework establishing the lessor's legal ownership of the asset and its ability to exercise its rights as owner in a timely fashion; and
 - The difference between the rate of depreciation of the physical asset and the rate of

amortization of the lease payments must not be so large as to over-estimate the risk mitigation effect of the leased assets.

2. Residual value risk is the bank's exposure to potential loss due to the fair value of the equipment declining below its residual estimate at lease inception. The residual value risk will be treated in the following manner:
 - The discounted lease payments will receive a risk weight appropriate for the lessee's PD estimate and LGD estimate based on the facility grade (supervisory value if under foundation approach).
 - The residual value will be risk-weighted at 100%.

(C) Specific requirements for the calculation of capital charge for equity exposures

1. The minimum quantitative standards for the internal models market-based approach
 - (1) The capital charge is equivalent to the potential loss on the bank's equity portfolio arising from an assumed instantaneous shock equivalent to the 99th percentile, one-tailed confidence sufficient to cover the adverse market movements relevant to the long-term risk profile of the bank's specific holdings.
 - (2) The data used should reflect the longest sample period for which data are available and meaningful in representing the risk profile of the bank's specific equity holdings. The data used should be sufficient to provide conservative, statistically reliable and robust loss estimates. The sampling period should be sufficient to reflect the long-term characteristics of market sample. Banks may use reviewed external data and adopt proper screening mechanism to avoid sampling errors.
 - (3) Banks must make sure that the volatility parameters incorporated in the model remains robust in the estimation of potential losses over a relevant long-term market or business cycle. If the data cannot capture long-run empirical value, there should appropriate adjustments built into the model. Or the bank may combine empirical analysis of available data with adjustments based on a variety of factors to attain model outputs that are reasonably conservative.
 - (4) The construction of Value at Risk (VaR) models should use quarterly excess returns (less risk-free interest rates). Banks may use quarterly data or adjust shorter horizon period data to a quarterly equivalent. Such adjustments must have theoretical support and empirical evidence, and be applied conservatively and consistently over time. Furthermore, where sample data or techniques are limited, banks must add appropriate margins of conservatism in order to avoid over-optimism.

- (5) Any reasonable VaR model (e.g. variance-covariance, historical simulation, or Monte Carlo) can be applied for calculation. However, the model used must be able to capture adequately all of the material risks embodied in equity returns, including both the general market risk and specific risk, and adequately explain historical price variation. Scenario analysis may also be used for estimation analysis. In such an event, the bank should effectively evaluate the reasonableness of scenario analysis performed.
- (6) Banks should have an internal model designed to capture effectively risks associated with financial instruments that are highly non-linear in nature (e.g. equity derivatives, convertibles).
- (7) The correlation of the equity portfolio (or implicit correlation) should be integrated with the bank's internal risk model. The quantification process should be completely and explicitly documented and supported by empirical evidence.
- (8) The use of market indices or specific risk factors as proxies for specific portfolio holdings should be plausible and intuitive. The mapping techniques and processes should be fully documented, and demonstrated with both theoretical and empirical evidence to be appropriate for the specific holdings.
- (9) Where factor models are used, either single or multi-factor models are acceptable depending upon the nature of the bank's holdings. The factors should be able to capture important equity market characteristics (for example, public, private, market capitalization industry sectors and sub-sectors, operational characteristics) in which the bank holds significant positions. Banks must demonstrate through empirical testing the appropriateness of those factors that they fully both general and specific risks of the bank's holdings.
- (10) A rigorous and comprehensive stress-testing program must be in place, which subject the internal model and estimation procedures (including volatility computations), to either historical or hypothetical scenarios.

2. Risk control process

- (1) Full integration of the internal model into the risk management and information systems of the bank, including: 1. internal risk assessment operation, such as calculating required return rates; 2. assessing equity portfolio performance after risk adjustment; and 3. allocating economic capital. The bank should be able to demonstrate what kind of essential role the internal model output plays in the management decision-making on

investment review.

- (2) Banks should establish the mechanism for periodic and independent review of the internal modeling process, including model revisions, vetting of model inputs, and review of model results (e.g. verification of calculation results). These reviews should also identify model limitations and theoretically known and potential weaknesses, with particular attention paid to the selection and switch of proxies. Such reviews may be conducted as part of internal independent risk control unit or by an external third party.
- (3) There should be adequate systems and procedures in place for monitoring investment limits and the risk exposures of equity investments.
- (4) The units responsible for the design and application of the model must be functionally independent from the units responsible for managing individual investments.
- (5) Personnel responsible for model construction must be adequately qualified. Management must allocate sufficient resources to the modeling function.

3. Validation

- (1) Banks must have a robust system in place to validate the accuracy and consistency of their internal models and modeling processes. A bank must demonstrate to the supervisory authority that the internal validation process enables it to assess the consistency and meaningful operation of its internal model and processes.
- (2) Banks must regularly compare actual gain/loss (including realized and unrealized gains and losses) with modeled estimates and be able to demonstrate that the differences are within the expected range. The models and data used in the comparison should be consistent, and clearly documented. This analysis and documentation should be updated annually.
- (3) Banks should make use of other validation tools and comparisons with external data sources to verify the reasonableness of the method used. The data used must be appropriate to the portfolio characteristics, are updated regularly, and cover a relevant observation period. Banks' internal assessments of the performance of their own model must be based on long data histories, covering a range of economic conditions, and one or more complete business cycles.
- (4) Banks using internal models should establish clear guidelines for internal model review process, especially when actual results significantly deviate from model prediction. The

guidelines must consider the impact of economic cycle and systemic risk on the return on equities. Banks must demonstrate that quantitative validation methods and data are consistent through time. Changes in estimation methods and data of the models used must be thoroughly documented in compliance with the internal review process.

- (5) Banks using the internal model approach to estimating equity risk exposures must construct and maintain databases on the actual quarterly performance of the equity holdings to facilitate backtesting. Banks should also backtest the volatility estimates used within their internal models and the appropriateness of the proxies used in the model. Supervisory authority may ask banks to backtest at a shortened interval than the quarterly test, and store performance data for the backtest work.

(D) Definition of default

1. General definition

- (1) A default is considered to have occurred with regard to an obligor when either or both of the two following events have taken place.
- Without considering the recourse such as liquidating the collateral, the bank determines that the obligor or the counterparty is unlikely to pay its credit obligations to the bank in full.
 - The obligor is past due more than 90 days on any material credit obligation to the bank.
- (2) A default event can be one of the following:
- The bank puts the credit obligation on non-accrued status, for example, transfer to the account of receivable on demand.
 - The bank makes a charge-off or sets aside loan loss provision due to significant decline in credit quality of the exposure.
 - The bank sells the credit obligation at a material credit-related economic loss.
 - The bank consents to a debt restructuring or material forgiveness (or postponement) of principal, interest and related fees which results in a decrease/loss in debt obligation.
 - The bank has filed for the obligor's bankruptcy or a similar legal procedure in respect of the obligor's credit obligation to the banking group.
 - The obligor has sought or has applied for reorganization, bankruptcy or similar proceedings that would allow the obligor to avoid or delay repayment of the credit obligation to the bank⁶⁵.

2. Standards for days past due

⁶⁵ Circumstances covered under a default event has included the content of the "acceleration clause" in a loan agreement. Thus no other indicators are provided.

- (1) “Days past due” means any material credit obligation with the bank is more than 90 days past due.
- (2) “Days past due” can be measured by: 1. the number of days the payment is owed, which is termed “time-based past due”, which is commonly applied to, for example, credit cards and overdrafts; 2. the equivalent time value converted from balance outstanding, which is termed “money-based past due”, which is commonly applied to, for example, personal unsecured loan. Either method may be used for determining days past due, as long as it is applied on a consistent basis.
- (3) For practical basis, banks may use “one month” or “30 days” as standard for calculating days past due. However the standard must be applied consistently to loans or investment portfolio. The definition of default and the standards for calculating days past due should be fully documented.
- (4) Counting of days past due:
 - Overdrafts will be considered as being past due once the customer has breached an advised limit or been advised of a limit below the current outstandings; non-preapproved overdrafts are considered as being past due once drawn.
 - For expired accounts with a balance, but not renewed or settled, the counting of days past due commences from the expiration date.
 - For loans under installment plan and other loans, the payoff date is the agreed date (the date the loan is in default). If the bank demands early payoff according to the contractual clause, the date designated by the bank for payoff by the obligor is the payoff date.
 - Credit card: The next cycle day following the payment due date is the day the account is in default.
 - For other products, the counting of days past due commences on the contractually agreed payment date.
- (5) For retail and public-sector entities (PSEs) obligations, if the 90 days figure for days past due is not in line with the actual default condition, the bank may pick another figure up to 180 days, subject to supervisory approval.

3. Default entity

- (1) Smallest entity for determination of default: at the level of individual obligor for corporate exposures, and at the level of individual account for retail exposures.
- (2) Determination of group enterprise default:
 - If the bank rates the group enterprise on the basis of the risk exposures to the entire group and all members in the group is assigned the same rating grade, all members in the group are treated as a single obligor such that when any member in the group is determined to be in default, the whole group is in default.

- If the bank rates the group enterprise on the basis of the risk exposures to some or individual members in the group, the individual or some members in the group may be treated as different obligors such that when a member in the group is determined to be in default, the entire group or other members in the group may be treated as in default.
- For the purpose of determination of default, banks must have well-articulated policies towards the determination of obligor. Such policies should be documented and applied on a consistent basis.

4. Re-aging

Re-aging cases that meet the definition of default in substance (including days past due or a recognized default event) shall be treated as in default according to the definition of default under the IRB approach. Banks must have clearly articulated policies in respect of the conditions for re-aging of facilities (including the granting of extension, deferrals, renewals, and rewrites to existing accounts), and the counting of days past due, which should pass the “use test.” Those policies include:

- Approval authorities and reporting requirements;
- Minimum age of a facility before it is eligible for re-ageing;
- Delinquency levels of facilities that are eligible for re-ageing;
- Maximum number of re-ageings per facility; and
- A reassessment of the borrower’s capacity to repay.

5. Overdrafts

For clients granted overdrafts, banks must have a rigorous management policy in place for setting the standards for credit assessment. The amount of overdraft must be acknowledged by the client. Banks must monitor accounts that break the limit of overdraft and treat the account as in default when the break of limit exceeds 90 days.

6. Other rules

- (1) A bank must record actual defaults on all exposure classes using the reference definition described above. A bank must also use the reference definition for its estimation of PD, LGD and EAD. In arriving at these estimations, a bank may use external data available. However, when the definition of default used by the external data is inconsistent with the reference definition, the bank must demonstrate to the supervisory authority that appropriate adjustments to the data have been made to achieve broad equivalence with the reference definition. This same condition would apply to any internal historical data used for the estimation of PD, LGD and EAD before implementation of the IRB approach. Internal data (including that pooled by banks) used in such estimates after the implementation of the IRB approach must be consistent with the reference definition of

default.

- (2) If the bank considers that a previously defaulted exposure's status is no longer in default, the bank must rate the borrower and estimate LGD as they would for a non-defaulted facility. If default again occurs subsequently, it would be considered a second default.

(E) Minimum requirements for collateral

1. Policies and procedures

- (1) Banks must have rigorous procedures in place to ensure compliance with documented internal policies, control, collateral measurement system or operation.
- (2) A bank's collateral measurement system or operation should operate in conjunction with internal exposure limits.
- (3) Banks should conduct independent regular audits of their collateral measurement system or operation as a part of the internal audit process.

2. Recognition of collateral

- (1) Banks must document clearly in their internal lending policies and procedures their policy and practices for the types of physical collateral accepted by the bank, and appropriate amount of each type of collateral relative to the exposure amount.
- (2) In compliance with the minimum requirements for collateral and risk management, banks using the foundation shall follow the rules for eligible collateral set forth in the section of "LGD under the foundation approach" with regard to the types and criteria for eligible collateral; banks using the advanced approach shall follow the rules for collateral set forth in the section of "LGD under the advanced approach", but are not subject to any restriction on the types of collateral.
- (3) Banks must take into account the illiquidity of lower-quality assets such that where the planned holding period (i.e. the time assumed will take to liquidate the collateral on a normal market) would be inappropriate given the liquidity of the collateral holding period, the holding period should be adjusted upward. should also identify where historical data may understate potential volatility
- (4) In order for collateral to provide protection, the credit quality of the counterparty and the value of the collateral must not have a material positive correlation (for example, securities issued by the counterparty - or by any related group entity would provide little protection and so would not be taken as legible collateral).

3. Legal validity of the collateral

- (1) Bank's loan agreement should have detailed description on the collateral such that any claim on a collateral taken must be legally enforceable in all relevant jurisdictions, and all legal requirements for establishing the claim have been fulfilled. Banks must also

safekeep all certificates evidencing the claim on the collateral. In addition, the collateral agreement and the legal process must provide for the bank to realize the value of the collateral within a reasonable timeframe.

- (2) All documentation used in collateralized transactions and for documenting on-balance sheet netting, guarantees and credit derivatives must be binding on all parties and legally enforceable in all relevant jurisdictions.
- (3) The legal mechanism by which collateral is pledged or transferred must ensure that the bank has the right to take necessary actions to obtain and maintain an enforceable security interest to mitigate or offset its claim in the event of the default, insolvency or bankruptcy (or otherwise-defined credit event set out in the transaction documentation) of the counterparty.
- (4) Only first lien on collateral are permissible under the standardized approach and foundation approach (unless the first lien is subject to the prior right of preferential creditors, including outstanding tax claims and employees wages). Bank must have priority over all other creditors to the realized proceeds of the collateral.

4. Loan to value ratio

Bank's lending policies should consider requirements for collateral relative to the associated risk, including the ability to readily liquidate the collateral, the acquisition of objective market value, and the volatility of the value of the collateral.

5. Operational requirements for the valuation of collateral

(1) Valuation basis

- a. Banks should determine the value of pledge or collateral provided by the borrowers according to macroeconomic factors, current value, depreciation, actual functions, and marketability.
- b. Banks should give the collaterals received credible appraisal and draft collateral appraisal standards, and implement the standards after approval in a joint meeting of the directors and supervisors.
- c. Both internal and external appraisal must ensure that the valuation method used meets the principles of reasonableness and prudence. The appraisal methods used should be clearly documented.
- d. The collateral must be valued at or less than the current fair value under which the property could be sold under private contract between a willing seller and an arm's-length buyer on the date of valuation.

(2) Ability of the appraiser

Banks should follow the established rules when enlisting the service of outside appraiser for the appraisal of collateral.

