DEPOSIT INSURANCE SCHEME

Technical Addendum

6 August 2002

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CONTENTS

1. INTRODUCTION

1.1 Oliver, Wyman & Company, an international consulting firm specialising in financial services, was engaged by the MAS to study the economics of deposit insurance in the Singapore market and recommend a design for the system.

1.2 The purpose of this technical addendum is to provide a detailed explanation of the choices made in the design of the Singapore deposit insurance scheme, and the approach and model used in the analysis underlying those choices. This document also provides details on the specific recommendations for asset maintenance, target fund size, fund build-up, risk bucketing and the pricing schedule. This technical addendum should be read in conjunction with the MAS Consultation Paper. Table 1 sets forth the key structural choices.

TABLE 1: Key Structural Choices

ELEMENT	CHOICE
Membership and Coverage[1]	• Mandatory participation by Full Banks and finance companies • Singapore dollar deposits held by individuals covered • Coverage limit of S$ 20,000 per depositor per institution
Funding	• Primarily ex-ante or ex-post funding
Deposit Priority	• Equal priority among deposits or priority for insured deposits
Asset Maintenance	• Whether to require a minimum level of assets to be held • Types of eligible assets • Adjustments for risk • Level of asset maintenance required
Target Fund Size	• Level of the fund in basis points (bps)
Fund Build-up	• Build-up period • Average price over build-up
Pricing Approach	• Risk-based or uniform pricing
Premium Assessment Base	• Deposits or insured deposits
Risk Bucketing	• Factors used in pricing schedule
Pricing	• Pricing schedule levels (build-up and steady state) • Interim solution • Ex-post contingency
Liquidity	• Government or private provision of liquidity to the scheme

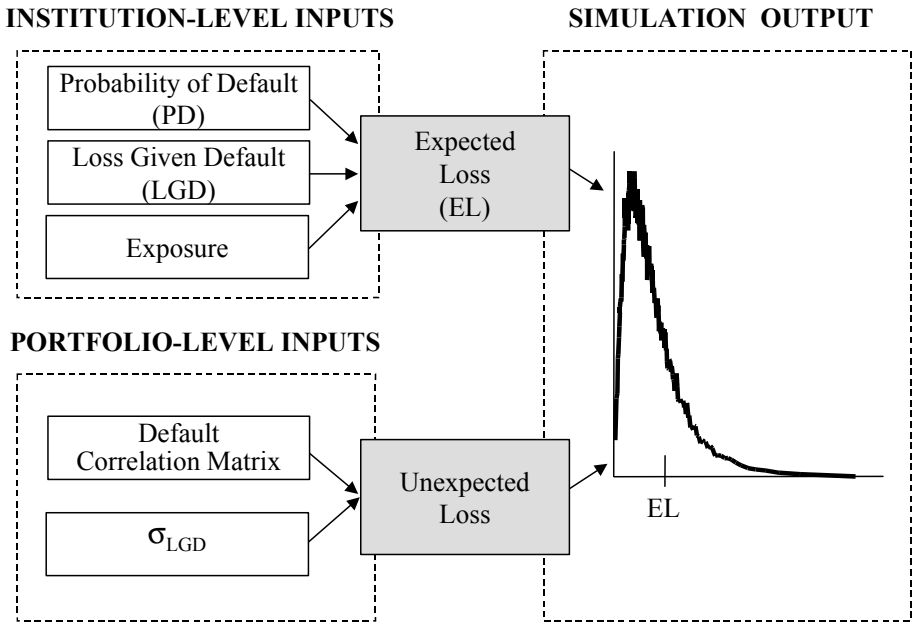
[1] Choices with respect to membership and coverage were made by the MAS prior to Oliver, Wyman & Company's involvement in the project. Given that these decisions were consistent with the objectives put forward for Deposit Insurance (DI) and with international practices, we concurred with these choices, and took them as inputs into the process.

2. *ELEMENTS THAT DETERMINE FUND SIZE*

2.1 Analytical Framework: Fund Adequacy Model

2.1.1 To assess the impact of different structural options on the risk, size, and coverage of the deposit insurance fund, Oliver, Wyman & Company developed an economic model of the deposit insurance system. Given a set of risk and coverage parameters for institutions in the system, the model produces a probability distribution of potential losses that may occur over a one-year horizon.[2] An understanding of the loss distribution is critical for assessing how large the fund needs to be to achieve a target solvency standard, as well as for evaluating the impact of design options such as deposit priority and asset maintenance. The basic architecture of the model is shown in Figure 1:

FIGURE 1: Structure of Fund Adequacy Model



2.1.2 The model uses a Monte Carlo simulation to generate 100,000 runs of hypothetical loss experience for the fund. In each simulation run, the model determines whether or not each institution fails, taking into account the inter-relationship between bank failures by including correlations between defaults. For any institution that fails under a particular run, the corresponding loss given default (LGD) is separately simulated. All the losses that occur across institutions in a given simulation run are added to obtain the loss to the fund in that run.

