

Part Two

Asset Securitization

I. Scope and Definitions

A. Scope

1. Banks shall determine regulatory capital requirements on credit risk exposures arising from traditional and synthetic securitizations or asset securitization transactions that contain features common to both in accordance with the provisions on asset securitization specified herein. The capital treatment of a securitization exposure must be determined on the basis of the economic substance of the securitization transaction rather than its legal form.
2. A “traditional securitization” is a transaction involving the transfer of credit risk associated with a real estate or financial asset to a third party in accordance with the provisions on real estate asset trust in Real Estate Securitization Act or the provisions in Financial Asset Securitization Act.
3. A “synthetic securitization” is a transaction involving the transfer of credit risk associated with an underlying pool of exposures or asset-backed securities to investors through the use of off-balance-sheet arrangements or credit derivatives (funded or unfunded)¹.
4. Banks’ exposures to securitization transactions are hereafter referred to as “securitization exposures”. Securitization exposures can include but are not restricted to the following: beneficial securities, asset-backed securities, credit enhancements, liquidity facilities, etc.

B. Definitions

1. Originating bank

A bank is considered to be an originator for a certain securitization if it meets either of the following conditions:

- a. At the time of securitization transaction, the bank holds the underlying asset pool and transfers associated credit risk through securitization; or

¹ An example of funded transfer is credit-linked notes; an example of unfunded transfer is credit default swaps.

b. The bank serves as a sponsor of an asset-backed commercial paper (ABCP) conduit or similar programme, thereby assuming the risk of the underlying pool of exposures; a bank would be considered a sponsor if the bank in fact or in substance manages or advises the ABCP conduit or similar programme, places securities into the market, or provides liquidity and/or credit enhancements.

2. Asset-backed commercial paper programme

An asset-backed commercial paper (ABCP) programme issues commercial paper with an original maturity of one year or less that is backed by assets or other exposures held in a bankruptcy-remote, special purpose entity (SPE).

3. Clean-up call

A clean-up call is an option that permits the originator to pay off early beneficial securities or asset-backed securities before they mature under certain contractually agreed conditions. In the case of traditional securitizations, this is generally accomplished by repurchasing the remaining securitization exposures once the pool balance or outstanding securities have fallen below some specified level. In the case of a synthetic transaction, the clean-up call may take the form of a clause that extinguishes the credit protection.

4. Credit enhancement

A credit enhancement is a contractual arrangement in which the bank retains or assumes beneficial securities or asset-backed securities, or provides added protection to other parties to the transaction in other manners.

5. Credit-enhancing interest-only strip

A credit-enhancing interest-only strip is an on-balance sheet asset that is subordinated and represents a valuation of cash flows related to future margin income.

6. Early amortization

Early amortization provisions are mechanisms that, once triggered, allow investors to be paid out prior to the originally stated maturity of the securities issued. For risk-based capital purposes, an early amortization provision is either “controlled” or “non-controlled”, to which

different credit conversion factors apply.

a. Controlled early amortization:

A “controlled” early amortization provision must meet all of the following conditions.

- (1) The bank must have an appropriate capital or liquidity plan in place to ensure that it has sufficient capital and liquidity available in the event of an early amortization.
- (2) Throughout the duration of the transaction (including the amortization period), there is the same pro rata sharing of interest, principal, expenses, losses and recoveries based on the bank’s and investors’ relative shares of the receivables outstanding at the beginning of each month.
- (3) The bank must set a period for amortization that would be sufficient for at least 90% of the total debt outstanding at the beginning of the early amortization period to have been repaid or recognized as in default.
- (4) The pace of repayment should not be any more rapid than would be allowed by straight-line amortization over the period set out in the preceding sub-paragraph (condition (3)).

b. Non-controlled early amortization:

An early amortization provision that does not satisfy the conditions for a controlled early amortization provision will be treated as a non-controlled early amortization.

7. Excess spread:

Excess spread is generally defined as gross finance charge collections and other income received by the trust or special purpose entity (SPE) minus certificate interest, servicing fees, charge-offs, and other senior expenses.

8. Implicit support:

Implicit support means the degree or manner of financial support provided by a bank to a securitization is in excess of its contractually-agreed obligation.

II. Recognition of risk transference and relevant requirements

The following criteria for recognizing risk transference are applicable to both the standardized and IRB approaches of asset securitization.

A. Risk transference recognition criteria for traditional securitizations

If a traditional securitization meets the following risk transference recognition criteria, the originating bank may exclude the underlying asset pool from the calculation of risk-weighted assets, but the bank must still hold regulatory capital against the specific securitization exposures it retains.

1. Significant credit risk associated with the securitized exposures has been transferred to third parties.
2. The originating bank does not maintain direct or indirect control over the underlying asset pool transferred, and the assets are legally isolated from the originating bank in such a way that the exposures are put beyond the reach of the bank and its creditors, even if the bank is in bankruptcy or receivership. These conditions should be supported by an opinion provided by a qualified legal counsel.
3. The originating bank does not have any of the following rights or obligations:
 - a. Able to repurchase the previously transferred underlying asset pool in order to realize benefits².
 - b. Obligated to retain the risk of the transferred underlying asset pool.
4. The beneficial securities or asset-backed securities backed by the underlying asset pool and issued are not obligations of the originating bank. That is, investors who purchase the securities only have claim to the underlying pool of assets, not against the originating bank.
5. The transferee or trustee of the underlying asset pool is a special-purpose entity (SPE) or a trust enterprise, and the beneficial securities or asset-backed securities issued by said SPE or trust enterprise can be traded or pledged without restriction.

² Except for clean-up calls that are exempted from capital charge.

6. If the originating bank has clean-up call, the call must satisfy the requirements for clean-up calls to be exempted from capital charge.
7. Securitization contract shall not contain any of the following clauses:
 - a. Requiring the originating bank to alter the underlying asset pool such that the pool's credit quality is improved; the foregoing provision does not apply to the improvement of credit quality by selling assets to independent and unaffiliated third parties at market prices;
 - b. Allowing for increases in a retained first loss position or credit enhancement provided by the originating bank after the transaction's inception; or
 - c. Requiring the originating bank to increase the yield payable to investors or providers of credit enhancements when the credit quality of the underlying asset pool deteriorates.