(3) Frequency of revaluation of collateral

- a. Financial collaterals that a bank takes on, such as cash, gold, bonds, equities, Collective Investments in Transferable Securities (UCITS) and mutual funds, and borrowed securities, repo-style transactions, OTC derivative transactions, and borrowed margin should be, in principle, marked to market daily (if it cannot be achieved, the adverse factors for evaluation frequency should be incorporated into the risk measurement system for consideration). Collateral other than those mentioned above (e.g. CRE, RRC) should be revalued frequently or at least once every year. In addition, if maturity mismatch exists, this adverse factor should be included in the risk measurement system for consideration.
- b. Banks should understand the adverse impact of the marketability and economic cycle on the value of collateral. The value of collateral with the market characteristic of high price volatility should be examined more frequently. Statistical methods of evaluation (e.g. reference to house price indices, sampling) may be used to update estimates or to identify collateral that may have declined in value and that may need re-appraisal.
- c. Banks should re-evaluate non-performing assets according to the internal collateral valuation measure at least once every year. When information indicates that the value of the collateral may have declined materially relative to general market prices or when a credit event, such as default, occurs, the collateral should be re-appraised promptly.
- d. The bank's periodic revaluation process must pay particular attention to fashion-sensitive collateral to ensure that valuations are appropriately adjusted downward of fashion, or model-year, obsolescence as well as physical obsolescence or deterioration.
- e. A loan facility that will be renewed upon expiration is considered a new case and should have credit check performed based on the current status of the borrower and the collateral revalued.

6. Safekeeping and monitoring of the movement of collateral

- (1) The collaterals should be posted on a record book indicating name, quantity, valuation, lien status and insurance information. The record book will be filed together with the hypothecation documents for reference.
- (2) Banks should conduct regular and irregular check or physical inspection of the collateral's usage, custody and maintenance to make sure the collateral is not sold, let, pledged, moved or otherwise disposed without authorization. The bank may set out the manner of inspection.
- (3) Where the collateral is held by a custodian, banks must take reasonable steps to ensure

that the custodian segregates the collateral from its own assets.

7. Receivables

The bank must maintain a continuous monitoring process for the specific exposures (either immediate or contingent) attributable to the collateral to be utilized as a risk mitigant. This monitoring process may include, as appropriate and relevant, ageing reports, control of trade documents, borrowing base certificates, frequent audits of collateral, confirmation of accounts, control of the proceeds of accounts paid, analyses of dilution (credits given by the borrower to the issuers) and regular financial analysis of both the borrower and the issuers of the receivables (especially in the case when a small number of large-sized receivables are taken as collateral). Observance of the bank's overall concentration limits should be monitored. Additionally, compliance with loan covenants, environmental restrictions, and other legal requirements should be reviewed on a regular basis.

8. Enforcement and disposal of collateral

- (1) There should be clear and prudent procedure for the enforcement and disposal of collateral. The procedure should include the legal conditions required for declaring the default of the customer and timely collection of collateral.
- (2) Banks must establish a set of clear and rigorous procedures for the liquidation of collateral readily to ensure that the collateral will be liquidated expeditiously.

(F) Stress testing

1. Functions and definition of stress testing

- (1) When the credit quality of borrowers deteriorates, the capital requirement will increase rapidly, leading to greater volatility of the bank's capital adequacy ratio. In order to render capital charge more risk sensitive, banks using the IRB approach must have in place sound stress testing procedures for use in the assessment of capital adequacy.
- (2) Stress testing can be defined as a model for banks to measure plausible, exceptional loss. Banks can, through scenario analysis or historical information, reassess the values of financial products or investment portfolio based on the change of possible risk factors and use the assessment as reference to determine whether an obligor can sustain the change of risk factors in material adverse circumstances (e.g. sudden rise of interest rate or sudden crash of the stock market).
- (3) General risk models equate risks with volatility and use historical data for basic computations. The risks embodying in those models refer to past change events. But risks carried in future uncertainties and unpredictable events are the most critical risks faced by

banks. Some events, for example, the 1987 U.S. stock market crash, the 1997 Asian financial storm, and the 1998 Russian government default, produced significant impact on the financial markets. General risk models would fail under those circumstances. Thus for comprehensive risk management, banks need to employ both general risk models and stress models.

2. Stress testing design and development

Subject to the supervisory review and consent, banks can choose their own stress tests based on their own circumstances. The tests must be meaningful and reasonably conservative. Banks must explain the reasons for material discrepancy between the IRB and stress test results and verify whether the tests cover the great majority of risk exposures.

(1) Risk analysis and scenario testing of investment portfolios

- a. Stress test must include the assessment of plausible material events or change of economic conditions that might produce adverse impact on the credit exposures of the bank and whether the bank is able to continue operate steadily under the changes. The most common stress testing is scenario testing that assesses the impact of specific circumstances on IRB capital charge, such as economic or industry downturn, market-risk events, and change of cash flows. Banks should also take into account the mild recession scenario and the bank's international diversification using consecutive quarters of zero growth to assess the effect on the bank's PDs, LGDs and EADs.
- b. Banks conducting stress test under the double default framework must consider as part of their stress-testing framework the impact of deterioration in the credit quality of protection providers, in particular the impact of protection providers falling outside the eligibility criteria due to rating changes. Banks should also consider the impact of the default of one but not both of the obligor and protection provider, and the consequent increase in risk and capital requirements at the time of default.
- c. Banks should make sure that the individual portfolios in investment portfolio subject to stress testing share the same risk characteristics (e.g. same country or same market), and identify stress events for the investment portfolio through predictions and observation of market and economic changes. Banks can also consult the service of external professionals for the creation of proper stress scenarios. The greater the extent of change in market conditions, the more diversified the design of stress scenarios should be.

(2) Definition of risk factors

Major risk factors faced by the bank can be categorized as follows:

- a. Credit risk factors: Including three major risk factors - PD, LGD, and EAD; credit

downgrade and declining repayment ability would also affect the investment portfolio. In addition, early repayment by borrower would result in reinvestment risk. Thus maturity (M) can also be considered a risk factor.

- b. Macroeconomic factors: Economic growth rate, unemployment rate, and consumer price index are macroeconomic risk factors that have an impact on the investment portfolio.
- c. Market risk factors: A bank is faced with both market risk and credit risk for its holding of a debt instrument or security. It might be difficult to effectively distinguish whether the effect of a stress event on this type of holdings belongs to market risk or credit risk. Thus both risk factors should be measured in stress testing.
- d. Other types of risk factors: It is typical for a risk model to make assumptions, such as liquidity risk. These assumptions should be relaxed for estimation under stress testing. Risk models often use portfolio related risk-based data as meta data, such as transition matrix and correlation matrix, which can be considered risk factors in stress testing.

(3) Stress testing methodology

- a. Stress testing can fall into the following categories: sensitivity analysis - this approach uses one particular risk factor or a set of risk factors, which change gradually within the extreme extent set by the operator to assess the impact on the investment portfolio; scenario analysis - this approach defines a set of risk factor as a scenario to assess the stress loss under respective scenario. The events in scenario analysis can be designed as: (1) historical scenario; and (2) hypothetical scenario.
- b. Stress testing can employ quantitative and qualitative techniques. Quantitative stress test depicts the plausible stress events and their effects on the bank in specific quantitative term; qualitative stress test allows a bank to gauge the response measures it can take for its capital and operations (e.g. hedging or changing the allocation of assets) after obtaining the stress test results to better manage over-concentration of risk or potential risk.

(4) Assessment of investment portfolio based on new stress scenarios

After grasping the risk factors that influence the investment portfolio and the magnitude of their changes, banks may use the information to re-value their portfolios to calculate the asset values under different scenarios, and capture the maximum loss that would occur under such stress scenarios by comparing the stress value with the original value.

3. Integrity and fairness of stress testing operation

- (1) The stress test process should be managed and coordinated by an independent unit (or mechanisms). Banks should set up a committee for the determination of stress scenarios (or include this requirement into the functions of existing committees). Wherever possible, members of the committee should include bank staff in the front, middle and back-office (e.g. credit checking personnel, risk management personnel or traders) in order to better integrate bank's portfolio characteristics, internal experience and external data and identify pertinent stress scenarios.
- (2) Banks must ensure that they have an adequate information system to support the stress-testing program. The system would allow stress testing different portfolios and business divisions and is able to summarize the stress test outcome on the basis of the entire bank.
- (3) With respect to data used for stress testing, banks should consider the following sources of data: 1. bank's own data should at least be able to estimate the grade migration of some exposures; 2. banks should consider the possible effect of mild deterioration of credit environment and worst-case scenarios on bank's internal ratings; and 3. banks should assess the change of external grades and map the internal grades to external grades.
- (4) Banks should confirm the accuracy of relevant data, including the volumes and prices of individual exposures. The measure of the market data used for respective risk factors (e.g. interest rate, exchange rate, etc.) and other risk-based data (e.g. transition matrix) is also an important validation procedure.
- (5) Banks should conduct stress tests regularly and document the adjustment of test frequency in relevant policies. Portfolios associated with market risk factors should be stress tested more frequently (e.g. daily or weekly), while portfolios that change more mildly (e.g. loans) should be stress tested at least quarterly. In the event of drastic change in economical or political environment, risk assessment of the possible impact should be performed readily.
- (6) Banks should regularly review and update the methods and effect of stress testing to promptly capture changes to the portfolio characteristics and external environment and assess whether the basic assumptions made are still valid. The review should be carried out at least annually or more frequently when material changes to the portfolio or the environment occurs. The review should cover the following: is the stress test procedure

sufficiently documented; are stress tests incorporated into routine risk management; the approval process for the stress testing procedure and authorization for material revision; risks covered by the stress testing program; the robustness of the management information system; accuracy and integrity of the portfolios used in stress testing; consistency, timeliness and reliability of the sources of data used in stress testing.

- (7) Suggestions for the revision of the stress test methods and procedures should be approved by the management.

4. Corporate governance and risk management system

- (1) The board of directors and management should understand fully and oversee the process for the stress-testing program. Management should actively participate in the design of stress test and the formulation of remedial action plan. The board of directors or the authorized committee should approve the stress testing program, examine the outcome of stress test, and ensure that proper actions are taken to mitigate the potential risk, and urge relevant department managers to pay particular attention to potential risks identified in the test and matters that are particularly vulnerable, and suggest possible remedial measures.
- (2) Banks should establish a set of explicit strategies or principles as guide to determine whether remedial measures should be taken based on the stress test outcome, including the use of emergency response plan (depending on the extent of potential loss or impact on earnings and capital). In addition, the unit responsible for deciding the remedial measures should be clearly specified. Once decided, the remedial measures should be properly documented and processed.
- (3) The remedial measures to be taken vary depending on individual cases. Generally they include: reallocation of assets, offset or hedge, purchasing hedged product or lowering risk limit; tightening underwriting rules to lower credit risk, increasing capital to address the potential effects of stressed scenarios, revising the pricing policy to reflect past and uncertain risks, and managing debt structure to ensure adequate funds as preparation for tight current funds under stress events. However if it is decided that no remedial actions need to be taken promptly, the bank should conduct more stress tests and draft response plan to ensure effective and ongoing oversight.
- (4) The supervisory authority will determine whether a bank operates at the level above the minimum capital requirements set forth in Pillar 1 based on its implementation of stress testing or the stress testing results directly, and respond to banks with inadequate capital according to the Pillar 2, which are commonly asking the bank to reduce its risk or hold excess capital/provision to ensure the bank's current capital charge could satisfy at the

same time the Pillar 1 requirements and the results reflected in stress testing.

III. Annexes

Annex 1 Mapping of Ratings of Eligible External Credit Assessment Institutions

(A) Mapping of ratings of eligible external credit assessment institutions - long-term

Standard & Poor's	Moody's Investors Service	Fitch Ratings Corporate
AAA	Aaa	AAA
AA+	Aa1	AA+
AA	Aa2	AA

AA-	Aa3	AA-
A+	A1	A+
A	A2	A
A-	A3	A-
BBB+	Baa1	BBB+
BBB	Baa2	BBB
BBB-	Baa3	BBB-
BB+	Ba1	BB+
BB	Ba2	BB
BB-	Ba3	BB-
B+	B1	B+
B	B2	B
B-	B3	B-
CCC+	Caa1	CCC+
CCC	Caa2	CCC
CCC-	Caa3	CCC-
CC	Ca	CC
C	C	C
D		D

(B) Mapping of ratings of eligible external credit assessment institutions -
short-term

Standard & Poor's	Moody's Investors Service	Fitch Ratings Corporate
A-1	P-1	F1
A-2	P-2	F2
A-3	P-3	F3
Others	Others	Others

(C) Mapping of domestic ratings to risk weights⁶⁶ - long-term

Risk weights for claims on regional governments and public-sector entities

Standard & Poor's	AAA ~AA-	A+ ~A-	BBB+ ~BBB-	BB+ ~B-	CCC+ and below	Unrated
Taiwan Ratings		TwAAA~twAA	twAA~twA	twA- ~twB	twB- and below	Unrated
Moody's Investors Service		Aaa.tw~Aa2.tw	Aa3.tw~A2.tw	A3.tw ~B2.tw	B3.tw and below	Unrated
Fitch Ratings Taiwan		AAA(twn) ~AA(twn)	AA-(twn)~A(twn)	A-(twn)~twB(twn)	twB-(twn) and below	Unrated
Risk weight	20%	50%	100%	100%	150%	100%

Risk weights for claims on banks

Standard & Poor's	AAA~AA-	A+~A-	BBB+~BBB-	BB+~B-	CCC+ and below	Unrated
Taiwan Ratings		twAAA~twAA	twAA~twA	twA~twB	twB- and below	Unrated
Moody's Investors Service		Aaa.tw~Aa2.tw	Aa3.tw~A2.tw	A3.tw~B2.tw	B3.tw and below	Unrated
Fitch Ratings Taiwan		AAA(twn)~AA(twn)	AA-(twn)~A(twn)	A-(twn)~twB(twn)	twB-(twn) 以下	Unrated
Risk weight	20%	50%	50%	100%	150%	100%
Risk weight for short-term claim	20%	20%	20%	50%	150%	50%

Risk weights for claims on corporates

Standard & Poor's	AAA~AA-	A+~A-	BBB+~BB-	B+ and below	Unrated
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⁶⁶The mapping of domestic ratings to risk weights are subject to change.

Taiwan Ratings		twAAA~twAA	twAA~twBBB -	twBB+ and below	Unrated
Moody's Investors Service		Aaa.tw~Aa2.tw	Aa3.tw~Baa3.tw	Ba1.tw and below	Unrated
Fitch Ratings Taiwan		AAA(twn)~A A(twn)	AA-(twn)~BBB -(twn)	BB+(twn) and below	Unrated
Risk weight	20%	50%	100%	150%	100%

(D) Mapping of domestic ratings to risk weights - short-term

International rating	A-1/P-1/F1	A-2/P-2/F2	A-3/P-3/F3	Others
Taiwan Ratings	--	twA-1	twA-2	Others
Moody's Investors Service	--	TwA-1	TwA-2	Others
Fitch Ratings Taiwan	--	F1(twn)	F2(twn)	Others
Risk weight	20%	50%	100%	150%

(D) Mapping of domestic ratings of securitization to risk weights⁶⁷

Securitization under the standardized approach - risk weights applicable to long-term ratings

Standard & Poor's	AAA~AA-	A+~A-	BBB+~BBB-	BB+~BB-	B+ and below (including unrated)
Taiwan Ratings		twAAA~tw AA	twAA~twA	twA~twBBB-	twBB+ and below
Moody's Investors Service		Aaa.tw~Aa2 .tw	Aa3.tw~A2.tw	A3.tw~Baa3.t w	Ba1.tw and below

⁶⁷The mapping of domestic ratings to risk weights are subject to change.