[2] The majority of outputs of the model discussed are distributions of risk over 1 year. The model also produces multi-year loss paths that are used in the assessment of fund build-up.

Parameterisation

2.1.3 Given that there have been no bank failures in Singapore, there is no historical experience on which to base many of the model parameters. Thus, a number of the parameters for the model need to be estimated based upon experience in other jurisdictions and tailored to the specific structure of Singapore financial institutions. The details of the parameterisation approaches are as follows:

- Exposure – the insured deposit base for each institution is calculated based upon data from a survey of deposits conducted by the MAS in May 2001 and uses a S$20,000 coverage limit per depositor per institution.

- Probability of Default (PD) for each institution – PD is determined from the credit rating of each institution. The ratings are converted to PDs on the basis of historical default experience for each rating category. Long-term deposit ratings from Moody's Investor Services are used where available. Where Moody's deposit ratings are not available, long-term issuer ratings are used. Where no credit ratings are available, the probability of default is estimated based upon the ratings of comparable institutions and rating agency sovereign ratings.

- Expected Loss Given Default (LGD) without insured deposit priority[3] – expected LGD is estimated to range from 9 to 50%. LGD estimates were developed based upon international experience of bank defaults, relying heavily on the experience of the US Federal Deposit Insurance Corporation (FDIC). [4] Because foreign bank branches do not have paid-up capital, the LGD estimates were tailored to the balance sheet structure of each bank. This tailoring takes into account the composition of each institution's assets and deposits.

- Distribution of LGD – all LGDs are modelled as stochastic variables with a mean, or expected LGD (described above) and a standard deviation (σ). The standard deviation has been estimated from the same international benchmarks used for the expected LGD[5].

- Default correlation – default correlations amongst institutions (the fact that if one institution fails, others are more likely to fail at the same time), are incorporated into the Monte Carlo simulation engine.[6] A two-tiered system is

[3] Insured deposit priority is the ranking of insured deposits before other deposits and unsecured creditors in the event of a bank failure (See section 2.3).

[4] FDIC experience is broadly consistent with other G7 default experience and provides the largest sample and most rigorous analysis of actual LGD. Given comparable regulatory, supervisory and accounting regimes as well as the strong capitalisation of Singapore-incorporated institutions, loss experience should be comparable to G7 experience.

[5] The LGD is assumed to follow a beta distribution. This is a standard assumption of credit portfolio models.

[6] Default correlations between two institutions are determined by a simple model of the asset return correlations between them, based on the assumption that default occurs whenever the value of the assets of an institution falls below the value of its liabilities.

used, with a higher correlation between local institutions and a lower correlation between all other institutions.

2.1.4 The same model was used to analyse deposit insurance under two rules of priority for recovery for insured deposits of failed institutions. Under the first rule, reflected above, insured deposits are assumed to be *pari passu* with other deposits. Under the second rule, insured deposits are assumed to have priority over uninsured deposits and other claims in bankruptcy. As discussed in the following section, adopting insured deposit priority has a major impact on LGD. In the model, the LGD approach for insured deposit priority has two components:

- Principal LGD – the Principal LGD is the expected loss when the value of assets in recovery is smaller than the claims of depositors. Principal LGD under insured deposit priority is developed in each simulation using the LGD without insured deposit priority and the ratio of insured to total deposits. For each simulation in which a loss occurs, the LGD for the total deposit base of the failed institution is simulated and compared to the ratio of insured to total deposits. If the LGD is not high enough to impact the insured portion (i.e. the LGD is less than the proportion of uninsured deposits), no losses are incurred. If the LGD exceeds the uninsured proportion, the losses to the insured deposits and the fund are calculated.

- Funding Cost – the scheme will need to pay depositors before it is compensated from the resolution of a failed institution, resulting in a funding cost borne by the fund. This funding cost is assessed separately from the LGD above for the case without insured deposit priority. The funding cost is estimated at 1% of insured deposits based upon the assumptions of a one-year resolution process, resolution of the institution evenly over the year, and a 2% funding cost.[7]

2.2 *Funding: Ex-post versus Ex-ante*

2.2.1 As discussed in sections 2.3-2.5 of the MAS Consultation Paper, a primarily ex-ante funding approach has significant advantages over an ex-post funded scheme. Thus, in general, we concur with the MAS proposal that an ex-ante fund is preferred. The funding approach will be revisited in the section on target fund size to address the specific situation of the proposed scheme.

[7] If a failed institution is resolved over the year, the average outstanding amount to be funded is one half of the total amount paid to depositors. The total funding cost becomes the 2% interest rate times the average outstanding funding 50% of the total amount owed, or 1%.