B. Risk transference recognition criteria for synthetic securitizations

1. Scope of credit risk mitigant (CRM)

For synthetic securitizations, the use of CRM (i.e. collateral, guarantees and credit derivatives) by an originating bank for hedging the risk exposures of underlying asset pool may be recognized only if the following conditions are satisfied:

- a. Credit risk mitigants must comply with the requirements as set out under the standardized approach to credit risk.
- b. Eligible collateral is limited to those recognized as credit risk mitigant under the standardized approach to credit risk (eligible collateral provided by SPE or trustee may also be recognized).
- c. Eligible guarantors or protection provider are as defined under the standardized approach to credit risk (SPE or trustee may not act as eligible guarantor or protection provider).
- d. The originating bank must transfer significant credit risk associated with the underlying asset pool to third parties.
- e. The instruments used to transfer credit risk may not contain the following terms or conditions:

- (1) Clauses that materially limit the credit protection or credit risk transference (e.g. significant materiality thresholds below which credit protection is deemed not to be triggered even if a credit event occurs; or allowing for the termination of the protection due to deterioration in the credit quality of the underlying asset pool);
 - (2) Clauses that require the originating bank to alter the underlying asset pool to improve the pool's credit quality;
 - (3) Clauses that increase the originating bank's cost of credit protection in response to deterioration in the quality of the underlying asset pool;
 - (4) Clauses requiring the originating bank to increase the yield payable to other related parties (e.g. investors or providers of credit enhancements) when the credit quality of the underlying asset pool deteriorates; and
 - (5) Clauses requiring the originating bank to provide for increases in a retained first loss position or credit enhancement after the transaction's inception.
- f. An opinion must be obtained from a qualified legal counsel that confirms the enforceability of the contracts in all relevant jurisdictions.
 - g. If the originating bank has a clean-up call, the call must satisfy the requirements for clean-up calls to be exempted from capital charge.

2. Treatment of credit risk mitigants (CRM)

- a. For synthetic securitizations, the effects of applying CRM techniques for risk-based capital purposes are treated according to relevant provisions under the standardized approach to credit risk.
- b. Where the effective maturity of the CRM comes earlier than that of the asset pool underlying a synthetic securitization, a maturity mismatch occurs and the CRM shall be treated according to the following provisions:
 - (1) A bank using the standardized approach for securitization must deduct from its capital all retained positions that are unrated or rated below investment grade.

- (2) A bank using the IRB approach must deduct from its capital retained positions if the deduction is so required under the IRB approach.
- (3) Maturity mismatch needs not be taken into account when the originating bank is required to deduct retained positions from its capital. For other maturity mismatch circumstances, the originating bank shall treat the CRM according to the provisions on CRM maturity mismatch under the standardized approach to credit risk.
- (4) When the assets in the underlying pool have different maturities, the longest maturity must be taken as the maturity of the pool.

C. Treatment of clean-up calls

1. For securitization transactions that include a clean-up call, the originating bank is not required to hold capital if the following conditions are met:
 - a. The exercise of the clean-up call must not be mandatory, in form or in substance, but rather must be at the discretion of the originating bank;
 - b. The clean-up call must not be structured to avoid allocating losses to credit enhancements or positions held by investors or otherwise structured to provide credit enhancement; and
 - c. The clean-up call must only be exercisable when 10% or less of the original underlying asset pool, or securities issued remain, or, for synthetic securitizations, when 10% or less of the original reference portfolio value remains.
2. When securitization transactions that include a clean-up call that does not meet all of the aforementioned criteria, for a traditional securitization, the originating bank must treat the underlying asset pools as if they were not securitized; for a synthetic securitizations, the bank purchasing protection must hold capital against the entire amount of the securitized asset pools as if they did not benefit from any credit protection.
3. If a synthetic securitization includes a call (other than a cleanup call) that effectively terminates the transaction and the purchased credit protection on a specific date, the originating bank must treat the transaction in accordance with the provisions on maturity

mismatch for synthetic securitizations.

4. When the originating bank exercised a clean-up call, if the clean-up call is found to serve as a credit enhancement, the exercise of the clean-up call must be considered a form of implicit support provided by the bank and the underlying asset pool must be treated as if they were not securitized and included in the calculation of risk-weighted assets.

D. Treatment of implicit support

When an originating bank provides implicit support to a securitization, it must treat the underlying asset pool as if they were not securitized and hold capital accordingly. In addition, the bank is required to disclose publicly that it has provided implicit support and the impact of doing so on capital charge.

III. Operational requirements for use of external credit assessments

The following operational criteria apply in the standardized and IRB approaches for securitization transactions.

1. The external credit assessment information used by a bank must properly reflect the amount of credit risk exposure the bank has. For example, if a bank is owed both principal and interest, the assessment must reflect the credit risk associated with timely repayment of both principal and interest.
2. The external credit assessment information must be from an eligible credit rating agency. A rating (including the transition matrix) from the eligible credit rating agency as recognized by the supervisory authority must be publicly available. Consequently, external credit assessment information that are made available only to the parties to a specific transaction do not satisfy this requirement.
3. Eligible credit rating agencies must have a demonstrated expertise in assessing securitizations, which may be evidenced by the degree of market acceptance.

4. A bank must apply external credit assessments from eligible credit rating agencies consistently across a given type of securitization exposure. Furthermore, a bank shall not use the credit ratings issued by different credit rating agencies for different tranches of positions within the same securitization structure.
5. If the assessments provided by two eligible external credit rating agencies for the same securitization transaction are inconsistent and associated with different risk weights, the assessment with higher risk weight shall be used. If there are three or more assessments associated with different risk weights, the bank shall choose two of the lowest risk weights and use the higher of those two weights.
6. Where CRM is provided by an eligible guarantor or protection provider directly to an SPE or a trust enterprise, and the effect of such CRM has been reflected in the external credit assessment, the risk weight associated with that external credit assessment should be used without double counting the effect of said CRM. If the CRM provider is not recognized as an eligible guarantor or protection provider, the covered securitization transaction should be treated as unrated, and the CRM effect is recognized in accordance with the credit risk mitigating methods provided under the standardized or foundation IRB approach to credit risk.
7. In the situation where a CRM is not obtained by an SPE or a trust enterprise but rather applied to a specific securitization exposure within a given structure (e.g. ABS tranche), the bank must treat the exposure as if it is unrated and then use the CRM treatment outlined in the standardized or foundation IRB approach to credit risk.

IV. Calculation of capital requirements

A. Capital deduction for securitization exposures

The provisions on capital deduction for securitization exposures are applied to the standardized approach and the IRB approach as follows:

1. Banks must deduct from Tier 1 capital any expected future margin income (FMI) resulting from a securitization transaction that results in a gain-on-sale and is recognized.

2. Except for the aforesaid gain-on-sale, when a bank is required to deduct a securitization exposure from regulatory capital, the deduction must be taken 50% from Tier 1 and 50% from Tier 2 capital.
3. When deducting credit-enhancing interest-only strip from capital, a bank shall first deduct the portion of recognized “gain-on-sale” as described above from Tier 1, and deduct 50% of the remainder from Tier 1 and 50% of the remainder from Tier 2 capital.
4. The amount of securitization exposure deductible from capital may be the net after deducting its specific loss provision. Similarly, any specific provisions against securitization exposures are not to be included in the measurement of eligible loss provisions.