Fitch Ratings Taiwan		AAA(twn)~ AA(twn)	AA-(twn)~A(t wn)	A-(twn)~BBB- (twn)	BB+(twn) and below
Risk weight - originating bank	20%	50%	100%	Full deduction	Full deduction
Risk weight - investing bank	20%	50%	100%	350%	Full deduction

Securitization under the standardized approach - risk weights applicable to short-term ratings

International rating	A-1/P-1/F1	A-2/P-2/F2	A-3/P-3/F3	All other grades or unrated
Taiwan Ratings	--	twA-1	twA-2	Others
Moody's Investors Service	--	TW-1	TW-2	Others
Fitch Ratings Taiwan	--	F1(twn)	F2(twn)	Others
Risk weight	20%	50%	100%	Full deduction

Securitization under the foundation IRB approach - risk weights applicable to long-term ratings

External rating (grades)	AAA	AA	A+	A	A-	BBB+	BBB	BBB-	BB+	BB	BB-	BB- and below and unrated
Taiwan Ratings			twAAA	twAA+	twAA	twAA-	twA+	twA	twA-	twBBB+ twBBB	twBBB-	Others
Moody’s Investors Service			Aaa.tw	Aa1.tw	Aa2.tw	Aa3.tw	A1.tw	A2.tw	A3.tw	Baa1.tw Baa2.tw	Baa3.tw	Others
Fitch Ratings Taiwan			AAA(twn)	AA+(twn)	AA(twn)	AA-(twn)	A+(twn)	A(twn)	A-(twn)	BBB+(twn) BBB(twn)	BBB-(twn)	Others
Risk weight for most senior exposure	7%	8%	10%	12%	20%	35%	60%	100%	250%	425%	650%	Full deduction
Base risk weight	12%	15%	18%	20%	35%	50%	75%					
Risk weight for non-granular portfolio	20%	25%	35%									

Securitization under the foundation IRB approach - risk weights applicable to short-term ratings

External rating (grades)	A-1/P-1/F1	A-2/P-2/F2	A-3/P-3/F3	All other grades or unrated
Taiwan Ratings	--	twA-1	twA-2	Others
Moody's Investors Service	--	TW-1	TW-2	Others
Fitch Ratings Taiwan	--	F1(twn)	F2(twn)	Others
Risk weight for most senior exposure	7%	12%	60%	Full deduction
Base risk weight	12%	20%	75%	Full deduction
Risk weight for non-granular portfolio	20%	35%	75%	Full deduction

Annex 2 Supervisory Slotting Criteria for Specialized Lending

Table 1 - Rating Grades for Project Finance Exposures

	Item	Strong	Good	Satisfactory	Weak
Financial strength	Market environment	<ul style="list-style-type: none"> • Few competitors. • Substantial and lasting advantage in location, cost, or technology. • Market demand is strong and growing. 	<ul style="list-style-type: none"> • Few competitors. • Better than average location, cost, or technology but this situation may not last. • Market demand is strong and stable. 	<ul style="list-style-type: none"> • No advantage in location, cost or technology (average level). • Market demand is adequate and stable. 	<ul style="list-style-type: none"> • Worse than average location, cost or technology. • Market demand is weak and declining.
	Financial ratios (e.g. debt service coverage ratio (DSCR), loan life coverage ratio (LLCR), project life coverage ratio (PLCR), and debt-to-equity ratio)	<ul style="list-style-type: none"> • Strong financial ratios in association with the level of project risk; very reasonable economic assumptions. 	<ul style="list-style-type: none"> • Strong to acceptable financial ratios in association with the level of project risk; reasonable economic assumptions. 	<ul style="list-style-type: none"> • Standard (average) financial ratios in association with the level of project risk. 	<ul style="list-style-type: none"> • Highly leveraged financial ratios in association with the level of project risk.

	Item	Strong	Good	Satisfactory	Weak
	Stress analysis	<ul style="list-style-type: none"> The project can fulfill its financial commitments and obligations even under severely stressed economic conditions. 	<ul style="list-style-type: none"> The project can fulfill its financial commitments and obligations under normal economic conditions. The project is likely to default under severely stressed economic conditions. 	<ul style="list-style-type: none"> The project is vulnerable to the stress conditions in an economic cycle, and might default in normal economic downturn. 	<ul style="list-style-type: none"> The project is likely to default unless the economic conditions improve soon.
	Financial structure Duration of loan as compared to the useful life of project income	<ul style="list-style-type: none"> Useful life of project income exceeds the duration of loan. 	<ul style="list-style-type: none"> Useful life of project income exceeds the duration of loan. 	<ul style="list-style-type: none"> Useful life of project income exceeds the duration of loan. 	<ul style="list-style-type: none"> Useful life of project income may not exceed the duration of loan.
	Amortization plan	<ul style="list-style-type: none"> Installed repayment of all principal before expiration. 	<ul style="list-style-type: none"> Installed repayment of all principal before expiration. 	<ul style="list-style-type: none"> Installed repayment of the majority of principal before expiration with limited amount of principal due upon expiration of loan. 	<ul style="list-style-type: none"> A small portion of principal repaid before expiration; the large portion of principal to be repaid in lump sum upon expiration.

	Item	Strong	Good	Satisfactory	Weak
Political and legal environment	Political risk, including transfer risk, considering project type and credit risk mitigants.	<ul style="list-style-type: none"> • Very low. • Effective mitigation instrument if needed. 	<ul style="list-style-type: none"> • Low. • Effective mitigation instrument if needed. 	<ul style="list-style-type: none"> • Moderate. • Fair mitigation instrument. 	<ul style="list-style-type: none"> • High. • No or ineffective mitigation instruments.
	Force majeure risk (war, civil unrest).	<ul style="list-style-type: none"> • Low. 	<ul style="list-style-type: none"> • Acceptable. 	<ul style="list-style-type: none"> • Standard protection. 	<ul style="list-style-type: none"> • Significant risk that cannot be fully mitigated.
	Government support and long-term importance of the project.	<ul style="list-style-type: none"> • Project of strategic importance for the country (export-oriented) with strong support from government. 	<ul style="list-style-type: none"> • Project considered important for the country and good support from the government. 	<ul style="list-style-type: none"> • Non-strategic project but having benefits for the country; support from the government not explicit. 	<ul style="list-style-type: none"> • Project not significant for the country, and no or weak support from the government.
	Stable legal environment (risk of regulatory change)	<ul style="list-style-type: none"> • Favorable and stable legal environment over the long term. 	<ul style="list-style-type: none"> • Favorable and stable legal environment over the medium term. 	<ul style="list-style-type: none"> • Regulatory environment can be predicted to be relatively stable. 	<ul style="list-style-type: none"> • Current or future regulatory issues might affect the project.
	Obtaining all necessary supports and approvals from local laws	<ul style="list-style-type: none"> • Strong 	<ul style="list-style-type: none"> • Acceptable 	<ul style="list-style-type: none"> • Fair 	<ul style="list-style-type: none"> • Weak

	Item	Strong	Good	Satisfactory	Weak
	Enforceability of contracts, collateral and debt	<ul style="list-style-type: none"> Contracts, collateral and debt are enforceable. 	<ul style="list-style-type: none"> Contracts, collateral and debt are enforceable. 	<ul style="list-style-type: none"> Contracts, collateral and debt are considered enforceable even if certain non-key issues may exist. 	<ul style="list-style-type: none"> Contracts, collateral and debt are considered enforceable but key unresolved issues exist.
Transaction characteristics	Design and technology risk	<ul style="list-style-type: none"> Fully certified technology and design. 	<ul style="list-style-type: none"> Fully certified technology and design. 	<ul style="list-style-type: none"> Design and technology not necessarily certified, but the risk of unforeseen events may be circumvented through comprehensive project planning. 	<ul style="list-style-type: none"> Design and technology not certified; technology issues exist or design is complex.
	Construction risk Permits and land	<ul style="list-style-type: none"> All promises have been obtained. 	<ul style="list-style-type: none"> Some promises are still in negotiation, but considered very likely. 	<ul style="list-style-type: none"> Some promises are still in negotiation, but the permitting process is well defined and will be carried out according to rules. 	<ul style="list-style-type: none"> Key promises have not been obtained; future uncertainty is high, and significant conditions may be attached.

	Item	Strong	Good	Satisfactory	Weak
	Type of turnkey project	<ul style="list-style-type: none"> Fixed price. Date certain. Turnkey construction EPC (engineering and procurement contract). 	<ul style="list-style-type: none"> Fixed price. Date certain. Turnkey construction EPC. 	<ul style="list-style-type: none"> Fixed price. Date certain. Construction contract with several contractors. 	<ul style="list-style-type: none"> Price not fixed. Date uncertain. Construction contract with several contractors and lacking integration mechanism.
	Completion guarantees	<ul style="list-style-type: none"> Full financial support for liquidated damages. Strong completion guarantors with good financial standing. 	<ul style="list-style-type: none"> Full financial support for liquidated damages. Completion guarantors with good financial standing. 	<ul style="list-style-type: none"> Adequate financial support for liquidated damages. Completion guarantors with good financial standing. 	<ul style="list-style-type: none"> Inadequate financial support for liquidated damages. Completion guarantor with weak financial standing.
	Track record and financial strength of contractor	<ul style="list-style-type: none"> Strong 	<ul style="list-style-type: none"> Good 	<ul style="list-style-type: none"> Satisfactory 	<ul style="list-style-type: none"> Weak
	Operating risk Scope and nature of operations and maintenance (O&M) contracts	<ul style="list-style-type: none"> Strong long-term O&M contract. With contractual performance incentives and O&M reserve account. 	<ul style="list-style-type: none"> Long-term O&M contract and/or O&M reserve account. 	<ul style="list-style-type: none"> Limited O&M contract. O&M reserve account. 	<ul style="list-style-type: none"> No O&M contract. High risk of O&M cost overrun.

	Item	Strong	Good	Satisfactory	Weak
	Operator's experience, track record and financial strength	<ul style="list-style-type: none"> • Very strong or committed technical assistance from project investor. 	<ul style="list-style-type: none"> • Strong 	<ul style="list-style-type: none"> • Acceptable 	<ul style="list-style-type: none"> • Limited/weak, or local operator limited by technical licensing.
	Buyer's risk (a) If it is a take-or-pay or fixed-price off-take contract	<ul style="list-style-type: none"> • Excellent credit reputation of product buyer. • Strong termination clause. • Term of contract exceeds the maturity of debt. 	<ul style="list-style-type: none"> • Good credit reputation of product buyer. • Strong termination clauses. • Term of contract exceeds the maturity of debt. 	<ul style="list-style-type: none"> • Product buyer has adequate financial support. • Normal termination clauses. • Term of contract matches the maturity of debt. 	<ul style="list-style-type: none"> • Weak product buyer. • Weak termination clauses. • Term of contract does not exceed the maturity of debt.
	(b) If it is not a take-or-pay or fixed-price off-take contract	<ul style="list-style-type: none"> • Project produces essential services or commodity sold on the world market. • Product can readily be sold at projected price and is highly marketable. 	<ul style="list-style-type: none"> • Project produces essential services or commodity sold in a regional market. • Product can readily be sold at projected price and is highly marketable. 	<ul style="list-style-type: none"> • Commodity sold in a limited product. • Commodity only sold at a price higher than the project price. 	<ul style="list-style-type: none"> • Project output is demanded by only one or a few buyers or not generally sold in a regular market.

	Item	Strong	Good	Satisfactory	Weak
	Supply risk Price, volume and transportation risks; supplier's track record and financial strength	<ul style="list-style-type: none"> Long-term supply contract; supplier of excellent financial standing. 	<ul style="list-style-type: none"> Long-term supply contract; supplier of good financial standing. 	<ul style="list-style-type: none"> Long-term supply contract; supplier of excellent financial standing. A certain degree of price risk may exist. 	<ul style="list-style-type: none"> Short-term supply contract or long-term supply contract with financially weak supplier. A certain degree of price risk may exist.
	Storage risk (reserve risk) (e.g. natural resource development)	<ul style="list-style-type: none"> Independently audited, validated and developed reserves well in excess of the requirements over lifetime of the project. 	<ul style="list-style-type: none"> Independently audited, validated and developed reserves in excess of the requirements over lifetime of the project. 	<ul style="list-style-type: none"> Validated reserves can supply the project adequately through the maturity of debt. 	<ul style="list-style-type: none"> Project relies to a certain extent potential and undeveloped reserves.
Financial strength of investor	Project investor's track record, financial strength and country/sector experience	<ul style="list-style-type: none"> Strong project investor with excellent track record and high financial standing. 	<ul style="list-style-type: none"> Good project investor with satisfactory track record and good financial standing. 	<ul style="list-style-type: none"> Adequate project investor with satisfactory track record and good financial standing. 	<ul style="list-style-type: none"> Weak project investor with questionable track record and weak financial standing.
	Project investor's support, including equity, ownership clauses and injection of additional cash if necessary	<ul style="list-style-type: none"> Strong. Project is highly strategic for the project investor (long-term core business strategy). 	<ul style="list-style-type: none"> Good. Project is strategic for the project investor (long-term core business strategy). 	<ul style="list-style-type: none"> Acceptable. Project is considered important for the project investors (core business). 	<ul style="list-style-type: none"> Limited. Project is not key to investor's long-term strategy or core business.

	Item	Strong	Good	Satisfactory	Weak
Debt security	Contract and account assignment	<ul style="list-style-type: none"> Totally rigorous 	<ul style="list-style-type: none"> Rigorous 	<ul style="list-style-type: none"> Acceptable 	<ul style="list-style-type: none"> Weak
	Pledge of assets; taking into account asset quality, value and liquidity	<ul style="list-style-type: none"> First perfected security interest in all project assets, contracts, and accounts for the project. 	<ul style="list-style-type: none"> Perfected security interest in all project assets, contracts, and accounts for the project. 	<ul style="list-style-type: none"> Acceptable security interest in all project assets, contracts, permits and accounts for the project. 	<ul style="list-style-type: none"> Little security for the project; weak no pledge clause.
	Lender's control over cash flow (e.g. control over funds, independent escrow account)	<ul style="list-style-type: none"> Strong 	<ul style="list-style-type: none"> Satisfactory 	<ul style="list-style-type: none"> Fair 	<ul style="list-style-type: none"> Weak
	Strength of covenant package (mandatory prepayment, payment deferrals, accelerated repayment, dividend restrictions, etc.)	<ul style="list-style-type: none"> Covenant package is strong. Project may not need to issue additional debt. 	<ul style="list-style-type: none"> Satisfactory covenant package. Project may need to issue limited additional debt. 	<ul style="list-style-type: none"> Fair covenant package. Project may need to issue limited additional debt. 	<ul style="list-style-type: none"> Insufficient covenant package. Project may need to issue unlimited additional debt.