2.3 Priority of Claims: Insured Deposit Priority

2.3.1 Different jurisdictions accord differing priority to various classes of depositors. Some accord equal priority to all deposits, others place non-bank deposits ahead of inter-bank deposits, and others accord priority to small depositors or the deposit insurance fund.[8] Currently, Singapore does not differentiate between small (or insured) and other depositors. A key decision for the deposit insurance scheme is whether Singapore should alter this priority arrangement to put insured depositors, to the extent of their insured deposits (and thus the deposit insurance fund) ahead of other depositors ["insured deposit priority"]. As discussed below, this decision will impact losses borne by the fund, which will, in turn, drive fund size and cost.

Impact of Insured Deposit Priority on Losses

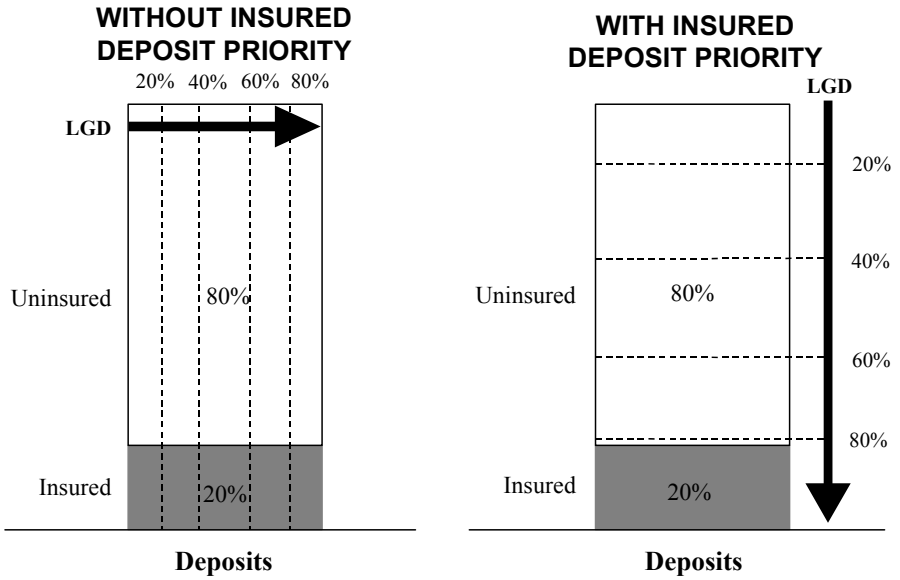
2.3.2 Losses borne by a deposit insurance fund are related to two factors: the probability that institutions in the scheme fail and the losses that the fund will suffer in the event of a failure, or LGD. As described earlier, the LGD consists of principal LGD and funding cost.

2.3.3 In the event of failure, the fund pays insured depositors and becomes subrogated to their claims against the assets of the failed institution. Principal LGD is the loss borne by the fund when the value of the assets in recovery is smaller than the claims of insured depositors. Funding costs are borne when there is a time lag between the payout of insured depositors' claims and the recovery of assets from the failed institution.

2.3.4 The priority of claims in the event of a failure directly affects the losses that different classes of liability holders bear. Claims of higher priority are expected to have higher recoveries on average, vis-à-vis claims of lower priority, as lower priority claims provide a buffer for the higher priority claims. Figure 2 illustrates how insured deposit priority would impact LGD for an institution:

[8] Hong Kong, Switzerland, and the Philippines all accord priority to small depositors or the insurance fund. The IMF cites a number of other jurisdictions as having similar deposit priority measures (Garcia, G.G.H, (2000), "Deposit insurance: actual and good practices." (Washington, DC: International Monetary Fund).

FIGURE 2: LGD of Typical Institution With and Without Insured Deposit Priority



2.3.5 In Figure 2, where all deposits have equal priority (as depicted on the left), losses to deposits cut evenly across insured and uninsured deposits. A 40% overall loss results in a 40% loss for both insured and uninsured deposits. On the other hand, where insured deposits have priority (as depicted on the right), the losses accumulate first to the uninsured deposits, and only when losses exceed 80%, do insured deposits suffer a loss. In the example, a 40% overall loss does not result in any losses to insured deposits[9].

2.3.6 As demonstrated, the impact of giving preference to the insured deposits (and thus the fund) will be to reduce the LGD for those insured deposits. The size of the reduction in loss will be driven by two factors:

- The size of insured deposits with respect to the total deposits of the institution – as insured deposits become a larger portion of total deposits, the 'buffering' effect of uninsured deposits is reduced, subjecting the insured deposits to greater risk.

- The expected loss in the event of failure for the deposit base as a whole – greater risk to the overall deposit base increases the probability that the uninsured 'buffer' will be breached.

In the case of the Singapore scheme, the impact of insured deposit priority will be substantial. The low coverage limit creates a high proportion of uninsured to insured deposits of 3.5 : 1 on average. For there to be a substantial loss to insured deposits, the overall LGD would need to be 78%.