B. Originating bank’s maximum capital requirement for securitizations

The maximum capital requirement for securitizations held by the originating bank³ shall be equal to the capital requirements that would have been assessed against the underlying exposures as if they were not securitized.

C. Standardized approach for securitization exposures

1. Scope

Banks that apply the standardized approach to credit risk for the type of underlying exposure(s) securitized must use the standardized approach under the securitization framework.

2. Risk weights

- a. The risk-weighted asset amount of a securitization exposure held by a bank is computed by multiplying the amount of the position by the corresponding risk weight presented in Table 1 and Table 2⁴.

³ Including all retained and repurchased securitization exposures and implicit support.

⁴ This calculation method uses the rating designations of Standard & Poor’s for illustrative purpose. It does not mean that Standard & Poor’s is the only eligible external credit rating agency. Unless ratings are mapped and adjusted with the consent of the rating agency, the mapping of credit ratings from each credit agency shall be handled according to Annex 1 of the Instructions and Forms for Calculating Bank’s Own Capital and Risk-Weighted Assets -

- b. For off-balance sheet securitization exposures, banks must apply a credit conversion factor (CCF) to calculate cash equivalent amount and then risk weight the resultant credit equivalent amount to calculate the amount of risk-weighted asset. If such an off-balance sheet exposure is rated by an external credit agency, a CCF of 100% must be applied.
- c. If a specific securitization exposure held by a bank is externally rated, when the long-term rating of the exposure held by the originating bank is BB+ or below, and the long-term rating of the exposure held by the investing bank is B+ or below, or when the short-term ratings of the exposures held by the originating bank and investing bank are other than A-1/P-1, A-2/P-2, A-3/P-3, the exposures of the originating bank and investing bank shall all be deducted from capital according to the provisions in the section of “Capital deduction for securitization exposures.” Unrated securitization exposures shall also be deducted in full from capital except for specific exposures that meet the criteria for “unrated securitization exposures exempted from full deduction” as described below.

Table 1 Risk Weights of Long-term Credit Rating Category

External credit rating	AAA to AA-	A+ to A-	BBB+ to BBB-	BB+ to BB-	B+ and below (including unrated)
Risk weights applicable to investing bank	20%	50%	100%	350%	Full deduction
Risk weights applicable to originating bank	20%	50%	100%	Full deduction	Full deduction

Table 2 Risk Weights of Short-term Credit Rating Category

External credit rating	A-1/P-1	A-2/P-2	A-3/P-3	All other ratings or unrated
Risk weight	20%	50%	100%	Full deduction

The risk weights for short-term ratings in Table 2 are applicable to both originating banks and investing banks.

3. Unrated securitization exposures exempted from full deduction

- a. Unrated securitization exposures must be deducted from capital in full with the following exceptions:
 - (1) The most senior exposure in a securitization;
 - (2) Exposures that are in a second loss position or better; in ABCP programmes and
 - (3) Eligible liquidity facilities.
- b. Capital requirement for unrated most senior securitization exposures
 - (1) If the most senior exposure in a securitization of a traditional or synthetic securitization is unrated, a bank that holds or guarantees such an exposure may determine the risk weight by applying the “look-through” treatment, provided the composition of the underlying pool is known at all times.
 - (2) In the look-through treatment, the unrated most senior position receives the average risk weight of the underlying asset pool. Where the bank is unable to determine the risk weights assigned to the underlying credit risk exposures, the unrated position must be deducted in full.
- c. Capital requirement for exposures in a second loss position or better in ABCP programmes

Full deduction is not required for those unrated securitization exposures to ABCP

programmes that satisfy the following requirements. Instead, the highest risk weight assigned to any of the underlying individual exposures covered by the facility or 100%, provided the highest risk weight is less than 100%, is adopted for calculating the amount of risk-weighted asset.

- (1) The exposure is economically in a second loss position or better and the first loss position provides significant credit protection to the second loss position;
- (2) The associated credit risk is the equivalent of investment grade or better; and
- (3) The bank holding the unrated securitization exposure does not retain or provide the first loss position.

d. Risk weights for eligible liquidity facilities:

Where external credit assessment information is not used to determine the risk weights for eligible liquidity facilities according to the provisions in section “Operational requirements for use of external credit assessments”, the risk weight applied to the exposure’s credit equivalent amount is equal to the highest risk weight assigned to any of the underlying individual exposures covered by the facility.

4. Credit conversion factors for off-balance sheet exposures

Banks must determine whether, according to the criteria outlined below, an off-balance sheet securitization exposure qualifies as an ‘eligible liquidity facility’ or an ‘eligible servicer cash advance facility’. All other off-balance sheet securitization exposures (including off-balance sheet credit enhancement facilities) that do not meet the criteria or solicit external rating will receive a 100% CCF.

a. Eligible liquidity facilities

Banks are permitted to treat off-balance sheet securitization exposures as eligible liquidity facilities if the following minimum requirements are satisfied:

- (1) The facility documentation must clearly identify and limit the circumstances under which it may be drawn. Draws under the facility must be limited to the amount that is likely to be repaid fully from the liquidation of the underlying exposures and any seller-provided

credit enhancements. In addition, the facility must not cover any losses incurred in the underlying pool of exposures prior to a draw, or be structured such that draw-down is regular or continuous;

- (2) The facility must be subject to an asset quality test that precludes it from being drawn to cover credit risk exposures that are in default. In addition, if the exposures that a liquidity facility is required to fund are externally rated beneficial securities or asset-backed securities, the facility can only be used to fund such securities that are externally rated investment grade at the time of draw;
- (3) The facility cannot be drawn after all applicable credit enhancements from which the liquidity would benefit have been exhausted; and
- (4) Repayment of draws on the facility must not be subordinated to any interests of any holder of the beneficial securities or asset-backed securities, or subject to deferral or waiver.

Where these conditions are met, the bank may apply a 20% CCF to the amount of eligible liquidity facilities with an original maturity of one year or less, or a 50% CCF if the facility has an original maturity of more than one year. However, if an external rating of the facility itself is used for risk-weighting the facility, a 100% CCF must be applied.

b. Eligible liquidity facilities available only in the event of market disruption

Banks may apply a 0% CCF to eligible liquidity facilities that are only available in the event of a general market disruption⁵ that the bank is obligated to pay the beneficial securities or asset-backed securities issued by a SPE or a trust enterprise upon maturity. To qualify for this treatment, the eligible liquidity facility must satisfy the aforesaid minimum requirements, and in addition, the amount of draw is collateralized by the underlying asset pool and has the same or higher claim over the claims of holders of the capital market instruments.