	Item	Strong	Good	Satisfactory	Weak
	Reserve funds (debt service, O&M, renewal or replacement, unforeseen events).	<ul style="list-style-type: none"> • Reserve account longer than project period. • Reserve funds fully funded in cash or letter of credit issued by highly rated bank. 	<ul style="list-style-type: none"> • Reserve account equal to project period. • Fully funded. 	<ul style="list-style-type: none"> • Reserve account equal to project period. • Fully funded. 	<ul style="list-style-type: none"> • Reserve fund shorter than project period. • Funded by operating cash flow only.

Table 2 - Rating Grades for Income-Producing Real Estate Exposures and High-Volatility Commercial Real Estate Exposures

	Item	Strong	Good	Satisfactory	Weak
Financial strength	Market environment	<ul style="list-style-type: none"> • The supply and demand for the project type and location are in equilibrium. • The number of new competitive properties on the market is equal to lower than the demand forecast. 	<ul style="list-style-type: none"> • The supply and demand for the project type and location are in equilibrium. • The number of new competitive properties on the market is roughly equal to the demand forecast. 	<ul style="list-style-type: none"> • Market conditions are roughly in equilibrium. • New competitive properties are in planning stage. • The design and functions of the project may not be comparable to new projects. 	<ul style="list-style-type: none"> • Market conditions are weak. It is uncertain when such conditions will improve and return to equilibrium. • Most tenants will not renew the lease upon expiration. New lease terms are less favorable.

	Item	Strong	Good	Satisfactory	Weak
	Financial ratios and loan to value ratio (LTV)	<ul style="list-style-type: none"> • The project's debt service coverage ratio (DSCR) is considered strong. • The LTV is considered low and the transaction can be underwritten in the secondary market according to market standards. 	<ul style="list-style-type: none"> • The DSCR is satisfactory. • The LTV is satisfactory. The transaction can be underwritten in the secondary market according to market standards. 	<ul style="list-style-type: none"> • The DSCR is low. • When market price falls, the LTV rises. 	<ul style="list-style-type: none"> • The DSCR has deteriorated significantly. • The LTV is well above the standards.
	Stress analysis	<ul style="list-style-type: none"> • The property's resources, reserves and debt structure allow it to meet the financial obligations during a period of financial stress (e.g. change of interest rates, and economic growth). 	<ul style="list-style-type: none"> • The property's resources, reserves and debt structure allow it to meet the financial obligations under a sustained period of financial stress (e.g. change of interest rates, and economic growth). But the property is likely to default under severe economic conditions. 	<ul style="list-style-type: none"> • During economic downturn, the property's income will decline and its ability to raise funds will be limited such that the risk of default is significantly increased. 	<ul style="list-style-type: none"> • The project might default unless economic conditions improve immediately.

	Item	Strong	Good	Satisfactory	Weak
	Control of cash flow (a) Completed and stably leased property	<ul style="list-style-type: none"> • The tenants have good credit and on long-term lease. • The maturity dates of the leases are scattered and the lease renewal rate is high. • Low vacancy rate. • Expenses (maintenance, insurance, security, and taxes) are within expected range. 	<ul style="list-style-type: none"> • The tenants have fair credit and the majority of leases are long-term. • The lease renewal rate is normal. • Low vacancy rate. • Expenses (maintenance, insurance, security, and taxes) are within expected range. 	<ul style="list-style-type: none"> • The tenants have fair credits and on medium-term or long-term lease. • The lease renewal rate is moderate. • Moderate vacancy rate. • Expense are relatively predictable but vary in relation to income. 	<ul style="list-style-type: none"> • The tenants have good credit and on varying terms of lease. • The lease renewal rate is low with high level of tenant turnover. • High vacancy rate. • Expenses increases along with new leases.
	(b) Complete but not stably leased property	<ul style="list-style-type: none"> • Leasing meets or exceeds expectation. The project will achieve stability in a short period. 	<ul style="list-style-type: none"> • Leasing meets or exceeds expectation. The project will achieve stability in a short period. 	<ul style="list-style-type: none"> • The majority of leasing activities are within projection. However the project is unable to achieve stability in a short period. 	<ul style="list-style-type: none"> • The leasing market does not meet expectation. Although target occupancy rate is achieved, the income level is not satisfactory and cash flow is tight.

	Item	Strong	Good	Satisfactory	Weak
	(c) Property in construction phase	<ul style="list-style-type: none"> The property is entirely pre-leased or pre-sold through the term of loan to investment grade tenant or buyer, or has received commitment for take-out financing from investment grade lenders. 	<ul style="list-style-type: none"> The property is entirely pre-leased or pre-sold to investment grade tenant or buyer, or has received commitment for take-out financing from lenders with good credit standing. 	<ul style="list-style-type: none"> The leasing activity is within projection but the building may not be pre-leased, and there are no other take-out financing that the bank may be the permanent lender. 	<ul style="list-style-type: none"> The property's price drops due to cost overrun, depressed market, tenant cancellation or other factors. The party providing permanent financing might take it as an excuse to stall the financing.
Asset characteristics	Location	<ul style="list-style-type: none"> Convenient location that can meet the needs of tenants. 	<ul style="list-style-type: none"> Convenient location that meets the needs of tenants. 	<ul style="list-style-type: none"> Location lacks competitive advantage. 	<ul style="list-style-type: none"> Location, configuration, design and maintenance are not desirable.
	Design and condition	<ul style="list-style-type: none"> The property is desired in terms of design, configuration and maintenance, and highly competitive with new properties. 	<ul style="list-style-type: none"> The property is moderately attractive in terms of design, configuration and maintenance and competitive with new properties in design and functions. 	<ul style="list-style-type: none"> The property is adequate in terms of design, configuration and maintenance. 	<ul style="list-style-type: none"> The property has weakness in design, configuration and maintenance.

	Item	Strong	Good	Satisfactory	Weak
	Under construction	<ul style="list-style-type: none"> • Construction budget is conservative and technical difficulty is limited. • The contractors are highly qualified. 	<ul style="list-style-type: none"> • Construction budget is conservative and technical difficulty is limited. • The contractors are highly qualified. 	<ul style="list-style-type: none"> • Construction budget is adequate. • The contractors are ordinarily qualified. 	<ul style="list-style-type: none"> • Project is over budget or technical difficulty is hard to surmount. • The contractors are inadequately qualified.
Financial strength of developer / investor	Financial strength and support of developer / investor	<ul style="list-style-type: none"> • The developer provides sufficient funds to the construction or purchase of the property. The developer has substantial resources and limited direct or contingent debt. The developer's real estate investments are diversified in terms of location and property type. 	<ul style="list-style-type: none"> • The developer provides material cash to the construction or purchase of the property. The developer's financial condition allows it to support the property in the event of cash shortage. The developer's real estate investments are scattered geographically. 	<ul style="list-style-type: none"> • The developer can only meet non-material or non-cash needs. The developer is below average in financial resources. 	<ul style="list-style-type: none"> • The developer lacks the capacity or willingness to support the property.

	Item	Strong	Good	Satisfactory	Weak
	Reputation and track record of developer in similar properties	<ul style="list-style-type: none"> Developer is experienced in management and of high quality, and has strong reputation with long and successful record in real estate development. 	<ul style="list-style-type: none"> Developer is experienced in management and of high quality, and has strong reputation with good record in real estate development. 	<ul style="list-style-type: none"> Developer has moderate management experience and quality. Track record in similar real estate development does not have much appeal. 	<ul style="list-style-type: none"> Developer has inadequate management experience and quality. Track record in the development of similar projects is poor.
	Relationship between developer and real estate actors	<ul style="list-style-type: none"> Strong relationship with leading actors such as leasing agents. 	<ul style="list-style-type: none"> Ordinary relationship with leading actors such as leasing agent. 	<ul style="list-style-type: none"> Adequate relationship with leasing agents and other parties providing important real estate services. 	<ul style="list-style-type: none"> Poor relationship with leasing agents and other parties providing important real estate services.
Debt security	Nature of lien	<ul style="list-style-type: none"> First lien⁶⁸ 	<ul style="list-style-type: none"> First lien 	<ul style="list-style-type: none"> First lien 	<ul style="list-style-type: none"> Ability of lender to foreclose is constrained.

⁶⁸ Bank loans on the market include junior liens. Junior liens may be indicative of the level of risk and occur if the amount of first lien does not exceed the total loan.

	Item	Strong	Good	Satisfactory	Weak
	Assignment of rents (projects with long-term lease)	<ul style="list-style-type: none"> The lender has obtained rent assignment and maintains copies of current lease and rent details where such information would facilitate collection of rent directly from tenants by the lender if necessary. 	<ul style="list-style-type: none"> The lender has obtained rent assignment and maintains copies of current lease and rent details where such information would facilitate collection of rent directly from tenants by the lender if necessary. 	<ul style="list-style-type: none"> The lender has obtained rent assignment and maintains copies of current lease and rent details where such information would facilitate collection of rent directly from tenants by the lender if necessary. 	<ul style="list-style-type: none"> The lender has not obtained rent assignment and does not maintain copies of current lease and rent details where such information would facilitate collection of rent directly from tenants by the lender where necessary.
	Quality of insurance coverage	<ul style="list-style-type: none"> Appropriate 	<ul style="list-style-type: none"> Appropriate 	<ul style="list-style-type: none"> Appropriate 	<ul style="list-style-type: none"> Substandard

Table 3 - Rating Grades for Object Finance Exposures

	Item	Strong	Good	Satisfactory	Weak
Financial strength	Market environment	<ul style="list-style-type: none"> • Demand is strong and growing. • High entry barrier. • Low sensitivity to changes in technology and economic outlook. 	<ul style="list-style-type: none"> • Demand is strong and stable. • Some entry barrier. • Some sensitivity to changes in technology and economic outlook. 	<ul style="list-style-type: none"> • Demand is moderate and stable. • Limited entry barrier. • High sensitivity to changes in technology and economic outlook. 	<ul style="list-style-type: none"> • Demand is weak and declining. • Very high sensitivity to changes in technology and economic outlook.
	Financial ratios (debt service coverage ratio (DSCR) and loan to value ratio (LTV))	<ul style="list-style-type: none"> • Strong financial ratios in association with the level of project risk; very reasonable economic assumptions. 	<ul style="list-style-type: none"> • Strong to acceptable financial ratios in association with the level of project risk; reasonable economic assumptions. 	<ul style="list-style-type: none"> • Standard (average) financial ratios in association with the level of project risk. 	<ul style="list-style-type: none"> • Highly leveraged financial ratios in association with the level of project risk.

	Item	Strong	Good	Satisfactory	Weak
	Stress analysis	<ul style="list-style-type: none"> Income is long-term and stable. The project can fulfill its financial commitments and obligations even under severely stressed economic conditions. 	<ul style="list-style-type: none"> Income is short-term and stable. The project can fulfill its financial commitments and obligations under normal economic conditions. The project is likely to default only under severely stressed economic conditions. 	<ul style="list-style-type: none"> Income is short-term and unstable. The project is vulnerable to the stress conditions in an economic cycle, and might default in normal economic downturn. 	<ul style="list-style-type: none"> Income is very unstable. The project is likely to default unless the economic conditions improve soon.
	Market liquidity	<ul style="list-style-type: none"> Global market. Highly liquid assets. 	<ul style="list-style-type: none"> Regional market. Relatively liquid assets. 	<ul style="list-style-type: none"> Regional market. Low liquidity. 	<ul style="list-style-type: none"> Regional market. Low liquidity or no niche markets.
Political and legal environment	Political risk (transfer risk)	<ul style="list-style-type: none"> Very low. 	<ul style="list-style-type: none"> Low. 	<ul style="list-style-type: none"> Moderate. 	<ul style="list-style-type: none"> High.
	Legal risk	<ul style="list-style-type: none"> Favorable legal environment. 	<ul style="list-style-type: none"> Favorable legal environment. 	<ul style="list-style-type: none"> Generally favorable legal environment. 	<ul style="list-style-type: none"> Poor legal environment.
Transaction characteristics	Financial structure Financing term compared to the useful life of asset	<ul style="list-style-type: none"> Full payout upon at expiration, no balloon and no grace period. 	<ul style="list-style-type: none"> Substantial balloon but acceptable. 	<ul style="list-style-type: none"> Significant balloon and potentially grace period. 	<ul style="list-style-type: none"> Small repayment with high balloon.

	Item	Strong	Good	Satisfactory	Weak
Operating risk	Permits / licensing	<ul style="list-style-type: none"> • All permits have been obtained. 	<ul style="list-style-type: none"> • Some permits are in the process of negotiation, but acceptance is relatively high. 	<ul style="list-style-type: none"> • Some permits are in the process of negotiation, but will be processed according to rules. 	<ul style="list-style-type: none"> • Important permits have not been obtained and highly uncertain in the futures, and there are other important conditions attached.
	Scope and nature of O&M contracts	<ul style="list-style-type: none"> • Strong long-term O&M contract. • Preferably with contractual performance incentives and O&M reserve account. 	<ul style="list-style-type: none"> • Long-term O&M contracts and/or O&M reserve account. 	<ul style="list-style-type: none"> • Limited O&M contract. • O&M reserve account. 	<ul style="list-style-type: none"> • No O&M contract. • High risk of O&M cost overrun.
	Operator's financial strength, track record of asset management, and capability of re-market the assets at the expiration of lease	<ul style="list-style-type: none"> • Excellent management experience. • Strong re-marketing capability. 	<ul style="list-style-type: none"> • Good management experience. • Good re-marketing capability . 	<ul style="list-style-type: none"> • Relatively weak management experience. • Uncertain re-marketing capability. 	<ul style="list-style-type: none"> • No or unknown management experience. • No re-marketing capability.

	Item	Strong	Good	Satisfactory	Weak
	Performance, size, design and maintenance as compared to other assets on the market	<ul style="list-style-type: none"> Strong advantage in design and maintenance; performance is standard and the asset has high market liquidity. 	<ul style="list-style-type: none"> Above average design and maintenance; standard performance with only a few exceptions and asset has high market liquidity. 	<ul style="list-style-type: none"> Average design and maintenance; performance is somewhat specific, and market is narrow. 	<ul style="list-style-type: none"> Below average design and maintenance; asset is near the end of useful life; performance is very specific, and market is very narrow.
	Market value	<ul style="list-style-type: none"> Current market value is well above the debt value. 	<ul style="list-style-type: none"> Current market value is above debt value. 	<ul style="list-style-type: none"> Current market value is slightly above debt value. 	<ul style="list-style-type: none"> Current market value is below debt value.
	Sensitivity of asset value and liquidity to economic cycles	<ul style="list-style-type: none"> Insensitive 	<ul style="list-style-type: none"> Sensitive. 	<ul style="list-style-type: none"> Quite sensitive. 	<ul style="list-style-type: none"> Highly sensitive.
	Operator's financial strength, track record in asset management, and leasing/marketing capability	<ul style="list-style-type: none"> Excellent track record in asset management and strong leasing/marketing capability. 	<ul style="list-style-type: none"> Good track record in asset management and good leasing/marketing capability. 	<ul style="list-style-type: none"> No or short track record in asset management and leasing / marketing capability uncertain. 	<ul style="list-style-type: none"> No or unknown track record in asset management and no leasing/marketing capability .
Sponsor's strength	Sponsor's track record and financial strength	<ul style="list-style-type: none"> Sponsor with excellent track record and financial standing. 	<ul style="list-style-type: none"> Sponsor with good track record and financial standing. 	<ul style="list-style-type: none"> Sponsor with adequate track record and financial standing. 	<ul style="list-style-type: none"> Sponsor with no or poor track record and poor financial standing.
	Asset control	<ul style="list-style-type: none"> Effective. 	<ul style="list-style-type: none"> Effective. 	<ul style="list-style-type: none"> Acceptable. 	<ul style="list-style-type: none"> None or poor.