[9] In the example, while the insured deposits suffer no losses, the uninsured deposits' losses increase vis-à-vis the case without insured deposit priority from 40% to 50% (40% loss shared by only 80% of deposits, 40%/80% = 50%).

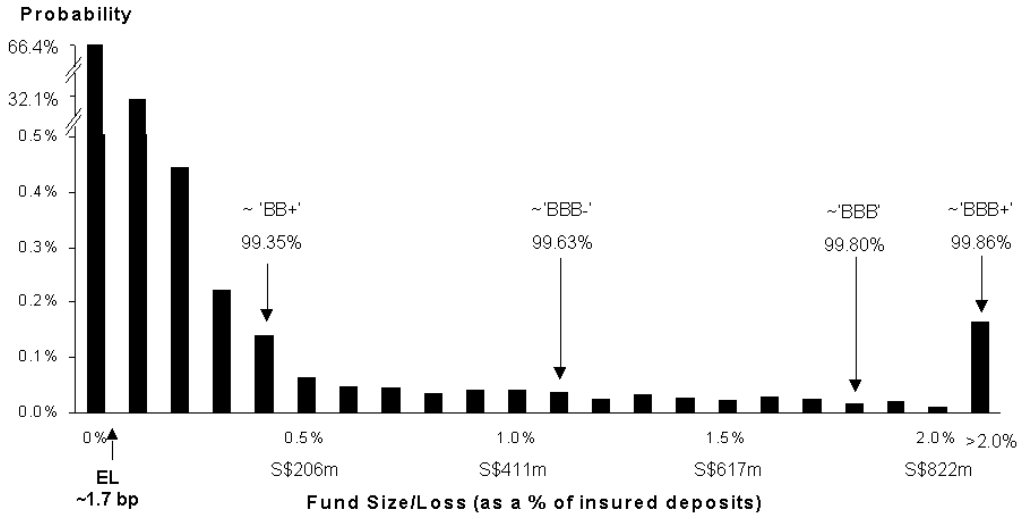
2.3.7 The probability of a loss as great as 78% is extremely low, given that that LGDs of banks are expected to be low on average. Thus, insured deposit priority will reduce the expected LGD for the average institution to a minimal level. For most institutions, the LGD will be driven by the funding cost. For institutions with a higher ratio of insured to total deposits and/or higher expected LGDs, the reduction in expected LGD will be smaller. The principal LGD will still be reduced substantially; however, it will not be driven to a minimal level.

Effect of Insured Deposit Priority on Optimal Fund Size

2.3.8 Using the fund adequacy model, the impact of insured deposit priority on optimal fund size can be assessed. The first step is to evaluate the loss distribution without insured deposit priority.

2.3.9 The loss distribution depicts the modelled losses to the fund over a one-year period. The height of each bar represents the probability or frequency of a loss to the fund within a size 'bucket'.[10]

FIGURE 3: Loss Distribution Without Insured Deposit Priority



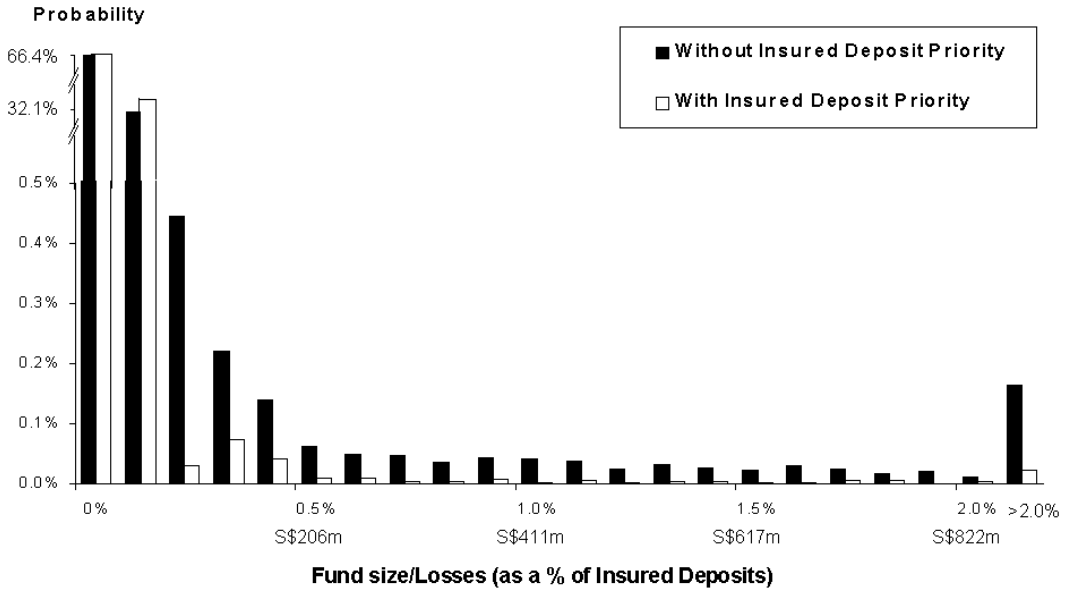
2.3.10 Using the simplest criterion of the fund being investment grade or better, a fund size of 110 basis points (bps) of insured deposits would be required in the absence of insured deposit priority.[11]

2.3.11 With insured depositor priority, the loss distribution changes substantially. The loss distributions with and without insured deposit priority are compared in Figure 4:

[10] Each size 'bucket,' save for the first and the last, represents losses in a 10 basis point (bp) range. I.e., the bucket labelled 0.5% represents losses from 0.4% to 0.5%.