⁵ For example, whereupon more than one SPE across different transactions are unable to roll over maturing commercial paper, and that inability is not the result of an impairment in the SPE's credit quality or in the credit quality of the underlying exposures.

c. Treatment of overlapping exposures

In the case of overlapping facilities provided by the same bank, the bank does not need to hold additional capital for the overlap. Rather, it is only required to hold capital once for the position covered by the overlapping facilities (whether they are liquidity facilities or credit enhancements). Where the overlapping facilities are subject to different conversion factors, the bank must attribute the overlapping part to the facility with the highest conversion factor. However, if overlapping facilities are provided by different banks, each bank must hold capital for the maximum amount of the facility.

d. Eligible servicer cash advance facilities

If it is contractually provided for that servicers may advance cash for the SPE or trust enterprise to ensure an uninterrupted flow of payments to investors of the beneficial securities or asset-backed securities so long as the servicer is entitled to full reimbursement and this right is senior to other claims on cash flows from the underlying pool of exposures, such undrawn servicer cash advances or facilities that are unconditionally cancellable without prior notice may be eligible for a 0% CCF.

5. Credit risk mitigation for securitization exposures

Credit risk mitigants (CRM) on securitization exposures include guarantees, credit derivatives, collateral and on-balance sheet netting. Such CRMs refers to those used to hedge the credit risk of a securitization exposure rather than the underlying asset pool of the securitization transaction.

When a bank other than the originator provides credit protection to a securitization exposure, it must calculate a capital requirement on the covered exposure as an non-originator. If a bank provides protection to an unrated credit enhancement, it must treat the credit protection provided as if it were directly holding the unrated credit enhancement and deduct the position from the capital in full.

a. Collateral

Eligible collateral is limited to that recognized under the standardized approach to credit risk.

The CRM effect of eligible collaterals provided by the SPE or trust enterprise involved in the securitization transaction may also be recognized.

b. Guarantees and credit derivatives

- (1) The scope of eligible guarantor or protection provider is the same as that recognized under the standardized approach to credit risk; the SPE or trust enterprise involved in the securitization transaction may be recognized may not be recognized as eligible guarantor or protection provider.
- (2) Where guarantees or credit derivatives satisfy the operational requirements provided under the standardized approach to credit risk, banks can take account of the CRM effect of such protection in calculating capital requirements for risk-weighted assets.
- (3) Capital requirements for the guaranteed/protected portion will be calculated according to CRM under the standardized approach to credit risk.

c. Maturity mismatches)

When a securitization exposure and its CRM have maturity mismatch, capital requirement will be treated the same as maturity mismatch under the standardized approach to credit risk. When the exposures being hedged have different maturities, the longest maturity shall be used.

6. Capital requirement for early amortization

a. Scope

When a securitization transaction has any of the following situations, an originating bank shall hold capital against the investors' interest (including the drawn and undrawn balances):

- (1) The securitization transaction contains an early amortization clause.
- (2) The exposures sold are of a revolving nature, that is, the borrower is allowed to vary the drawn amount and repayments within an agreed limit under a line of credit (e.g. credit card receivables and corporate loan commitments).

- (3) For securitization transactions wherein the underlying pool comprises revolving and term exposures at the same time, a bank must apply the relevant early amortization treatment to that portion of the underlying pool containing revolving exposures.
- (4) Banks are not required to calculate a capital requirement for early amortizations in the following situations:
 - (a) The underlying pool does not revolve and the early amortization ends the ability of the bank to add new position to the underlying pool.
 - (b) Transactions of revolving assets containing early amortization features that give the transaction a term structure that does not subject the bank to the risk of new exposures after early amortization.
 - (c) After the originating bank begins early amortization, the holders of beneficial securities or asset-backed securities assume fully the risk of future draws by borrowers.
 - (d) The trigger of early amortization clause is not related to the performance of the underlying asset pool or the originating bank (e.g. material changes in tax laws or regulations).

b. Calculation of capital requirement

- (1) The originator's capital charge for the investors' interest is determined as the product of items (a), (b) and (c) below:
 - (a) the investors' interest;
 - (b) the appropriate CCF; and
 - (c) the risk weight appropriate to the underlying exposure type, as if the exposures had not been securitized.
- (2) The aforesaid CCF is determined by the following three conditions:
 - (a) The early amortization is "controlled" or "uncontrolled" mechanism;
 - (b) The securitized assets are retail credit lines (e.g. credit card receivables) or non-retail credit lines (e.g. revolving corporate facilities).

(c) The credit line is “committed” or “uncommitted” (a line is considered uncommitted if it is unconditionally cancellable without prior notice).

(3) CCF is determined by the following steps:

- (a) Compare the “compare the three-month average excess spread” and the “excess spread trapping point” of the securitization transaction with early amortization feature. “Excess spread trapping point” means the point of excess spread at which the bank is required to trap excess spread from early amortization as economically required by the structure. In cases where such a transaction does not require excess spread to be trapped, the trapping point is deemed to be 4.5%;
- (b) Divide the excess spread level by the transaction’s excess spread trapping point to determine the appropriate segments; and
- (c) Apply the corresponding conversion factors as outlined in Table 3 and Table 4 according to the nature of the credit facility related to securitized exposure.

Table 3 Credit Conversion Factors (CCF) for “Controlled” Early Amortization

	Uncommitted		Committed
Retail credit lines	Ratio of 3-month average excess spread to excess spread trapping point (denoted by R)	Credit Conversion Factor (CCF)	90% CCF
	$133.33\% \leq R$	0% CCF	
	$100\% \leq R < 133.33\%$	1% CCF	
	$75\% \leq R < 100\%$	2% CCF	
	$50\% \leq R < 75\%$	10% CCF	

	$25\% \leq R < 50\%$	20% CCF	
	$R < 25\%$	40% CCF	
Non-retail credit lines	90% CCF		90% CCF

Table 4 Credit Conversion Factors (CCF) for “Controlled” Early Amortization

	Uncommitted		Committed
Retail credit lines	Ratio of 3-month average excess spread to excess spread trapping point (denoted by R)	Credit Conversion Factor (CCF)	100% CCF
	$133.33\% \leq R$	0% CCF	
	$100\% \leq R < 133.33\%$	5% CCF	
	$75\% \leq R < 100\%$	15% CCF	
	$50\% \leq R < 75\%$	50% CCF	
	$R < 50\%$	100% CCF	
Non-retail credit lines	100% CCF		100% CCF

D. Internal ratings-based (IRB) approach for securitization exposures

1. Introduction

The major difference between the standardized approach and the IRB approach for securitization transactions lies only in the way of how risk weights are determined. Thus banks that adopt the IRB approach for securitization exposures shall observe foregoing provisions on “capital deduction”, “cap of capital charge” and other relevant provisions under the standardized approach unless it is otherwise provided in this section.