	Item	Strong	Good	Satisfactory	Weak
Debt security	Rights and means of the lender to monitor the location and condition of the asset	<ul style="list-style-type: none"> • Lender is able to monitor the location and current condition of the asset at any time. 	<ul style="list-style-type: none"> • Lender is able to monitor the location and current condition of the asset at most of the time. 	<ul style="list-style-type: none"> • Lender is able to monitor the location and current condition of the asset at most of the time. 	<ul style="list-style-type: none"> • Lender's ability to monitor the location and current condition of the asset is limited.
	Insurance against damages	<ul style="list-style-type: none"> • Full insurance coverage (including collateral damages). • Insurance underwritten by top quality insurers. 	<ul style="list-style-type: none"> • Adequate insurance coverage (not including collateral damages). • Insurance underwritten by insurers of good quality. 	<ul style="list-style-type: none"> • Fair insurance coverage (not including collateral damages). • Insurance underwritten by insurers of acceptable quality. 	<ul style="list-style-type: none"> • Inadequate insurance coverage (no collateral damages). • Insurance underwritten by insurers of poor quality.

Table 4 - Rating Grades for Commodities Finance Exposures

	Item	Strong	Good	Satisfactory	Weak
Financial strength	Degree of over-collateralization of trade	<ul style="list-style-type: none"> • Strong 	<ul style="list-style-type: none"> • Good 	<ul style="list-style-type: none"> • Acceptable 	<ul style="list-style-type: none"> • None or weak
Political and legal environment	Country risk	<ul style="list-style-type: none"> • No country risk 	<ul style="list-style-type: none"> • Limited country risk (in particular offshore location in an emerging country) 	<ul style="list-style-type: none"> • High country risk (in particular offshore location in an emerging country) 	<ul style="list-style-type: none"> • Strong country risk (in particular inland area in an emerging country)
	Mitigation of country risk	<ul style="list-style-type: none"> • Very full mitigation. • Full offshore hedging instrument. • Strategic commodity. • Buyer with first-class credit standing. 	<ul style="list-style-type: none"> • Full mitigation. • Full offshore hedging instrument. • Strategic commodity. • Buyer with good credit standing. 	<ul style="list-style-type: none"> • Acceptable mitigation. • Acceptable offshore hedging instrument. • Somewhat strategic commodity. • Buyer with acceptable credit standing. 	<ul style="list-style-type: none"> • Only partial mitigation. • Lack of offshore hedging instrument. • Non-strategic commodity. • Buyer with poor credit standing.
Asset characteristics	Market liquidity and susceptibility to damage	<ul style="list-style-type: none"> • Commodity is quoted and can be hedged through futures or OTC trade. 	<ul style="list-style-type: none"> • Commodity is quoted and can be hedged through futures or OTC trade. 	<ul style="list-style-type: none"> • Commodity is not publicly traded but liquid. • Uncertain hedging possibility. 	<ul style="list-style-type: none"> • Commodity is not publicly traded. • Liquidity is limited under existing market scale. • No appropriate hedging instrument.

	Item	Strong	Good	Satisfactory	Weak
		<ul style="list-style-type: none"> Commodity is not susceptible to damage. 	<ul style="list-style-type: none"> Commodity is not susceptible to damage. 	<ul style="list-style-type: none"> Commodity is not susceptible to damage. 	<ul style="list-style-type: none"> Commodity is quite susceptible to damage.
Strength of investor	Financial strength of trader	<ul style="list-style-type: none"> Very strong relative to trading philosophy and risk. 	<ul style="list-style-type: none"> Strong 	<ul style="list-style-type: none"> Moderate 	<ul style="list-style-type: none"> Weak
	Track record, including management capability	<ul style="list-style-type: none"> Extensive experience in handling all kinds of deals. Strong record of operating success and cost efficiency 	<ul style="list-style-type: none"> Sufficient experience in handling all kinds of deals. Above average record of operating success and cost efficiency. 	<ul style="list-style-type: none"> Limited experience in handling all kinds of deals. Average record of operating success and cost efficiency. 	<ul style="list-style-type: none"> Limited or uncertain experience in handling all kinds of deals. Unstable costs and income.
	Trading control and hedging policies	<ul style="list-style-type: none"> Strong standards for counterparty selection, hedging and monitoring. 	<ul style="list-style-type: none"> Adequate standards for counterparty selection, hedging and monitoring. 	<ul style="list-style-type: none"> Past deals have experienced no or minor problems. 	<ul style="list-style-type: none"> Trader has experienced huge losses in past deals.
	Quality of financial disclosure	<ul style="list-style-type: none"> Excellent 	<ul style="list-style-type: none"> Good 	<ul style="list-style-type: none"> Fair 	<ul style="list-style-type: none"> Uncertain or inadequate

	Item	Strong	Good	Satisfactory	Weak
Debt security	Asset control	<ul style="list-style-type: none"> • If necessary, the first security interest ensures lender's right to carry out forced liquidation at any time. 	<ul style="list-style-type: none"> • If necessary, the first security interest ensures lender's right to carry out forced liquidation at any time. 	<ul style="list-style-type: none"> • At some point in the liquidation process, there is deficiency in lender's control of the asset. • The deficiency can be mitigated by knowledge of the trading process or a third party undertaking. 	<ul style="list-style-type: none"> • The contract leads to the risk of losing control over the assets. • Recovery capability is thereby damaged.
	Insurance against damages	<ul style="list-style-type: none"> • Full insurance coverage (including collateral damages). • Insurance underwritten by top quality insurers. 	<ul style="list-style-type: none"> • Adequate insurance coverage (not including collateral damages). • Insurance underwritten by insurers of good quality. 	<ul style="list-style-type: none"> • Fair insurance coverage (not including collateral damages). • Insurance underwritten by insurers of acceptable quality. 	<ul style="list-style-type: none"> • Inadequate insurance coverage (no collateral damages). • Insurance underwritten by insurers of poor quality.

Annex 3 Capital Charge for Counterparty Credit Risk

Banks may use Current Exposure Method (CEM), Standardized Method, or Internal Model Method (IMM) for measuring counterparty credit risk (CCR). Banks that adopt standardized method or internal model method must acquire the approval of the supervisory authority.

A. Definitions

1. Counterparty credit risk (CCR)

Counterparty credit risk (CCR) is the risk that the counterparty to a transaction could default before the final settlement of the transaction. An economic loss would occur if the transactions or portfolio of transactions with the counterparty has a positive economic value at the time of default. Unlike a firm's exposure to credit risk through a loan, where the exposure to credit risk is unilateral and only the lending bank faces the risk of loss, CCR creates a bilateral risk of loss: the market value of the transaction can be positive or negative to either counterparty to the transaction, thereby creating bilateral credit risk.

2. Transaction types

(1) Securities financing transactions

Securities financing transactions are transactions such as repurchase agreements (RP), reverse repurchase agreements (RS), security lending and borrowing, and margin lending transactions, where the value of the transactions depends on market valuations and the transactions are often subject to margin agreements.

(2) Margin lending transactions

Margin lending transactions are transactions in which a bank extends credit in connection with the purchase, sale, carrying or trading of securities, which do not include other loans secured by securities collateral. Generally, in margin lending transactions, the loan amount is collateralized by securities whose value is greater than the amount of the loan.

3. Netting sets, hedging sets, and related terms

(1) Netting set

Netting Set is a group of transactions with a single counterparty that are subject to a legally enforceable bilateral netting arrangement and such netting arrangement conforms to the rules for cross-product netting, bilateral netting agreement set forth in this Annex, or the netting rules for credit risk mitigants under the standardized approach to credit risk. Transactions that are not subject to any of the legally enforceable netting arrangement as described above are recognized as netted transactions and measure counterparty credit risk for regulatory

capital purposes according to the rules.

(2) Risk position

Risk Position is a risk number that is assigned to a transaction under the CCR standardized method (set out in this Annex) using a regulatory algorithm.

(3) Payment leg

Payment leg refers to the cash flow payment agreed by the parties in an OTC derivative transaction. For example, in a forward bond transaction, a party will pay cash in exchange of a bond on a specific date in the future. This payment on a specific date in the future is referred to as the payment leg. Transactions that stipulate the exchange of payment against payment, such as an interest rate swap or a foreign exchange forward, consist of two payment legs. Payment legs are calculated in the following manner:

- a. The payment legs consist of the contractually agreed gross payments, hence including the notional amount of the transaction. Banks may disregard the interest rate risk from payment legs with a remaining maturity of less than one year from the following calculations.
- b. Banks may exclude interest rate risk from payment legs with remaining maturity of less than one year.
- c. Transactions with equity, gold, other commodities as the underlying should be mapped to a risk position in the respective hedging set of equity, gold or commodity. The payment leg of these transactions is mapped to an interest rate risk position within the appropriate interest rate hedging set. If the payment leg is denominated in a foreign currency, the transaction is also mapped to a foreign exchange risk position in the respective currency.
- d. Transactions with linear risk profiles that have a debt instrument (e.g. a bond or a loan) as the underlying instrument are mapped to an interest rate risk positions with one risk position for the debt instrument and another risk position for the payment leg.
Transactions with agreement to exchange payment against payment are mapped to an interest rate risk position for each of the payment legs. If the underlying debt instrument is denominated in a foreign currency, the debt instrument is mapped to a foreign exchange risk position in the respective currency.
- e. The CCR exposure or EAD in respect to a foreign exchange basis swap transaction is zero.

(4) Hedging set

Hedging set is a group of risk positions from the transactions within a single netting set for which only their balance after long-short offset is used for determining the counterparty exposure amount or exposure-at-default (EAD) under the CCR standardized method.

(5) Margin agreement

Margin Agreement is a contractual agreement or provisions to an agreement under which one counterparty must supply collateral to a second counterparty when an exposure of that second counterparty to the first counterparty exceeds a specified level.

(6) Margin threshold

Margin threshold is the largest amount of an exposure that does not require additional margin under the margin agreement.

(7) Margin period of risk

Margin period of risk is the time period from the last exchange of collateral covering a netting set of transactions the bank has with a defaulting counterparty until that counterparty is closed out and the resulting market risk is re-hedged.

(8) Effective maturity under the Internal Model Method

Effective maturity under the Internal Model Method for a netting set with maturity greater than one year is the ratio calculated by the method as follows: a. the numerator is the sum of expected exposure over the life of the transactions in a netting set discounted at the risk-free rate of return; b. the denominator is the sum of expected exposure over one year in a netting set discounted at the risk free rate. Banks may use the “effective expected exposure under one year” to replace the “expected exposure” in the calculation of effective maturity to reflect the rollover risk. The formula for effective maturity under the Internal Model Method is given in this Annex.

(9) Cross-product netting

Cross-product netting refers to the inclusion of transactions of different product categories within the same netting set pursuant to the Cross-Product Netting Rules set out in this Annex.

(10) Current market value (CMV)

Current market value (CMV) refers to the net market value of the portfolio of transactions within the netting set which is the result of positive and negative market values offsetting against each other.

4. Distributions

(1) Distribution of market values)

Distribution of market values is the forecast of the probability distribution of net market values of transactions within a netting set for some future date given the realized market value of those transactions up to the present time.

(2) Distribution of exposures

Distribution of exposures is the forecast of the probability distribution of future market values that is generated by setting forecast instances of negative net market values as zero⁶⁹.

(3) Risk-neutral distribution

Risk-neutral distribution is a distribution of market values or exposures at a future time period where the distribution is calculated using market implied values (e.g. implied volatility).

(4) Actual distribution

Actual distribution is a distribution of market values or exposures at a future time period where the distribution is calculated using historic or realized values (e.g. volatilities calculated using past price or rate changes).

5. Exposure measures and adjustments

(1) Current exposure

Often called replacement cost, current exposure is positive market value of all transactions within a netting set; the current exposure is zero when market value is negative.

(2) Peak exposure

Peak exposure is a high percentile (typically 95% or 99%) of the distribution of exposures at any particular future date before the maturity date of the longest transaction in the netting set. A peak exposure value is typically generated after repeating the calculation for many future dates up until the longest maturity date of transactions in the netting set.

(3) Expected exposure

Expected exposure is the average of the distribution of exposures at any particular future date before the longest-maturity transaction in the netting set matures. An expected exposure value is typically generated after repeating the calculation for many future dates up until the longest maturity date of transactions in the netting set.

(4) Effective expected exposure

Effective expected exposure at a specific date is the maximum expected exposure that occurs on that date or any prior date. In other words, it is defined as the greater of the expected exposure at the specific date, or the effective exposure at a previous date. Therefore, the effective expected exposure increases or at least stays unchanged over time.

(5) Expected positive exposure (EPE)

⁶⁹ This setting method means the bank does not have an exposure to the counterparty when the bank has net liability against the counterparty.

Expected positive exposure (EPE) is the weighted average over time of expected exposures where the weights are the proportion that an individual expected exposure represents of the entire time interval. When calculating the minimum capital requirement, the weighted average in the first year is taken, or, if all the contracts in the netting set mature in one year, the weighted average expected exposures of the longest-maturity contract in the netting set is taken.

(6) Effective expected positive exposure; effective EPE

Effective expected positive exposure (effective EPE) is the weighted average over time of effective expected exposures where the weights are the proportion that an individual expected exposure represents of the entire time interval. When calculating the minimum capital requirement, the weighted average in the first year is taken, or, if all the contracts in the netting set mature in one year, the weighted average expected exposures of the longest-maturity contract in the netting set is taken.

(7) Credit valuation adjustment

Credit valuation adjustment is an adjustment to the market valuation of the portfolio of trades with a counterparty. This adjustment reflects the market value of the credit risk due to any failure to perform on contractual agreements with a counterparty. This adjustment may reflect the market value of the credit risk of the counterparty or the market value of the credit risk of both the bank and the counterparty.

(8) One-sided credit valuation adjustment

One-sided credit valuation adjustment is a credit valuation adjustment that reflects the market value of the credit risk of the counterparty to the bank, but does not reflect the market value of the credit risk of the bank to the counterparty.

6. CCR-related risks

(1) Rollover risk

Rollover risk is the amount by which expected positive exposure (EPE) is underestimated when future transactions with a counterpart are expected to be conducted on an ongoing basis, but the additional exposure generated by those future transactions is not included in calculation of EPE.

(2) General wrong-way risk

General wrong-way risk arises when the probability of default of counterparties is positively correlated with general market risk factors.

(3) Specific wrong-way risk

Specific wrong-way risk arises when the exposure to a particular counterpart is positively correlated with the probability of default of the counterpart due to the nature of the transactions with the counterpart.