[11] Additional criteria such as the need to cover the failures of medium-sized institutions also would require a fund size of at least 110 bps as medium-sized institutions contribute the bulk of the loss distribution between 50 and 150 bps. It also should be noted that the fund would require a reinsurer or other guarantor to be able to credibly cover the tail losses in excess of 2%.

FIGURE 4: Loss Distribution With and Without Insured Deposit Priority



2.3.12 As expected, the impact of insured deposit priority is a substantially less skewed loss distribution, as the LGD for each occurrence of default without insured deposit priority is reduced substantially.

2.3.13 This comparison of loss distributions confirms a much smaller fund requirement in the case with insured deposit priority than in the case without insured deposit priority. A fund of 30 bps would imply a solvency standard of over 99.9%, the equivalent of an 'A' rating. Without priority, a fund of similar size would have a 99.2% solvency standard, in the neighbourhood of a 'BB' rating and would not have the ability to cover losses caused by failures of medium-sized institutions.

2.3.14 A smaller fund size will translate into substantially lower premiums for deposit insurance, reducing the cost substantially to the institutions. Clearly this is preferable as long as the cost of insured deposit priority is low.

Impact of Insured Deposit Priority on Uninsured Deposits

2.3.15 Insured deposit priority affects the sharing of losses between insured and uninsured deposits. The losses that would have previously been shared by insured and uninsured deposits are now borne only by uninsured deposits. If the impact of this loss transfer on uninsured deposits were large, it might outweigh the advantages that insured deposit priority has on the fund.

2.3.16 The impact of insured deposit priority is related to the size of the shift of losses in the event of a failure from the insured deposits to other deposits. If insured deposits were a large portion of total deposits, this impact would be large. For example, if insured deposits constituted 95% of total deposits, the impact of priority

on the uninsured portion would be to increase LGD from its expected level (10% for the sake of this example) to nearly 100%.

2.3.17 However, as discussed in the previous section, insured deposits typically represent a small proportion of total deposits, and in most cases, LGDs for the total deposit base are low. Thus, across most institutions, the increase in risk will be minimal and the impact on uninsured deposits will be small.

Recommendation 1: Given the goal of keeping costs low while providing substantial coverage, and the small impact of insured deposit priority on other depositors, insured deposit priority should be instituted along with deposit insurance.

2.4 *Asset Maintenance*

2.4.1 If one medium or large institution were to pose a large risk to the fund, a small fund might not be sufficient in the event of failure. In addition, if any bank poses a large risk to the fund, it would create potential for large cross-subsidisation within the fund. While insured deposit priority makes this unlikely, there remains some uncertainty around the LGD, specifically the LGD for foreign branches. Without the assurance that large losses are and will remain unlikely, a small fund would not be possible. If a foreign bank fails, Singapore depositors would be assured of claims only on assets in Singapore.

2.4.2 Clearly, the more assets on which the claims of Singapore depositors will be certain, the lower the expected LGD and the less risk the bank imposes on the fund. Analysis of the balance sheets of foreign bank branches shows that for most foreign bank branches, the ratio of 'safe' assets to insured deposits is quite high and thus the LGDs are quite low. This is why the loss distribution shown in Figure 4 was less skewed than that in Figure 3.

2.4.3 However, while the ratio of assets to insured deposits is high for most foreign bank branches today, it is low for a few of them. In fact, a small number of institutions would contribute some principal loss risk to the loss distribution if the system were implemented today. More importantly, there is no guarantee that institutions that currently have high ratios of assets to liabilities, and thus low LGDs, will maintain them. Thus, a mechanism is needed to ensure that foreign banks maintain a base level of assets to insured deposits that will make certain that they do not pose substantial risk to the fund. Only with the assurance that the fund will not be subject to the potential of large losses, is a small fund possible.

Recommendation 2: An Asset Maintenance (AM) requirement should be established for foreign bank branches. They should be required to maintain a base level of approved assets to insured deposits in Singapore.

Asset Maintenance Details

2.4.4 The AM mechanism will establish a minimum requirement for assets (in relation to insured deposits) that assures that the LGD will be small. The details of the asset maintenance mechanism relate to three questions:

- What types of assets will be available to Singapore depositors in the event of failure and can therefore be counted towards AM?

- For assets that can be relied upon, what would a conservative estimate of their value be at the time of failure?