2. Scope

- a. Banks that have received approval to use the IRB approach for the type of underlying exposures securitized must use the IRB approach for securitizations.
- b. Where there is no specific IRB treatment for the exposure type in the underlying asset pool, originating banks that have received approval to use the IRB approach must calculate capital charges on their securitization exposures using the standardized approach in the securitization framework; investing banks with approval to use the IRB approach must apply the ratings-based approach (RBA) as described below.
- c. If the bank is using the standardized approach and the IRB approach for different securitized exposure types in the underlying pool, it should generally use the approach corresponding to the predominant share of exposures within the pool for calculating capital requirements for securitization exposures.

3. Applicable approaches and hierarchy of approaches

- a. Approaches include: Ratings-based Approach (RBA), Internal Assessment Approach (IAA) and Supervisory Formula (SF).
- b. Hierarchy of approaches:
 - (1) The Ratings-based Approach (RBA) must be applied to securitization exposures that are rated, or where a rating can be inferred
 - (2) Where an external or an inferred rating is not available, either the Supervisory Formula (SF) or the Internal Assessment Approach (IAA) must be applied.
 - (3) The IAA is only available to liquidity facilities and credit enhancements that banks extend to asset-backed commercial papers (ABCP).
- c. The CCFs for eligible liquidity facilities are determined in the following manner:
 - (1) 100% CCF if the risk weight of facility is determined by RBA or IAA.
 - (2) If the risk weight of facility is determined by Supervisory Formula⁶:

⁶ If K_{IRB} for eligible liquidity facility is not available, capital requirement can be calculated by using the highest risk weight applied to any individual exposure it protects under the standardized approach and CCF determined by Supervisory Formula set out in this section.

- (a) 50% CCF if the facility has an original maturity of one year or less.
- (b) 100% CCF if the facility has an original maturity of more than one year.
- (c) 20% CCF if the facility is available only in the event of a general market disruption.
- d. A 0% CCF is applied to eligible servicer cash advance facilities.
- e. Non-eligible liquidity facilities must be deducted from the capital.
- f. If RBA, IAA or SF is used for calculating capital requirement for securitization exposures, the treatment of credit risk mitigants shall refer to related provisions under the foundation IRB approach to credit risk.
- g. Unless with the approval of the supervisory authority, securitization exposures to which none of these approaches provided herein can be applied for determining risk weights and CCF must be deducted in full from capital.

4. Ratings-based Approach (RBA)

- a. Under the RBA, the risk-weighted assets are determined by multiplying the amount of the exposure by the appropriate risk weights (see Table 5 and Table 6).
- b. The risk weights in Table 5 and Table 6 depend on the following four items:
 - (1) The credit rating (external or inferred) represents a long-term or a short-term rating;
 - (2) The external rating grade or an available inferred rating;
 - (3) The granularity of the underlying asset pool; and
 - (4) The “seniority” of the position.
- c. External rating and inferred rating

If the securitization exposure has an external rating which represents a long-term or a short-term rating and a rating grade, the risk weights in Tables 5 and 6 apply. When the following minimum operational requirements are satisfied, a bank must attribute an inferred rating to an unrated position. These requirements are intended to ensure that the unrated position is senior in all respects to an externally rated securitization exposure termed the ‘reference securitization exposure’. The “minimum operational requirements”

include the following criteria (i.e. the following operational requirements must be satisfied to recognize inferred ratings):

- (1) The reference securitization exposure must be subordinate in all respects to the unrated securitization exposure. Credit enhancements, if any, must be taken into account when assessing the relative subordination of the unrated exposure and the reference securitization exposure. If the reference securitization exposure comes with any third-party guarantees or other credit enhancements that are not available to the unrated exposure, then the unrated exposure may not be assigned an inferred rating based on the reference securitization exposure.
- (2) The maturity of the reference securitization exposure must be equal to or longer than that of the unrated exposure.
- (3) Any inferred rating must be updated continuously to reflect any changes in the external rating of the reference securitization exposure.
- (4) The external rating of the reference securitization exposure must satisfy the “operational requirements for the use of external credit assessments”.

d. The granularity and risk weights of underlying pool are decided as follows:

- (1) When the effective number of exposures (N) in the underlying pool is less than 6, it is a “non-granular pool” to which the risk weights outlined under “Risk weights for tranches backed by non-granular pools” (column 4) in Table 5 and Table 6 apply.
- (2) If the effective number of exposures is equal to or greater than 6, risk weight is determined by whether the exposure is a “senior position.” For senior positions, risk weights outlined under column 2 of Table 5 and Table 6 apply; for other positions, the “base risk weights” in column 3 of Table 5 and Table 6 apply.
- (3) The effective number of exposures (N) is calculated by the following formula:

$$N = \frac{(\sum_i EAD_i)^2}{\sum_i EAD_i^2}, \text{ where } EAD_i \text{ represents the exposure-at-default associated with the}$$

ith exposure in the pool.

Table 5 RBA Risk Weights - Based on Long-term Ratings

External rating (illustrative)	Risk weights for senior positions	Base risk weight	Risk weights for tranches backed by non-granular pools
AAA	7%	12%	20%
AA	8%	15%	25%
A+	10%	18%	35%
A	12%	20%	
A-	20%	35%	
BBB+	35%	50%	
BBB	60%	75%	
BBB-	100%		
BB+	250%		
BB	425%		
BB-	650%		
Below BB- and unrated	Full deduction		

Table 6 RBA Risk Weights - Based on Short-term Ratings

External rating (illustrative)	Risk weights for senior positions	Base risk weight	Risk weights for tranches backed by non-granular pools
A-1/P-1	7%	12%	20%
A-2/P-2	12%	20%	35%

A-3/P-3	60%	75%	75%
All other ratings or unrated	Full deduction	Full deduction	Full deduction

e. “Senior position” is determined in the following manner:

- (1) For purposes of the RBA, a securitization exposure is treated as a senior tranche if it is effectively backed or secured by a first claim
- (2) In a traditional securitization where all tranches above the first-loss position are rated, the most highly rated position would be treated as a senior tranche. However, when there are several tranches that share the same rating, only the most senior one in the waterfall would be treated as senior.
- (3) In a synthetic securitization, the “super-senior” tranche would be treated as a senior tranche, provided that all of the operational requirements for inferred ratings are satisfied and the exposure is shown to have better claim over exposures in other tranches.
- (4) Usually a “liquidity facility” supporting an ABCP programme would not be the most senior position within the programme; the commercial paper, which benefits from the liquidity support, typically would be the most senior position.