B. Scope of application

1. Banks may calculate CCR exposure or EAD according to the rules for calculating netting set exposure or EAD provided in the Current Exposure Method, Standardized Method or Internal Model Method set out herein. The Current Exposure Method and the Standardized Method are applicable to OTC derivatives only, while the Internal Model Method is applicable to securities financing transactions and OTC derivative transactions.
2. When a bank purchases credit derivative protection against a banking book exposure, or against a counterparty credit risk exposure, it will determine its capital requirement for the hedged exposure subject to the criteria and general rules for the recognition of credit derivatives, including the adoption of risk weight substitution or recognizing double default rules. Where these rules apply to the capital charge for credit derivatives, the exposure amount or EAD for counterparty credit risk from such instruments is zero.
3. For sold credit default swaps in the banking book, the exposure amount or EAD for counterparty credit risk is zero where they are treated as a guarantee provided by the bank and subject to a credit risk charge for the full notional amount.

C. Cross-product netting rules

1. These cross-product netting rules apply specifically to netting across securities financing transactions or OTC derivatives. If only netting within a commodity category is involved, the respective applicable rules shall apply.
2. Banks that have been approved by the supervisory authority to apply Internal Model Method (IMM) to calculating CCR exposure and meet the following legal and operational criteria for a cross-product netting arrangement may include cross-product transactions of a single counterparty in a netting set, subject to the approval of the supervisory authority.
3. Legal criteria for cross-product netting:
 - (1) The bank has executed a written, bilateral netting agreement (cross-product netting arrangement) with the counterparty which stipulates that in the event that the counterparty fails to perform due to default, bankruptcy, liquidation or similar circumstances, a single

legal obligation covering all applicable agreements and transactions included in the netting arrangement will be created, such that the bank would have either a claim to receive or obligation to pay only the net sum of the positive and negative closeout values or the market values of all included individual transactions.

- (2) The bank has a written legal opinions concluding that, in the event of a legal dispute, relevant courts or administrative authorities would find the bank's exposure under the cross-product netting arrangement to be the cross-product net amount under the laws of relevant jurisdictions. Thus the legal opinions must address the validity and enforceability of the entire cross-product netting arrangement under its terms and all legal issues that may arise from the netting arrangement.
- (3) The laws of relevant jurisdictions include:
 - a. the law of the jurisdiction in which the counterparty is chartered and, if the foreign branch of a counterparty is involved, then also under the law of the jurisdiction in which the branch is located;
 - b. the law that governs the individual transactions, and
 - c. the law that governs any netting related contract or agreement.
- (4) The bank has internal procedures to verify that, prior to including a transaction in a netting set, the transaction is covered by legal opinions that meet the above criteria.
- (5) The bank update legal opinions in a timely manner to ensure continuing enforceability of the cross-product netting arrangement in light of possible changes in relevant law.
- (6) The cross-product netting arrangement does not include a walkaway clause. That is, the arrangement does not permit a non-defaulting counterparty to make only limited payments, or no payment at all, to the defaulter with net claim.
- (7) All agreements and transactions covered by the cross-product netting arrangement must meet the counterparty credit risk mitigation rules under the bilateral netting agreement or the risk mitigation rules under the standardized approach to credit risk.
- (8) The bank maintains all required documentation in its files to evidence compliance with the netting rules.

4. Operational criteria for cross-product netting:

- (1) Banks must factor the impact of cross-product netting arrangement into the bank's measurement and management of a counterparty's aggregate credit risk exposure.
- (2) Banks must factor counterparty exposure obtained after cross-product netting into factored into credit limit management and economic capital assessment system.

D. Current Exposure Method

1. Current Exposure Method may only be adopted for measuring CCR exposure of OTC derivatives; the securities finance transactions are subject to the treatment of Internal Model Method set out in this Annex for CCR exposures or the comprehensive approach for risk mitigation under the standardized approach to credit risk for risk-mitigated exposures.
2. The steps of Current Exposure Method are as follows:
 - (1) Credit equivalent amount is the total of current exposure plus potential future exposure.
 - (2) The risk mitigated exposure is the credit equivalent adjusted by the simplified approach or comprehensive approach for risk mitigation effect under the standardized approach to credit risk.
 - (3) Risk-weighted asset is equal to risk-mitigated exposure multiplied by counterparty risk weight⁷⁰.
3. Calculation of current exposure: The replacement cost⁷¹ of a credit derivative contract is assessed by its market value; if the replacement cost is positive, it will be the "current exposure"; if the replacement cost is negative, the "current exposure" is zero.
4. Calculation of potential future exposure:
 - (1) For credit derivatives in the trading book, the potential future exposures are calculated based on the notional amounts of the credit derivatives and the add-on factors illustrated in the table below:

	Protection buyer	Protection provider
Total return swap		
"Qualifying" reference obligation	5%	5%
"Non-qualifying" reference obligation	10%	10%

⁷⁰ Banking book and trading book should use the same risk weight determination method (standardized approach or IRB approach). If the counterparty is a SME, the SME size-adjustment formula under the IRB approach may apply.

⁷¹ "Replacement cost" is the profit/loss of a credit derivative after assessment based on market value; positive replacement cost means profit; negative replacement cost means loss.

Credit default swap		
“Qualifying” reference obligation	5%	5%
“Non-qualifying” reference obligation	10%	10%
		(See note 3)

- Notes: 1. The add-on factors in this table are the same for credit derivatives with different residual maturities.
2. The term “qualifying” in this table is defined the same as that for the “qualifying” category for the treatment of specific risk under the standardized approach for market risk.
3. The protection provider (protection seller) of a credit default swap shall only be subject to the add-on factor where it is subject to closeout upon the insolvency of the protection buyer while the underlying is still solvent. Add-on should then be capped to the amount of unpaid premiums.
4. Where the credit derivative is a first to default transaction, the add-on will be determined by the lowest credit quality underlying in the basket, i.e. if there are any nonqualifying items in the basket, the non-qualifying reference obligation add-on should be used. For second and subsequent to default transactions, underlying assets should continue to be allocated according to the credit quality, i.e. the second lowest credit quality will determine the add-on for a second to default transaction etc.

(2) The potential future exposures for derivatives related to interest rate, foreign exchange, equity or commodity in the banking book and trading book are calculated based on the notional amount of the contract multiplied by the add-on factor for respective residual maturity of the contract as depicted in the table below:

Residual term to maturity of contract (residual maturity)	Interest rate	FX Gold	Equity securities	Precious metal except gold	Other commodities
One year or less	0.0%	1.0%	6.0%	7.0%	10.0%
Over one year to five years	0.5%	5.0%	8.0%	7.0%	12.0%
Over five years	1.5%	7.5%	10.0%	8.0%	15.0%

- Notes: 1. Forward contracts, swaps, call options and other like-kind derivatives not related to interest rate, foreign exchange, gold, equity or other precious metal use the add-on factor under the “other commodities” category in the table.

2. A floating to floating interest rate swap involving a single currency only needs to calculate current exposure whereas potential future currency is not required.
3. The calculation of potential future exposure should be based on actual amount instead of the notional amount in form. If the notional amount of the contract produces leverage effect or is increased, the calculation of potential future exposure should use the amount used in the calculation of actual profit/loss.

(3) Credit risk mitigation rules for the bilateral netting arrangement of derivatives

Banks that have executed a bilateral netting agreement with the counterparty may measure CCR exposure by the net exposure. In the case of payments netting for reduce the costs and operational risk in the liquidation process, which does not change the legal payment obligations of the parties, the risk mitigation effect may not be recognized.

- a. Under the following circumstances, a bank may calculate the credit equivalent using the net exposure to the same counterparty:
 - (i) The bank has executed a substitution agreement with the counterparty which allows the bank and the counterparty to combine their obligation to pay specific currency on a specific valuation date with other obligations having the same valuation date and the same currency, and hence create a single legal obligation in place of the original gross debt obligation.
 - (ii) The bank has executed a legally valid bilateral netting agreement other than the agreement mentioned above with the counterparty, including other forms of substitution agreement.
 - (iii) The netting agreement must meet the following criteria for the bank to apply net exposure to the calculation of credit equivalent:
 - The bank has executed a agreement with the counterparty which stipulates that in the event that the counterparty fails to perform due to default, bankruptcy, liquidation or similar circumstances, the bank would have either a claim to receive or obligation to pay only the net sum of the positive and negative closeout values or the market values of all included individual transactions.
 - The bank must have a written legal opinions on the enforceability of the bilateral netting agreement under the laws of the relevant jurisdiction provided by an independent external professional. The legal opinion shall analyze whether, in the event of a legal dispute, relevant courts or administrative authorities would recognize the bank's net exposure under the following laws. If there is any doubt about the validity and enforceability of the netting arrangement under the laws of relevant jurisdictions, the bank may not use net exposure for the calculation of credit

equivalent.

- the law of the jurisdiction in which the counterparty is chartered and, if the foreign branch of a counterparty is involved, then also under the law of the jurisdiction in which the branch is located.
- the law that governs the individual transactions.
- the law that governs any netting related contract or agreement.

■ The bank must establish an appropriate procedure to review the continuing enforceability of the netting agreement in light of possible changes in relevant law.

■ The bank must maintain complete documentation, including a copy of the bilateral netting agreement and the legal opinions to facilitate the perusal or examination by the FSC.

The netting arrangement must not include a walkaway clause. That is, the arrangement does not permit a non-defaulting counterparty to make only limited payments, or no payment at all, to the defaulter with net claim.

- b. For derivative contracts that meet the bilateral netting rules described above, their credit equivalent is the net replacement cost assessed by market value (only positive value is taken) plus the “potential future exposure” calculated based on the notional amount of the contract. The potential future exposure (A_{Net}) is calculated as follows:

$$A_{\text{net}} (\text{potential future exposure}) = 0.4 \times A_{\text{gross}} + 0.6 \times \text{NGR} \times A_{\text{gross}}$$

A_{gross} = the total of potential future exposures of all transactions included in the bilateral netting agreement entered with a counterparty.

NGR = Net replacement cost / total of gross replacement cost of all transactions included in the bilateral netting agreement.

c. Examples

Transaction	Counterparty A		Counterparty B		Counterparty C	
	Replacement cost	Potential future exposure	Replacement cost	Potential future exposure	Replacement cost	Potential future exposure
Interest rate swap	10	0.5	8	0.75	-3	0.45
Interest rate forward agreement	-5	5	2	2.5	1	1.5
Gross replacement cost (GR)	10		10		1	

Net replacement cost (NR)	5	10	0
NGR (individual counterparty approach)	5 / 10 = 0.5	10 / 10 = 1	0 / 1 = 0
NGR (summation approach)	(5+10+0) / (10+10+1)=15 / 21 = 0.71		

For counterparty A:

(i) Credit equivalent before mitigation = $(10 + 0.5) + (0 + 5) = 15.5$

(ii) Credit equivalent after mitigation = current exposure + potential future exposure
= Total of positive replacement costs + $(0.4 \times A_{\text{gross}} + 0.6 \times \text{NGR} \times A_{\text{gross}})$
= $[10 + (-5)] + [0.4 \times (0.5 + 5) + 0.6 \times 0.71 \times (0.5 + 5)]$
= $5 + 4.543 = 9.543$

5. If the bank's OTC derivatives are collateralized, applicable requirements on credit risk mitigation techniques under the standardized approach to credit risk shall apply to the recognition of eligible collateral and risk mitigation effect.

E. Standardized Method

1. The standardized method can be used only for OTC derivatives. Securities finance transactions (SFTs) are subject to the treatments set out under the Internal Model Method of this Annex or the comprehensive approach for risk mitigation under the standardized approach to credit risk for risk-mitigated exposures. A bank must have the approval of the supervisory authority before adopting standardized method for assessing the exposure amount or exposure at default (EAD). Banks that use either IRB approach or standardized approach to credit risk may apply for the use of standardized method for calculating counterparty credit risk exposure.
2. The CCR exposure under the standardized method is calculated as follows:

$$\text{Exposure amount or EAD} = \beta \times \max \left(CMV - CMC, \sum_j \left| \sum_i RPT_{ij} - \sum_l RPC_{lj} \right| \times CCF_j \right)$$

where

CMV : current market value of the portfolio of transactions within the netting set with a counterparty gross of collateral. $CMV = \sum_i CMV_i$, where CMV_i is the current market value of transaction i ;

CMC : current market value of the collateral assigned to the netting set. $CMC = \sum_l CMC_l$,

where CMC_l is the current market value of collateral l .

i : transaction i ;

l : collateral l ;

j : hedging set j . These hedging sets correspond to supervisory risk weights, where risk positions of opposite sign in the same hedging set can be offset to yield a net risk position on which the exposure measure is then based;

RPT_{ij} : risk position from transaction i with respect to hedging set j ⁷²;

RPC_{lj} : risk position from collateral l with respect to hedging set j ;

CCF_j : credit conversion factor with respect to the hedging set j ;

β : supervisory scaling factor.

When collateral is received from a counterparty, RPC_{lj} has a positive sign; when collateral is posted to a counterparty, RPC_{lj} has a negative sign. The provisions for eligible collateral as risk mitigant under the standardized approach to credit risk apply to the scope of collateral.

3. The formula for calculating risk position is as follows:

(1) For all financial instruments other than debt instruments, use effective notional value, or

delta equivalent notional value, i.e. risk position = $P_{ref} \frac{\partial V}{\partial P}$

where

P_{ref} : price of the underlying instrument, expressed in the domestic currency;

V : value of the financial instrument (in the case of an option: option price; in the case of a transaction with a linear risk profile: value of the underlying instrument itself multiplied by quantity);

P : price of the underlying instrument, expressed in the same currency as V .

(2) For debt instruments and the payment legs of all transactions: effective notional value, or delta equivalent in notional value multiplied by the modified duration, i.e. risk position =

$$\frac{\partial V}{\partial r}$$

where

r : interest rate level;

V : value of the financial instrument (in the case of an option: option price; in the case of a transaction with a linear risk profile: value of the underlying instrument itself or of the payment leg, respectively). If V is denominated in a currency other than the domestic currency, the derivative must be converted into the domestic currency by multiplication with the relevant exchange rate.

⁷² E.g. a short-term FX forward with one leg denominated in the bank's domestic currency will be mapped into three risk positions: 1. an FX risk position, 2. a foreign currency interest rate risk position, 3. a domestic currency risk position.

(3) The risk position of a credit default swap is the value of the debt instrument (V) multiplied by the residual term to maturity of the credit default swap (expressed in years).

4. Interest rate positions arising from low-risk debt instruments are to be mapped into one of six hedging sets for each represented currency:

Residual term to maturity or remaining time to the next repricing of floating rate	Sovereign rate as reference interest rate	Other rate as reference interest rate
Less or equal to one year	Hedging set A	Hedging set D
Over one year to five years	Hedging set B	Hedging set E
Longer than five years	Hedging set C	Hedging set F

(1) A “low-risk debt instrument” is an instrument subject to a 1.6% or lower capital charge under the specific interest rate risk in the standardized approach to market risk.

(2) Interest rate positions arising from the payment legs of low-risk debt instruments and money deposits received from the counterparty as collateral are to be treated as “low-risk debt instrument” and assigned to the same hedging sets as interest rate risk positions.