- What is the level of assets required (given the likely reduction in value prior to failure) to reduce LGD to minimal levels?

Eligible Assets

2.4.5 Due to the likelihood of competing claims from non-Singapore depositors, Singapore depositors can only be certain that they will have first claim on a limited number of asset types. Assets on which Singapore depositors' claims are certain under Singapore law and legal precedent should be permitted for AM and are listed in Recommendation 3 below.

2.4.6 Three classes of assets are excluded although the primary claim upon them is held by Singapore depositors: assets required for minimum liquid assets (MLA) and minimum cash balance (MCB) purposes, securities in Singapore (those not included in the definition of eligible assets), and net interbank placements. Assets counted for MLA/MCB purposes are excluded because counting them towards the AM requirement would negate their use for liquidity purposes. Securities in Singapore are excluded due to their liquidity and ease of transfer. Net interbank assets are excluded as interbank placements may be netted against deposits or placements with the same bank.

Recommendation 3: The following asset types should be counted towards the asset maintenance requirement:

- **Singapore dollar denominated loans and advances to non-bank residents in Singapore, less provisions**
- **Immovable property in Singapore**
- **Core assets <u>less</u> assets used to meet MLA and MCB requirements. Core assets are defined as:**
  - **Singapore dollar notes and coins**
  - **Singapore Government Securities**
  - **Balances with the MAS**

Haircuts

2.4.7 While assets belonging to the eligible asset categories will be available to Singapore depositors, their value at the point of a failure will almost certainly be significantly smaller than their value today. Singapore dollar loans are subject to asset, interest rate and operational risk, which can result in a substantial decline in value, as well as a small amount of risk that the assets may be sold or transferred prior to failure.[12] The main risk associated with immovable property is the volatility of property value. Core assets are liquid; their main risk is that in the event of a solvency crisis, they could be sold and the proceeds used to pay other creditors or simply repatriated (prior to default). In this case, they would not be available to insured depositors.

2.4.8 To account for these risks, a system of haircuts will be used. The haircuts are applied to current asset values to determine the remaining value of assets once a bank has failed. The haircuts were determined upon this basis for each of the asset classes:

TABLE 2: Haircuts on Assets

Asset Type	Haircut	Rationale
Singapore Dollar Loans	35%+/- Depending Upon Portfolio Composition	The base haircut for Singapore dollar loans is the loss on assets that is necessary to produce the LGD on deposits for a typical bank[13] plus a small additional margin to account for the possibility of asset flight.
Property	40%	Reflects 'worst case' potential decline in value of property.[14]
Core Assets	50%	Developed based upon the expectation of the portion of these assets that are likely not to be sold prior to failure. An extremely conservative assumption could have been a 100% haircut, given that these assets are liquid and can be easily sold. Given that prior to the failure of a bank, supervisory action to stem asset outflow will likely be taken by the MAS, a lower haircut of 50% was deemed appropriate.

2.4.9 Differentiation of the haircut for Singapore dollar loans is required because of substantial differences in the risk of different types of loans in this category. The clearest identifiable differentiating factor (given current reporting) between the risk profiles of the Singapore dollar loan portfolios of different institutions is the proportion of the portfolio that is in retail mortgages.

[12] The additional risk that they may be sold prior to failure is low given the low liquidity of loans.
[13] The calculation begins with the base LGD for the bank. The LGD on assets needed to arrive at the bank-wide LGD is equal to the bank-wide LGD plus the capital that the loss would need to exceed before any loss was suffered by deposit holders.
[14] A 40% haircut is consistent with the largest two-year decline in property values.

2.4.10 Retail mortgages are substantially less risky than commercial loans given their low default rates and high collateralisation.[15] Thus, the haircut for Singapore dollar loans will be adjusted to take into account the proportion of retail mortgages to loans. The haircut formula was developed such that for a bank with a proportion of retail mortgages of 30%, the base haircut is 35% and the ratio of risk between retail mortgages and other loans before the additional flight haircut is 1:2. After considering flight risk, this is equivalent to a 25% haircut for retail mortgages and a 40% haircut for other loans. The formula for differentiating the haircut is as follows:

Haircut for Singapore dollar Loans to Residents ("Adjusted Haircut") =
40% - 15% * (Proportion of Retail Mortgages)

2.4.11 The formula for calculating the level of AM or Asset Maintenance ratio ("AM ratio") is as follows:

$$\text{AM Ratio} = \frac{A + B + C}{\text{Insured Deposits}}$$

Where:

A = Singapore dollar loans to Residents * (1- Adjusted Haircut)
B = Immovable Property * 60%
C = Core Assets - MLA/MCB * 50%

Minimum Requirement

2.4.12 In order to ensure that no institution poses too large a risk to the fund (and thus contributes disproportionately to the possibility of an ex-post special assessment), a minimum AM Requirement should be imposed. Given that haircuts were constructed to account for the likely level of diminution in asset value and flight, a ratio of 1 should create the expectation of minimal LGD. While a level of above 1 would be somewhat safer, it would also be more costly and thus, a level of 1 was deemed appropriate.