5. Internal Assessment Approach (IAA)

A bank may use its internal assessments of the credit quality of the securitization exposures to unrelated liquidity facilities and credit enhancements in an ABCP programmes if the bank’s internal assessment process meets the operational requirements below. Internal assessments of exposures provided to ABCP programmes must be mapped to equivalent external ratings of an external credit assessment institution (ECAI), and the amount of risk-weighted assets is calculated using appropriate risk weights under the RBA.

Banks must meet specific operational requirements to adopt internal assessment. If the bank's internal assessment process is deemed inappropriate and suspended by the request of the supervisory authority, the bank shall use Supervisory Formula or other alternatives. The operational requirements for bank's internal assessment process:

- a. The ABCP programme that provides liquidity facilities or credit enhancements must be externally rated.
- b. The internal assessment of the credit quality of a securitization exposure to the ABCP programme must be based on an ECAI criteria for the asset type purchased and must be the equivalent of at least investment grade when initially assigned to an exposure. The internal assessment must be used in the bank's internal risk management processes, including management information and economic capital systems, and must meet the minimum operational requirements of the IRB framework for credit risk.
- c. Banks shall have proper processes and documents to demonstrate that:
 - (1) all external credit assessment information they use are provided by eligible ECAI; and
 - (2) the internal assessment process adopts the rating methodologies used by the ECAI and correspond to the ECAI standards.
- d. The bank's internal assessment process must identify gradations of risk. Internal assessments must correspond to the external ratings of ECAIs so that the supervisory authority can determine which internal assessment corresponds to each external rating category of the ECAIs.
- e. In the development of internal assessment process, banks should consider all publicly available ECAI ratings methodologies, and the internal assessment process must be at least as conservative as the publicly available rating criteria of the major ECAIs (particularly for determining the level of credit enhancement) as described below:
 - (1) In the case where the commercial paper issued by an ABCP programme is externally rated by two or more ECAIs and the different ECAIs' benchmark stress factors require different levels of credit enhancement to achieve the same external rating equivalent,

the bank must apply the ECAI stress factor that requires the most conservative or highest level of credit protection. For example, if one ECAI required enhancement of 2.5 to 3.5 times historical losses for an asset type to obtain a single A rating equivalent and another required 2 to 3 times historical losses, the bank must use the higher range of stress factors in determining whether the seller-provided credit enhancement achieves an appropriate level.

- (2) When selecting ECAIs to externally rate an ABCP, a bank must not choose only those ECAIs that generally have relatively less restrictive rating methodologies. If there are changes in the methodology of one of the selected ECAIs (including the stress factors) that adversely affect the external rating of the programme's commercial paper, the bank should consider whether to revise its internal assessment process.
 - (3) A bank can not use an ECAI's rating methodology to derive an internal assessment if the ECAI's process or rating criteria is not publicly available, unless the bank has access to such information through other means. Under certain circumstances (e.g. for new or uniquely structured transactions), a bank may discuss the specific transaction with supervisory authority to determine whether it may use IAA for such exposures.
- f. A bank should have proper functions or personnel to regularly review the implementation and the effectiveness of their IAA. These functions and personnel must be independent.
 - g. A bank should track the actual performance of its internal assessments over time and make adjustments, as necessary, to its assessment process when the performance of the exposures routinely diverges from the assigned internal assessments on those exposures.
 - h. The ABCP programme must have credit and investment guidelines. In the consideration of purchasing the underlying asset pool, the ABCP programme administrator should also develop guidelines. Factors to be considered include the type of asset being purchased; type and monetary value of the exposures arising from the provision of liquidity facilities and credit enhancements; possible cash flow in case of asset loss; and legal and economic isolation of the transferred assets from the sellers of the assets.

- i. A bank should perform a credit analysis of the asset seller's risk profile and should consider factors including past and expected future financial performance; current market position; expected future competitiveness; leverage, cash flow, and interest coverage; and debt rating. In addition, the bank should review of the seller's underwriting standards, servicing capabilities, and collection processes.
- j. The ABCP programme's underwriting policy must include the following particulars:
 - (1) Excluding the purchase of assets that are significantly past due or defaulted;
 - (2) Limiting excess concentration to individual obligor or geographic area; and
 - (3) Limiting the tenor of the assets to be purchased.
- k. The ABCP programme should have collections processes established that consider the operational capability and credit quality of the servicer. The programme should mitigate to the extent possible seller/servicer risk through various methods, such as triggers based on current credit quality that would preclude co-mingling of funds and impose lockbox arrangements⁷ that would help ensure the fund liquidity of the ABCP programme.
- l. When an ABCP programme is considering asset purchase and assessing the possible loss on the asset pool, it should consider all sources of potential risk (e.g. credit risk and dilution risk). If the dilution risk for the particular risk-weighted asset is material, then a separate reserve should be established for dilution risk. In sizing the required enhancement level, the bank should review several years of historical information, including losses, delinquencies, dilutions, and the turnover rate of the receivables. Furthermore, the bank should evaluate the characteristics of the underlying asset pool, e.g. weighted average credit score, identify any concentrations to an individual obligor or geographic region, and the granularity of the asset pool, and assess possible loss.
- m. The ABCP programme must incorporate structural features into the purchase of assets in order to mitigate potential credit deterioration of the underlying portfolio. Such features

⁷ "Lockbox arrangement" means the establishment of a mechanism to separate the asset pool receivables and the originating bank to preclude the co-mingling of funds.

may include a mechanism to wind down the asset pool position under certain circumstances.