(3) For debt instruments or payment legs using floating rate as reference interest rate, the remaining time to the next repricing of floating interest rate should be the standard for hedging set categorization; for other debt instruments or payment legs, the residual term to maturity of the debt instrument or the remaining life of the transaction should be the standard for hedging set categorization.

5. For the reference debt instrument that underlies a credit default swap, there is one hedging set for each issuer.
6. There is one hedging set for each issuer of a high-risk debt instrument, i.e. debt instruments to which a capital charge of more than 1.60 percent applies. The same applies to the “payment legs” of the risk positions of high-risk debt instruments and money deposits that are posted with a counterparty as collateral. For example, when the “payment leg” of a total return swap emulates a high-risk debt instrument, there should be one hedging set for each issuer of the reference debt instrument. Risk positions of the same issuer can be assigned to the same hedging set, regardless whether it is from individual debt instrument, from reference debt instruments that are emulated by payment legs or from reference debt instruments that underlie a credit default swap.
7. Underlying financial instruments other than debt instruments, such as equities, precious metals,

or commodities, are assigned to the same respective hedging sets only if they are identical or similar instruments as determined in a manner below:

- (1) For equities, similar instruments are those of the same issuer. An equity index is treated as a separate issuer.
- (2) For precious metals, similar instruments are those of the same metal. A precious metal index is treated as a separate precious metal.
- (3) For commodities, similar instruments are those of the same commodity. A commodity index is treated as a separate commodity.
- (4) For electric power, similar instruments refer to those that can be delivered in the same peak or off-peak load time interval within any 24-hour interval.

8. The following rules apply to the credit conversion factor with respect to the hedging set category:

- (1) The credit conversion factors for foreign exchange and financial instruments other than debt instrument:

Exchange rates	Gold	Equity	Precious metals except gold	Electric power	Other commodities excluding precious metals
2.5%	5.0%	7.0%	8.5%	4%	10.0%

- (2) The credit conversion factors for risk position from debt instruments:
 - a. 0.6% for high-risk debt instrument.
 - b. 0.3% for a reference debt instrument that underlies a credit default swap and that is of low risk.
 - c. 0.2% for other debt instruments.
- (3) Underlying instruments of OTC derivatives that are not in any of the categories above are assigned to separate individual hedging sets for each category of underlying instrument and a credit conversion factor of 10%.
- (4) For transactions with a non-linear risk profile for which the bank cannot determine the delta with a model that the supervisor has approved (e.g. options model approved for the purposes of the standardized approach for market risk, or model approved for the internal modeling approach for market risk), the bank should use apply Current Exposure Method or apply to the supervisory authority for approval of applicable credit conversion factors or method used for determining credit conversion factors. Netting is not allowed for this type of transaction. That is, the exposure amount or EAD is to be determined as if there were a netting set that comprises just the individual transaction.

9. The supervisory scaling factor (β) in the formula for calculating exposure amount under the standardized method for counterparty credit risk is set at 1.4.
10. Banks must evaluate whether the estimation results of the Standardized Method properly measure the actual CCR exposures of the bank. If the Standardized Method does not capture the inherent risks of related transactions (e.g. structured or more complex OTC derivatives), the supervisory authority may require the bank to calculate the CCR charge on a transaction-by-transaction basis (i.e. not netting will be recognized) using the Standardized Method or the Current Exposure Method.

F. Internal Model Method

1. General

- (1) A bank that wishes to adopt Internal Model Method to measure exposure or EAD for regulatory capital purposes must seek approval from the supervisory authority. Banks that adopt either the internal ratings-based approach or the standardized approach to credit risk may apply for the use of Internal Model Method for measuring counterparty credit risk (CCR) exposure.
- (2) A bank may choose to adopt Internal Model Method to measure CCR exposures or EAD for regulatory capital purpose to only OTC derivatives, to only securities finance transactions (SFTs), or to both, subject to the compliance with the netting rules specified in this Annex. During the initial implementation of the Internal Model Method, a bank may use the Standardized Method or the Current Exposure Method for a portion of its assets. The bank must submit a plan to its supervisory authority to bring all material exposures for that category of transactions under the Internal Model Method.
- (3) Banks that have not received approval from the supervisory authority to use the Internal Model Method must use either the Standardized Method or the Current Model Method for all OTC derivative transactions and for all long settlement transactions.
- (4) After adoption of the Internal Model Method, the bank must comply with the relevant rules and requirements on a permanent basis. Only under exceptional circumstances can a bank revert to either the Current Exposure or Standardized Methods for all or part of its exposure, subject to the consent of the supervisory authority. The bank must demonstrate that reversion to a less sophisticated method does not lead to an arbitrage of the regulatory capital rules.
- (5) If a bank's exposure estimation or alpha calculated by the Internal Model Method is not sufficient to reflect its CCR exposure, the supervisory authority has the discretion to require

the bank to revise its estimate, use higher estimate of exposure amount or alpha, repeal the approval for Internal Model Method, or take other pertinent actions.

2. Measuring exposure amount or exposure-at-default (EAD)

- (1) CCR exposure or EAD is measured at the level of the netting set. A qualifying internal model for measuring counterparty credit exposure must specify the forecasting distribution for changes in the market value of the netting set attributable to changes in market variables (e.g. interest rates, foreign exchange rates). The model then computes the bank's CCR exposure for the netting set at each future date given the changes in the market variables. For counterparties that have paid margin, the model may also capture future collateral movements. Banks may include eligible financial collateral as defined according to the credit risk mitigation rules under the standardized approach to credit risk in their forecasting distributions for changes in the market value of the netting set, if the quantitative, qualitative and data requirements for internal model method are met for the collateral.
- (2) If a bank has recognized collateral in exposure amount or EAD via current exposure, the bank would not be permitted to recognize the benefits in its estimates of loss given default (LGD). As a result, the bank would be required to use an LGD of an otherwise similar uncollateralized facility.
- (3) Under the Internal Model Method, the bank need not employ a single model. Although this section describes an internal model as a simulation model, no particular form of model is required. Analytical models are acceptable so long as they meet all of the requirements set forth in this section and are applied to all material exposures subject to a CCR-related capital charge as noted above, with the exception of long settlement transactions.
- (4) Expected exposure or peak exposure measures should be calculated based on a distribution of exposures that accounts for the possible non-normality of the distribution of exposures, including the existence of leptokurtosis ("fat tails").
- (5) When using an internal model, exposure amount or EAD is calculated as specified below:
$$\text{EAD} = \alpha \times \text{weighted average of effective expected positive exposure (effective EPE)} \quad (1)$$
- (6) Weighted average of Effective EPE is estimated as follows:
 - a. First, estimate the expected exposure (EEt) at future date t , where the average is taken across possible future values of relevant market risk factors, such as interest rates and foreign

exchange rates. The internal model estimates EE at a series of future dates $t_1, t_2, t_3 \dots$ ⁷³.

b. Next, *Effective* EE_{tk} is computed recursively as follows:

$$\text{Effective } EE_{tk} = \max(\text{Effective } EE_{tk-1}, EE_{tk}) \quad (2)$$

Where, t_0 denotes the current date of exposure, *effective* EE_{t_0} is the current exposure.

c. The weighted average of “Effective EPE” is the average Effective EE during the first year of future exposure. If all contracts in the netting set mature in one year, EPE is the average of expected exposure until all contracts in the netting set mature. Effective EPE is computed as a weighted average of Effective EE as expressed below:

$$\text{Effective EPE} = \sum_{k=1}^{\min(1\text{年}, \text{到期日})} \text{Effective } EE_{tk} \times \Delta t_k \quad (3)$$

Where, weight $\Delta t_k = t_k - t_{k-1}$ allows for the case when future exposure is calculated at dates that are not equally spaced over time.

(7) Estimation of alpha

a. Alpha (α) is set at 1.4.

b. Supervisory authority has the discretion to require a higher alpha based on a bank’s CCR exposures. Factors that may require a higher alpha include the low granularity of counterparties; particularly high exposures to general wrong-way risk; particularly high correlation of market values across counterparties; and other institution-specific characteristics of CCR exposures.

c. Banks may seek approval from their supervisors to compute internal estimates of alpha subject to the following operating requirements:

(i) A floor of 1.2.

(ii) Alpha is equal to the following ratio:

- The numerator is the economic capital from a full simulation of counterparty exposure across counterparties;
- The denominator is the economic capital based on EPE.

⁷³ In theory, the expectations should be taken with respect to the actual probability distribution of future exposure and not the risk-neutral one. For practical considerations, it may be more feasible to use the risk-neutral one. As a result, the kind of forecasting distribution to employ is not specified.

- (iii) Banks must meet all the operating requirements for internal estimates of EPE and must demonstrate that their internal estimates of alpha capture in the numerator the material sources of stochastic dependency of distributions of market values of transactions or of portfolios of transactions across counterparties (e.g. the correlation of defaults across counterparties and between market risk and default).
- (iv) In the denominator, EPE must be used as if it were a fixed outstanding loan amount.
- d. Banks that estimate alpha on their own must ensure that the numerator and denominator of alpha are computed in a consistent fashion with respect to the modeling methodology, parameter specifications and portfolio composition. The approach used must be based on the bank's internal economic capital approach, be well-documented and be subject to independent validation. In addition, banks must review their estimates on at least a quarterly basis, and more frequently when the composition of the portfolio varies over time. Banks must assess the model risk.
- e. Volatilities and correlations of market risk factors used in the joint simulation of market and credit risk must consider the conditions of credit risk factor to reflect potential increases in volatility or correlation in an economic downturn. Internal estimates of alpha should take account of the granularity of exposures.

(8) Maturity

- a. If the original maturity of the longest-dated contract contained in the set is greater than one year, the formula for effective maturity (M) under the IRB approach to credit risk is replaced with the following:

$$M = \frac{\sum_{k=1}^{t_k \leq 1 \text{ 年}} \text{Effective} EE_k \times \Delta t_k \times df_k + \sum_{\substack{\text{到期日} \\ t_k > 1 \text{ 年}}} EE_k \times \Delta t_k \times df_k}{\sum_{k=1}^{t_k \leq 1 \text{ 年}} \text{Effective} EE_k \times \Delta t_k \times df_k}$$

where df_k is the risk-free discount factor for future time period tk and the remaining symbols are defined above. Similar to the treatment under corporate exposures, M has a cap of five years⁷⁴.

- b. For netting sets in which all contracts have an original maturity of less than one year, the estimation of effective maturity (M) and a floor of one year still follow the provisions for effective maturity under the IRB approach to credit risk⁷⁵.

⁷⁴ Conceptually, M equals the effective credit duration of the counterparty exposure. A bank that has been approved by the supervisory authority to use an internal model to calculate a one-sided credit valuation adjustment (CVA) can use the effective credit duration estimated by such a model in place of the above formula.

⁷⁵ Refer to Instructions for Calculating Bank's Equity Capital and Risk-Weighted Assets and Forms - Credit Risk, II - Internal Ratings-Based Approach to credit risk: E. Capital Charge for Risk-Weighted Assets: (A) Corporate Exposure:

3. Margin agreement

- (1) If the netting set is subject to a margin agreement and the internal model has considered the effects of margining when estimating EE, the model's EE measure may be used directly in equation (2).
- (2) A bank that can model EPE without margin agreements but cannot achieve the higher level of modeling sophistication to model EPE with margin agreements can use the following method for margined counterparty. The method is a simple and conservative approximation to Effective EPE and sets Effective EPE for a margined counterparty equal to the lesser of:
 - The positive threshold under the margin agreement plus an add-on that reflects the potential increase in exposure over the margin period of risk. The add-on is computed as the expected increase in the netting set's exposure beginning from current exposure of zero over the margin period of risk⁷⁶. If a netting set consists of repo-style transactions which are subject to daily remargining and daily mark-to-market, a floor of five business days for mark-to-market or repricing is imposed; for other netting sets, a ten business days on the margin period of risk is imposed;
 - Weighted average Effective EPE without a margin agreement.

4. Model validation

Banks that use EPE model or value-at-risk (VaR) model must meet the following requirements for model validation:

- (1) In principle, the qualitative standards of the Internal Models Approach for Market Risk for the use of VaR models should apply to EPE models. However, an EPE model has additional elements that require validation:
 - Interest rates, foreign exchange rates, equity prices, commodities, and other market risk factors must be forecast over a long period of time for measuring counterparty exposure. The performance of the forecasting model for market risk factors must be validated over a long period of time (in contrast, VaR for market risk is measured over a short period of time, typically one to ten days).
 - The pricing models used to calculate CCR exposure for a given scenario must be tested as part of the model validation process. These pricing models may be different from those used to calculate VaR. Pricing models for options must account for the nonlinearity of option value with respect to market risk factors.

4. Risk components: (4) Effective maturity.

⁷⁶ The add-on equals EE at the end of the margin period of risk assuming current exposure of zero. Since no transactions would be occurring as part of this EE calculation, there would be no difference between EE and Effective

- An EPE model must capture transaction-specific information in order to aggregate exposures at the level of the netting set. Banks must verify that transactions are assigned to the appropriate netting set within the model.
 - To capture the effects of margining, an EPE model must also include transaction-specific information on possible changes to the current amount of margin and margin that would be passed between counterparties. Such a model must account for the nature of margin agreements (unilateral or bilateral), the frequency of margin calls, the margin period of risk, the margin maintenance ratio the bank is willing to accept, and the minimum transfer amount. Such a model must either model the mark-to-market change in the value of collateral posted or apply the risk mitigation rules for collateral under the standardized approach to credit risk.
- (2) In the process of model validation, static, historical backtesting on representative counterparty portfolios must be carried out. A bank must conduct such backtesting on a number of representative counterparty portfolios (actual or hypothetical) at least once every three months. These representative portfolios must be chosen based on their sensitivity to the material risk factors and correlations to which the bank is exposed.
 - (3) Backtesting of an EPE model should starting at a particular historical date, using the internal model to forecast each portfolio's probability distribution of exposure at various time horizons. Using historical data on movements in market risk factors, backtesting then computes the actual exposures that would have occurred on each portfolio at each time horizon assuming no change in the portfolio's composition. These realized exposures would then be compared with the model's forecast distribution at various time horizons. The above must be repeated for several historical dates covering a wide range of market conditions (e.g. rising rates, falling rates, quiet markets, volatile markets). If significant differences between the realized exposures and the model's forecast distribution occur, it is indicative of a problem with the model or the underlying data. In such event, the supervisory authority would require the bank to correct or increase capital. Unlike the backtesting requirement for VaR models prescribed under the market risk requirements, no particular statistical test is specified for backtesting of EPE models.
 - (4) Subject to the approval of the supervisory authority, banks that adopt the Internal Model Approach may use a measure that is more conservative than Effective EPE (e.g. a measure of risk based on peak rather than average exposure) for every counterparty in place of alpha times Effective EPE in equation (1). The degree of relative conservatism will be assessed upon initial supervisory approval and subject to periodic validation.

5. Operational requirements for EPE models

A bank that adopt an internal model for estimating EPE must meet the following operational requirements, including meeting the qualifying standards on counterparty credit risk management, use test, stress testing, identification of wrong-way risk, and internal control.