Recommendation 4: An Asset Maintenance Ratio of at least 1 should be maintained by all foreign branches at all times.

2.4.13 Consistent with the goal of keeping costs low for institutions, the impact of this AM Requirement on foreign banks will be minimal, given current balance sheets. Most institutions exceed the requirement today.

Pledging

2.4.14 Institutions that want to increase their AM ratios should be allowed to voluntarily pledge assets to the fund. Given that the pledged assets cannot be sold

[15] Both BIS I and BIS II require lower capital for mortgage loans vis-à-vis other loan categories. BIS I required capital of 4% for residential mortgages versus 8% for most loans.

without prior approval, their availability to depositors in the event of failure would be significantly more secure than that of assets that are not pledged. Thus, pledged assets should only require haircuts related to potential volatility in their value.

2.4.15 For institutions seeking to meet the AM requirement, voluntary pledging provides a lower cost alternative to meeting the AM requirement compared to purchasing or booking new assets. From the perspective of the fund, pledging decreases risk, as pledged assets are more certain to be available than other assets, even with significant haircuts.

Recommendation 5: To increase their AM Ratios, banks should be allowed to voluntarily pledge assets to the fund.

2.4.16 The assets that will be eligible for pledging are marketable securities and other core assets. Non-marketable securities and loans are excluded due to the difficulty of properly assessing their value. Assets should be pledged at current market value with haircuts reflecting the asset risk. The proposed haircuts were developed to be consistent with bank practices for assets pledged as collateral.

Recommendation 6: Institutions should be allowed to pledge the following types of marketable securities. The market value of pledged securities should be subject to the following haircuts when pledged:

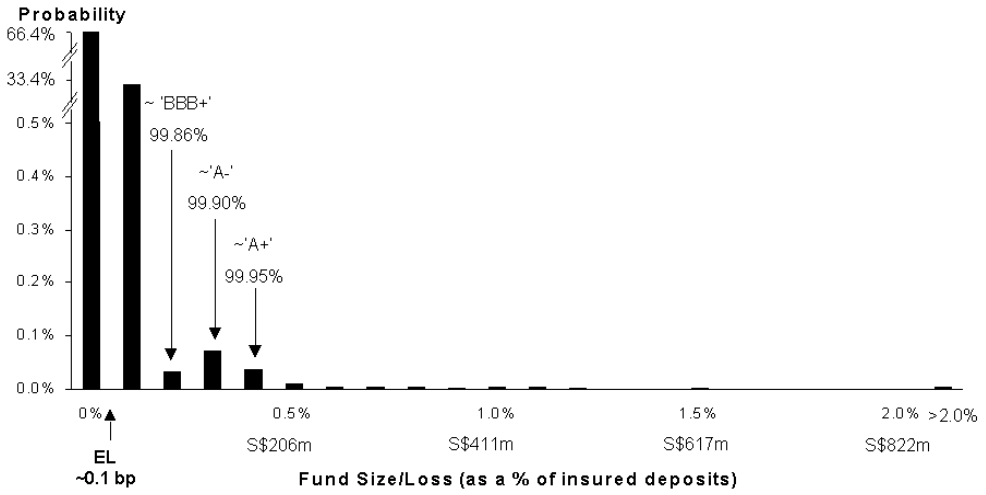
- **Core assets not used to meet MLA and MCB 5%**
- **Public Securities of Statutory Authorities of Singapore 10%**
- **Equity investments in Singapore-listed companies 50%**
- **Treasury Bills and other securities of other governments 35%**
- **Equity investments in companies listed outside Singapore 65%**

2.5 Target Fund Size

2.5.1 With insured deposit priority and AM, the loss distribution of the fund can be assessed to determine the optimal fund size. Given priority and AM[16], the loss distribution is as follows:

[16] For banks that currently do not meet the asset maintenance requirement, the LGD assumptions are set consistent with an AM Ratio of 1.

FIGURE 5: Loss Distribution With AM and Insured Deposit Priority



2.5.2 The corresponding solvency standards of different fund sizes are compared in Table 3.

TABLE 3: Fund Size and Implied Solvency Standard

Fund Size (in bps)	Current Implied Solvency Standard
10	99.81%
20	99.84%
30	99.91%
40	99.95%

2.5.3 Since the distribution of losses is less skewed than in the case without insured deposit priority, the choice between ex-post and ex-ante funding requires reconsideration. The low level of expected losses reduces the procyclicality of ex-post funding. In addition, a small fund size reduces the ability of an ex-ante fund to provide substantive liquidity. However, an ex-ante fund still has significant advantages:

- Increased stability through increased fund credibility and depositor confidence
- Perception of fairness– institutions that fail would have contributed to the fund
- Institutions pay for fund in good times, before problems occur
- Liquidity available for small losses
- Allows institutions to budget costs

Recommendation 7: A primarily ex-ante funding mechanism should be used for deposit insurance.