6. Supervisory Formula (SF)

- a. Risk-weighted assets generated through the use of the SF are calculated by multiplying the capital charge by 12.5.
- b. Under the SF, the capital charge for a securitization tranche depends on the following five parameters:
 - (1) The IRB capital charge before the securitization of the underlying exposures (K_{IRB});
 - (2) The exposure's credit enhancement level (L);
 - (3) The exposure's thickness (T);
 - (4) The original effective number of exposures in the pool (N);
 - (5) The original weighted average loss-given-default (LGD) of exposures in the pool.
- c. The capital charge using the SF is calculated as follows:

$$(1) \text{ Capital charge} = \text{Amount of exposures securitized} \times \text{Max}(0.0056 \times T \cdot S[L+T] - S[L])$$

where the function $S[.]$ is termed the "Supervisory Formula"

- (2) The Supervisory Formula is defined as follows:

$$S[L] = \begin{cases} L & \text{when } L \leq K_{IRB} \\ K_{IRB} + K[L] - K[K_{IRB}] + (d \cdot K_{IRB} / \omega)(1 - e^{\omega(K_{IRB} - L) / K_{IRB}}) & \text{when } K_{IRB} < L \end{cases}$$

Where:

$$h = (1 - K_{IRB} / LGD)^N$$

$$c = K_{IRB} / (1 - h)$$

$$v = \frac{(LGD - K_{IRB})K_{IRB} + 0.25(1 - LGD)K_{IRB}}{N}$$

$$f = \left(\frac{v + K_{IRB}^2}{1 - h} - c^2 \right) + \frac{(1 - K_{IRB})K_{IRB} - v}{(1 - h)\tau}$$

$$g = \frac{(1 - c)c}{f} - 1$$

$$a = g \cdot c$$

$$b = g \cdot (1 - c)$$

$$d = 1 - (1 - h) \cdot (1 - \text{Beta}[K_{IRB}; a, b])$$

$$K[L] = (1 - h) \cdot ((1 - \text{Beta}[L; a, b])L + \text{Beta}[L; a + 1, b]c)$$

Note: Beta [L; a, b] refers to the cumulative β distribution with parameters a and b evaluated at L.

(3) The parameters set by the supervisory authority are as follows: $\tau = 1000$, and $\omega = 20$.

d. Capital charge ratio (K_{IRB})

- (1) K_{IRB} is equal to (a)/(b), where (a) is the IRB capital requirement including the expected loss (EL) portion for the underlying exposures in the pool; and (b) is the exposure amount of the pool (e.g. the sum of drawn amounts related to securitized exposures plus the exposure-at-default (EAD) associated with undrawn commitments; both are gross before deduction of specific provision).
- (2) Quantity (a) above must be calculated in accordance with the applicable IRB standards (including the provisions on credit risk mitigation) as if the exposures in the pool were held directly by the bank. K_{IRB} is expressed in decimal form. For example, if capital charge plus EL are equal to 15% of the exposure amount of the pool, K_{IRB} would be expressed as 0.15).
- (3) If the risk weight resulting from the Supervisory Formula (SF) is 1250%, banks must deduct the securitization exposure subject to that risk weight from the capital according to the aforesaid provisions on capital deduction.

e. Credit enhancement level (L)

- (1) L (expressed in decimal form) is equal to (a)/(b), where (a) is the amount of all other securitization exposures subordinate to the specific exposure held by the bank; and (b) is the amount of exposures in the underlying asset pool.
- (2) Any gain-on-sale, credit-enhancing interest-only strip, reserves that have not been set aside, and interest rate and currency swaps that cannot be measured at their current value are not to be included in the measurement of L. When interest rate and currency swaps that may be measured at their current values are included in the calculation of L, potential future exposures are excluded.

f. Thickness of exposure (T)

- (1) T is equal to (a)/(b), where (a) is the nominal size of specific securitization exposure held by the bank; and (b) is the amount of exposures in the underlying asset pool.
- (2) In the case of an exposure arising from an interest rate or currency swap, the bank must incorporate potential future exposure. If the current value of the swap contract is non-negative, the exposure size should be measured by the current value plus the add-on. If the current value is negative, the exposure should be measured by using the potential future exposure only.

g. Effective number of exposures (N)

- (1) The effective number of exposures is calculated as follows:

$$N = \frac{(\sum_i EAD_i)^2}{\sum_i EAD_i^2}$$

where EAD_i represents the exposure-at-default associated with the i^{th} exposure in the pool. Multiple exposures to the same obligor must be consolidated (i.e. treated as a single asset). In the case of re-securitization (securitization of securitization exposures), the formula applies to the number of securitization exposures in the pool and not the number of underlying exposures in the original pools. If the portfolio share associated with the largest exposure (C_1) is available, the bank may compute N

as $1/C_1$.

- (2) For example, if there are 100 exposures in the pool, of which, the EADs of 50 exposures are 10,000, while the EADs of the other 50 exposures are 20,000, then the effective number of exposures (N) is $(1,500,000)^2 / 25,000,000,000 = 90$.

h. Exposure-weighted average loss given default (LGD)

The exposure-weighted average LGD is calculated as follows:

$$LGD = \frac{\sum_i LGD_i \cdot EAD_i}{\sum_i EAD_i}$$

where LGD_i represents the average LGD associated with all exposures to the i th obligor. In the case of re-securitization, an LGD of 100% must be assumed for the underlying securitized exposures held by the bank. When default and dilution risks for purchased receivables are treated in an aggregate manner (e.g. a single reserve or over-collateralization is available to cover losses from either source) within a securitization, the LGD input must be calculated as the 100% LGD for dilution risk and a weighted-average of the LGD for default risk. The weights are respective risk weights for default risk and dilution risk under the IRB approach to credit risk.

i. Simplified method for computing N and exposure-weighted average LGD

For securitizations involving retail exposures, the Supervisory Formula (SF) may be implemented using the simplifications:

$$h = 0 \text{ and } v = 0$$

- j. Under the conditions provided below, banks may employ a simplified method for calculating the effective number of exposures and the exposure-weighted average LGD.

Let C_m in the simplified calculation denote the share of the pool corresponding to the sum of the largest “m” exposures (e.g. a 15% share corresponds to a value of 0.15). The level of m is set by each bank.

- (1) If the portfolio share associated with the largest exposure (C_1) is no more than 0.03 (or 3%), then for purposes of the SF, the bank may set $LGD=0.50$ and N equal to the

following amount.

$$N = \left(C_1 C_m + \left(\frac{C_m - C_1}{m - 1} \right) \max\{1 - m C_1, 0\} \right)^{-1}$$

- (2) If only C_1 is known and not larger than 0.03, the bank can define $LGD=0.50$ and $N=1/C_1$.

V. Illustrative examples: Calculating risk-weighted assets for securitization exposures

A. Basic assumptions

1. Assume the asset pool is a long-term loan of NT\$10 billion, which is split into two tranches after securitization, of which the NT\$8 billion senior tranche has a rating of A, and the remaining NT\$2 billion junior tranche has a rating of BB+.
2. Assume the K_{IRB} is 6% under the IRB approach.
3. Assume the recovery rate is very low if default happens, thus let LGD be 95%.
4. Assume the NT\$10 billion asset pool contains 10 corporate exposures, including 3 NT\$1.5 billion senior exposures (AA rating), 2 NT\$1 billion senior exposures (A- rating), 3 NT\$0.5 billion senior exposures (BBB rating) and 2 NT\$1 billion junior exposures (B- rating).