(1) Qualifying standards for counterparty credit risk (CCR) management

- a. Counterparty credit risk (CCR) represents a form of credit risk. Thus standards in the IRB approach to credit risk regarding stress testing, “residual risks” associated with credit risk mitigation techniques, and credit concentrations should apply to CCR.
- b. The bank must have sound counterparty credit risk management policies, processes and systems that are implemented with integrity relative to the sophistication and complexity of bank’s holdings of exposures. A sound CCR management framework shall include the identification, measurement, management, approval and internal reporting of CCR.
- c. The bank’s risk management policies must take account of the market, liquidity, legal and operational risks that can be associated with CCR and, to the extent practicable, interrelationships among those risks. The bank must not undertake business with a counterparty without assessing its creditworthiness and must take due account of both settlement and pre-settlement credit risk. These risks must be managed as comprehensively as practically possible at the counterparty level (aggregating counterparty exposures with other credit exposures) and at the firm-wide level.
- d. The board of directors and senior management must be actively involved in the CCR control process and must regard this as an essential aspect of the business to which significant resources need to be devoted. Where the bank is using an internal model for CCR, senior management must be aware of the limitations and assumptions of the model used and the impact these can have on the reliability of the output. They should also consider the uncertainties of the market environment (e.g. timing of cashing the collateral) and operational issues (e.g. inability to access pricing information regularly) and be aware of how these problems are handled in the model.
- e. The daily reports prepared on bank’s CCR exposures must be reviewed by a level of management with sufficient seniority and authority to enforce both reductions of positions taken by individual credit managers or traders and reductions in the bank’s overall CCR exposure.
- f. The bank’s CCR management system must be used in conjunction with internal credit and trading limits. Credit and trading limits must be related to the firm’s risk measurement

model in a manner that is consistent over time and that is well understood by credit managers, traders and senior management.

- g. The measurement of CCR must include monitoring end-of-day and intra-day usage of credit lines. The bank must measure current exposure gross and appropriate and meaningful net of collateral exposures to positions held (e.g. OTC derivatives, and margin lending). Banks must heed large or concentrated positions, including concentrations by groups of related counterparties, by industry, by market, customer investment strategies, etc.
- h. The bank must have a routine and rigorous procedure for stress testing in place as a supplement to the CCR analysis based on the day-to-day output of the bank's risk measurement model. The results of this stress testing must be reviewed periodically by senior management and must be consistent with the CCR policies and limits set by management and the board of directors. Where stress tests reveal particular vulnerability to a given set of circumstances, management should explicitly consider appropriate risk management strategies (e.g. by hedging against that outcome, or reducing the size of the firm's exposures).
- i. The bank must have a routine in place for ensuring compliance with a documented set of internal policies, controls and procedures concerning the operation of the CCR management system. The CCR management system must be well documented, for example, through a risk management manual that describes the basic principles of the risk management system and that provides an explanation of the empirical techniques used to measure CCR.
- j. The bank must conduct an independent review of the CCR management system regularly through its own internal auditing process. This review must include both the activities of the business credit and trading units and of the CCR control unit. A review of the overall CCR management process must take place at least once a year and must specifically address, at a minimum:
 - (i) the adequacy of the documentation of the CCR management system and process;
 - (ii) the reasonableness of the organization framework of the CCR control unit;
 - (iii) the integration of CCR measures into daily risk management;
 - (iv) the approval process for risk pricing models and valuation systems used by front, middle and back-office personnel;
 - (v) the adequacy of the validation of any significant change in the CCR measurement method and process;
 - (vi) the scope of counterparty credit risks captured by the risk measurement model;

- (vii) the reliability of the management information system;
 - (viii) the accuracy and completeness of CCR data;
 - (ix) the verification of the consistency, timeliness, reliability and independence of data sources used to run internal models;
 - (x) the accuracy and appropriateness of volatility and correlation assumptions in the risk measurement model and the model parameters;
 - (xi) the accuracy of valuation and risk transfer calculation (transfer of risks to others through trading), i.e. the effective measurement of the hedging effect; and
 - (xii) the accuracy of frequent back-testing and model validation performed by the risk control unit.
- k. A bank must monitor the appropriate risks and have processes in place to adjust its estimation of EPE when those risks become significant, including:
- (i) Banks must identify and manage their exposures to specific wrong-way risk.
 - (ii) For exposures with a rising risk profile after one year, banks must compare on a regular basis the estimate of EPE over one year with the EPE prior to the maturity of exposure.
 - (iii) For exposures with a maturity below one year, banks must compare on a regular basis the replacement cost (current exposure) and the realized exposure profile, and/or store data that allow such a comparisons.

(2) Use test

- a. The distribution of exposures generated by the internal model used to calculate the weighted average of effective EPE must be closely integrated into the day-to-day CCR management process of the bank. For example, the bank could use the peak exposure from the distributions for counterparty credit limits or expected positive exposure for its internal allocation of capital. The internal model's output must accordingly play an essential role in the credit approval, counterparty credit risk management, internal capital allocations, and corporate governance of the bank that seek supervisory approval to apply such models for capital adequacy purposes.
- b. A bank must have a credible track record in the use of internal models that generate a distribution of exposures to CCR. Thus, the bank must demonstrate that it has been using an internal model to calculate the distributions of exposures upon which the weighted average EPE calculation is based that meets broadly the minimum requirements for at least one year prior to supervisory approval.
- c. Banks employing the Internal Model Method must have an independent control unit that is responsible for the design and implementation of the bank's CCR management system,

including the initial and on-going validation of the internal model. This unit must control input data integrity and produce and analyze reports on the output of the firm's risk measurement model, the relationship between measures of risk exposure and credit and trading limits. This unit must be independent from business credit and trading units and adequately staffed; it must report directly to senior management of the bank. The work of this unit should be closely integrated into the day-to-day credit risk management process of the bank. Its output should accordingly be an integral part of the process of planning, monitoring and controlling the bank's credit or overall risk profile.

- d. The internal model used to generate the distribution of exposures should be part of a CCR management framework that includes the identification, measurement, management, approval and internal reporting of counterparty risk. This framework must include the measurement of usage of total credit lines and economic capital allocation after CCR exposure. In addition to EPE for measuring future exposure, a bank must measure and manage current exposures (including gross exposure and net of collateral exposure). The use test is satisfied if a bank uses other counterparty risk measures, such as peak exposure or potential future exposure (PFE), based on the distribution of exposures generated by the same model to compute EPE.
- e. Unless a bank demonstrates to the supervisory authority that its exposures to CCR warrant some less frequent calculation, the bank must have the system capability to estimate EE daily. In addition, the bank must choose a forecasting time horizons that adequately reflects the time structure of future cash flows and maturity of the contracts. For example, to stay in line with the actual composition of the exposure, a bank may compute EE at the following frequencies: on a daily basis for the first ten days, once a week for the first month, once a month first the 2nd through the 18th month, once a quarter from the 19th month on to five years, and in a manner consistent with the materiality of the exposure beyond five years.
- f. A bank must measure CCR exposure until all contracts in the netting set have matured (not just to the one year horizon), and monitor and control its CCR exposures. The bank must have routine procedures in place to identify and control the CCR where exposure rises beyond the one-year horizon. Moreover, the forecasted increase in exposure must be inputted into the bank's internal economic capital model.

(3) Stress testing

- a. A bank must have in place sound stress testing processes for use in the assessment of capital adequacy. These stress measures must be compared against the measure of EPE and considered by the bank as part of its internal capital adequacy assessment process.

Stress testing must also involve identifying possible events or future changes in economic conditions that could have unfavorable effects on the bank's credit exposures and assessment of the bank's ability to withstand such changes. Examples of stress scenarios are; (i) economic or industry downturns, (ii) market-place events, or (iii) decreased liquidity.

- b. The bank's stress testing must include jointly stressing market and credit risk factors, consider concentration risk to a single counterparty or groups of counterparties, correlation risk across market and credit risk, and the impact of liquidating the counterparty's positions on the market. Such stress tests must also consider the impact on the bank's own positions of such market moves and integrate that impact in its assessment of counterparty risk.

(4) Wrong-way risk

- a. Banks must be aware of exposures that give rise to wrong-way risk.
- b. A bank is said to be exposed to "specific wrong-way risk" if future exposure to a specific counterparty is expected to be high when the counterparty's probability of default is also high. A bank must have procedures in place to identify, monitor and control cases of specific wrong way risk, beginning at the beginning of a trade and continuing through the life of the trade.

(5) Integrity of modeling process

- a. A bank's internal controls must ensure the integrity of model inputs (including transaction data, historical market data, frequency of calculation, and valuation models used in measuring weighted average of EPE).
- b. The internal model must reflect transaction terms and specifications in a timely, complete, and conservative manner. Such terms include (but are not limited to) contract notional amounts, maturity, reference assets, collateral maintenance ratio, margining arrangements, netting arrangements, etc. The terms and specifications must be stored in a secure database that is subject to formal and periodic audit. The process for recognizing netting arrangements must require signoff by legal staff to verify the legal enforceability of netting and be input into the database by an independent unit. The transmission of transaction terms and specifications data to the internal model must also be subject to internal audit and formal reconciliation processes must be in place between the internal model and source data systems to verify on an ongoing basis that transaction terms and specifications are being reflected in EPE correctly or at least conservatively.

- c. The internal model must employ current market data to compute current exposures. When using historical data to estimate volatility and correlations, at least three years of historical data must be used and must be updated at least quarterly if market conditions warrant. The data should cover one full business cycle. A unit independent from the business unit must validate the price supplied by the business unit. The data must be acquired independently of the lines of business, must be input into the internal model in a timely and complete fashion, and maintained in a secure database subject to formal and periodic audit. Banks must also have a well-developed data integrity process to identify erroneous or anomalous observations. To the extent that the internal model relies on proxy market data, the bank's internal policies must identify suitable proxies and the bank must demonstrate empirically that the proxy provides a conservative representation of the underlying risk under adverse market conditions. If the internal model includes the effect of collateral on changes in the market value of the netting set, the bank must have adequate historical data to model the volatility of the collateral.
- d. The EPE model (and modifications thereof) must be subject to an internal model validation process. The process must be clearly articulated in bank's policies and procedures. The validation process must specify the kind of testing needed to ensure model integrity and identify conditions under which assumptions are violated and may result in an understatement of EPE. The validation process must include a review of the comprehensiveness of the EPE model, for example, whether the EPE model covers all products that would produce significant counterparty risk exposures.
- e. Banks using internal models to estimate EPE must demonstrate that they meet the "general criteria" under the internal models approach to market risk ⁷⁷ in the aspects of the integrity of the risk management system, risk measurement operation, the skills of control staff, the accuracy of models, and the rigor of internal controls over relevant internal processes.
- f. For a bank that qualifies to net transactions, the bank must have internal procedures to verify that, prior to including a transaction in a netting set, the transaction is covered by a legally enforceable netting contract that meets the applicable requirements on credit risk mitigation techniques under the standardized approach to credit risk, and the Cross-Product Netting Rules set forth in section C of this Annex.
- g. For a bank that makes use of collateral to mitigate its CCR, the bank must have internal procedures to verify that, prior to recognizing the effect of collateral in its calculations, the

⁷⁷ Refer to Instructions for Calculating Bank's Equity Capital and Risk-Weighted Assets and Forms - Market Risk, III. Internal Models Approach: B. General Criteria (A) and (B).

collateral meets the appropriate legal certainty standards as set out for risk mitigation techniques under the standardized approach to credit risk.

Annex 4 Capital Treatment of Failed Trades and Non-Delivery-versus-Payment (DvP) Transactions

I. General Principles

1. Transactions where both sides settle simultaneously include delivery-versus-payment (DvP) in which payment and transfer of security occur simultaneously, and payment-versus-payment (PvP) in which the transfer of payment occur simultaneously. DvP or PvP transactions expose a bank to a risk of loss on the difference between the transaction valued at the agreed settlement price and the transaction valued at current market price. Transactions where cash is paid without receipt of the corresponding receivable (securities, foreign currencies, gold, or commodities) or, conversely, deliverables were delivered without receipt of the corresponding cash payment, which is defined as non-DvP (or free-delivery) expose a bank to a risk of loss on the full amount of cash paid or deliverables delivered. The set out in this Annex address the capital requirements for these two kinds of risk exposures. Banks should continue to develop, implement and improve systems for tracking and monitoring the credit risk exposures arising from unsettled and failed transactions as appropriate for producing management information that facilitates action on a timely basis.
2. The capital charge methodology provided in this Annex is applicable to all transactions on securities, foreign exchange instruments, and commodities that give rise to a risk of delayed settlement or delivery, including transactions through recognized clearing houses that are subject to daily mark-to-market and payment of daily variation margins and that involve a mismatched trade, but excluding securities and margin lending and borrowing that fail to settle on time⁷⁸.
3. In cases of a system wide failure of a settlement or clearing system, banks may apply to the supervisory authority for waiver of capital charges until the situation is rectified.
4. Failure of a counterparty to settle a trade in itself will not be deemed a default for purposes of credit risk under this Annex.
5. In applying a risk weight to failed free-delivery exposures, banks using the IRB approach to credit risk may assign PDs to counterparties for which they have no other banking book exposure on the basis of the counterparty's external rating. Banks using the Advanced IRB approach may use a 45% LGD to all failed trade exposures. Alternatively, banks using the IRB approach may opt to apply a 100% risk weight or the standardized approach risk weights.

II. Capital Charge

⁷⁸ All securities lending and borrowing transactions, regardless whether they are settled on time or not, are treated according to the provisions in Annex 3 or risk mitigation techniques under the standardized approach to credit risk.

6. For DvP or PvP transactions, if the settlement has not yet taken place five business days after the agreed settlement date, banks must calculate a capital charge by multiplying the positive current exposure of the transaction by the appropriate factor according to the table below.

Number of business days after the agreed settlement date	Corresponding risk multiplier
5 to 15 days	8%
16 to 30 days	50%
31 to 45 days	75%
46 days or longer	100%

7. For non-DvP transactions (i.e. free deliveries), a bank that has made the payment or record it as a payable according to the contract will treat its exposure as a loan if it has not received the receivable by the end of the business day⁷⁹. This means that a bank under the IRB approach will apply the appropriate IRB formula for the exposure to the counterparty in the same way as it does for all other banking book exposures under the IRB approach to credit risk. Similarly, banks under the standardized approach will use the standardized risk weights under the standardized approach to credit risk. However, when exposures are not material, the bank may choose to apply a uniform 100% risk-weight to these exposures, in order to reduce the cost of a full credit assessment. If five business days after the second contractual payment/delivery date the receivable has not yet been received, the bank that has made the first payment will deduct from capital the full amount of the securities delivered or payment made plus replacement cost, if any. This treatment will apply until the receivable is effectively received.

⁷⁹ If the dates when two payment legs are made are the same according to the time zones where each payment is made, it is deemed that they are settled on the same day. For example, if a bank in Tokyo transfers Yen on day X (Japan Standard Time) and receives corresponding US Dollar via CHIPS on day X (US Eastern Standard Time), the settlement is deemed to take place on the same settlement date.