B. Calculations

1. Standardized Approach (SA)

- a. If the bank holds NT\$8 billion senior position with rating of A, with risk weight of 50%, the capital charge will be $NT\$8 \text{ billion} \times 50\% \times 8\% = NT\$ 0.32 \text{ billion}$.
- b. If the originating bank holds NT\$2 billion junior position for the provision of credit enhancement, the capital charge will be estimated as follows:

(1) Capital charge before securitization

$$\text{Risk-weighted assets} = (3 \times 1.5 \times 20\%) + (2 \times 1 \times 50\%) + (3 \times 0.5 \times 100\%) + (2 \times 1 \times 150\%) = \text{NT\$6.4 billion}$$

$$\text{Capital charge} = 6.4 \times 8\% = \text{NT\$512 million}$$

- (2) Capital charge after securitization = NT\$2 billion (junior positions should be deducted from the capital).
- (3) Because capital charge after securitization is NT\$2 billion, which does not exceed the capital charge prior to securitization, the amount of risk-weighted asset should be calculated as if the exposures were not securitized (i.e. capital charge is adjusted to NT\$512 million).
- c. If an investing bank holds the NT\$2 billion junior position, with risk weight of 350%, the capital charge will be $\text{NT\$2 billion} \times 350\% \times 8\% = \text{NT\$560 million}$.

2. Ratings-based Approach (RBA)

- a. Effective number of exposures (N):

$$N = \frac{(\sum_i EAD_i)^2}{\sum_i EAD_i^2} = \frac{(3 \times 15 + 2 \times 10 + 3 \times 5 + 2 \times 10)^2}{(3 \times 15^2 + 2 \times 10^2 + 3 \times 5^2 + 2 \times 10^2)} = \frac{(100)^2}{1150} = 8.70 \quad (1)$$

- b. In the most senior position of NT\$8 billion with rating of A, N is 8.70 as known from (1), which is greater than 6. Thus the bank is eligible for using the risk weight for most senior position as shown in Table 5, which is 12%. The capital charge will be $\text{NT\$8 billion} \times 12\% \times 8\% = \text{NT\$76.8 million}$.
- c. For the junior position of NT\$2 billion with rating of BB+, its risk weight is 250% according to Table 5. The capital charge will be $\text{NT\$2 billion} \times 250\% \times 8\% = \text{NT\$400 million}$.
- d. The total capital charge will be NT\$476.8 million (76.8 million + 400 million = 476.8 million).

3. Supervisory Formula (SF)

Using the same assumptions in the examples above, how to calculate risk weights and capital charge for most senior position using Supervisory Formula?

- a. Assume the K_{IRB} is 6% under the IRB approach.
- b. The credit enhancement level (L) of bank's NT\$8 billion most senior exposure with rating of A is 20%, i.e. NT\$2 billion junior position divided by the amount of exposures in the pool (NT\$10 billion).
- c. The thickness of exposure (T) of bank's NT\$8 billion most senior exposure with rating of A is 80%, i.e. NT\$8 billion most senior position divided by amount of exposures in the pool (NT\$10 billion).
- d. Effective number of exposures (N):
- $$N = \frac{(\sum_i EAD_i)^2}{\sum_i EAD_i^2} = \frac{(3 \times 15 + 2 \times 10 + 3 \times 5 + 2 \times 10)^2}{(3 \times 15^2 + 2 \times 10^2 + 3 \times 5^2 + 2 \times 10^2)} = \frac{(100)^2}{1150} = 8.70$$
- e. Supervisory value: $\tau = 1000$, and $\omega = 20$.
- f. Credit enhancement level (L) is 20%, which is greater than KIRB (6%). Following calculation S[L] is 9.35%, and S[L+T] is 9.62%.
- g. IRB capital requirement = $Max(0.0056 \times 0.8, 9.62\% - 9.35\%) = 0.45\%$, then the amount of risk-weighted assets for credit risk is NT\$8 billion $\times 0.45\% \times 12.5 =$ NT\$448 million (capital charge will be NT\$448 million $\times 8\% =$ NT\$35 million) (See annex for detailed calculation process).

Annex:

$$1.h = (1 - K_{IRB} / LGD)^N = (1 - 6\% / 95\%)^{8.70} = 0.5669$$

$$2.c = K_{IRB} / (1 - h) = 6\% / (1 - 0.5669) = 0.1385$$

$$3.v = \frac{(LGD - K_{IRB})K_{IRB} + 0.25(1 - LGD)K_{IRB}}{N}$$

$$= \frac{(95\% - 6\%) \times 6\% + 0.25 \times (1 - 95\%) \times 6\%}{8.70} = 0.0062$$

$$4. f = \left(\frac{v + K_{IRB}^2}{1 - h} - c^2 \right) + \frac{(1 - K_{IRB})K_{IRB} - v}{(1 - h)\tau}$$

$$= \left(\frac{0.0062 + (6\%)^2}{1 - 0.5669} - (0.1385)^2 \right) + \frac{(1 - 6\%) \times 6\% - 0.0062}{(1 - 0.5669) \times 1000} = 0.0036$$

$$5. g = \frac{(1 - c)c}{f} - 1 = \frac{(1 - 0.1385) \times 0.1385}{0.0036} - 1 = 32.0832$$

$$6. a = g \cdot c = 32.0832 \times 0.1385 = 4.4446$$

$$7. b = g \cdot (1 - c) = 32.0832 \times (1 - 0.1385) = 27.6386$$

$$8. d = 1 - (1 - h)(1 - \text{Beta}[K_{IRB}; a, b])$$

$$= 1 - (1 - 0.5669) \times (1 - \text{Beta}[6\%, 4.4446, 27.6386]) = 0.5972$$

$$9. K[L] = (1 - h) \cdot ((1 - \text{Beta}[L; a, b])L + \text{Beta}[L; a + 1, b]c)$$

$$K[20\%] = (1 - 0.5669) \times ((1 - \text{Beta}[20\%; 4.4446, 27.6386]) \times 20\% + \text{Beta}[20\%; 5.4446, 27.6386] \times 0.1385)$$

$$= 0.0572$$

$$10. S[L] = K_{IRB} + K[L] - K[K_{IRB}] + (d \cdot K_{IRB} / \omega) (1 - e^{\omega(K_{IRB} - L) / K_{IRB}})$$

$$S[20\%] = 6\% + 0.0572 - 0.0256 + (0.5972 \times 6\% / 20) (1 - e^{20 \times (6\% - 20\%) / 6\%}) = 9.35\%$$

$$11. \text{Similarly, } S[L + T] = 9.62\%$$

$$12. \text{Max} (0.0056 \times 0.8, 9.62\% - 9.35\%) = 0.45$$