2.5.4 The target fund size needs to meet three key criteria:

- The solvency standard is high enough for fund to be credible.
- The fund can credibly cover losses of institutions of all sizes.
- The size of the fund is credible in comparison to other size benchmarks.

2.5.5 A fund of 30 bps of insured deposits will successfully meet each of these criteria:

- The solvency standard is greater than 99.9% and equivalent to 'A-.'
- The fund can credibly cover losses of institutions of all sizes given the low LGDs implied by insured deposit priority and AM requirement.
- While a 30 bp fund is on the small end of target fund sizes internationally, insured deposit priority and the AM requirement make a 30 bp fund sufficient and credible.
- The implied dollar size of the fund of over S$120m (based upon the current insured deposit base) should be credible to depositors.

2.5.6 As the composition of the balance sheets and riskiness of institutions may change (and worsen) over time, potential changes should be considered in the evaluation of fund size. Table 4 shows a comparison between the current solvency standard and a 'stress test' solvency standard, where the level of insured to total deposits rises and the likelihood of failure of all institutions increases. The stress test shows the impact of a 50% increase in the size of insured deposits and an across-the-board half-notch rating downgrade.

TABLE 4: Stress Test Results

Fund Size (in bps)	Current Implied Solvency Standard	Stress Test Implied Solvency Standard
10	99.81%	99.55%
20	99.84%	99.62%
30	99.91%	99.75%
40	99.95%	99.80%

2.5.7 A fund of 30 bps would still have a high solvency standard under these stress conditions (slightly worse than a 'BBB' level), while a somewhat smaller fund would suffer a larger decline in the solvency standard. Therefore, a 30 bp fund is prudent given potential changes in the structure of the financial sector.[17]

Recommendation 8: The target fund size should be 30 bps of insured deposits.

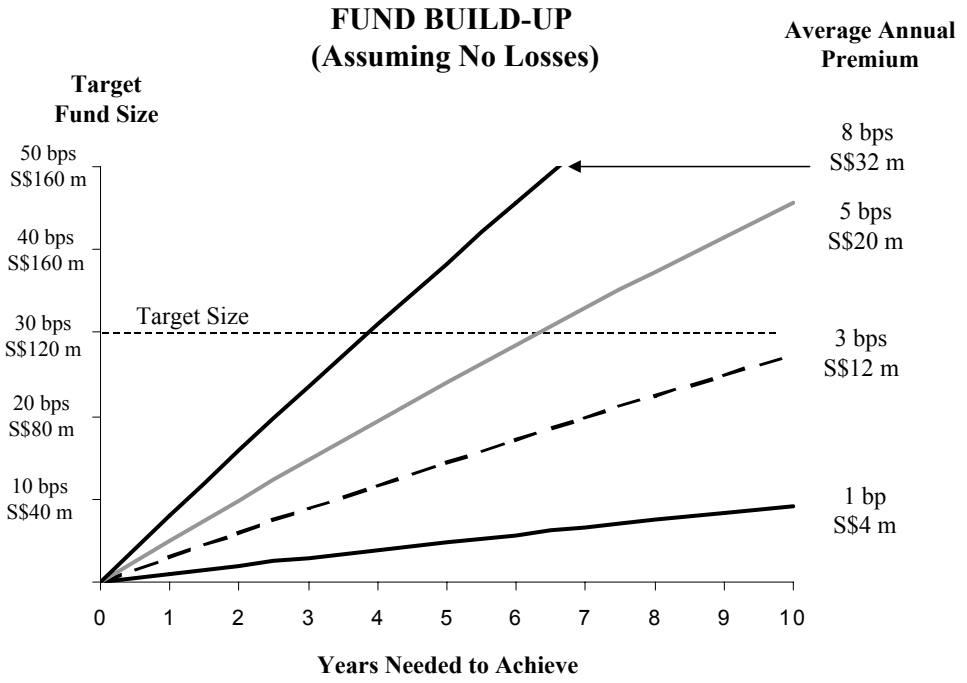
[17] Other stress tests confirm this finding.

3. PRICING AND LIQUIDITY

3.1 Fund Build-Up and Required Pricing

3.1.1 Given a target fund size of 30 bps, the build-up period and required pricing during that period must be chosen in tandem. The decision requires a trade-off between cost per annum and time required to achieve the fund target. Figure 6 shows a few possible options:

FIGURE 6: Average Premium Over Duration of Fund Build-up



3.1.2 A longer build-up period with lower premiums is consistent with the goal of keeping costs low. A potential drawback to a longer build-up is that the fund could be put into deficit by a loss in the early years (given that the fund does not build up quickly). While the fund will be relatively small in the early years, the fund adequacy model shows that the fund still only has a 1% chance of going into deficit during the build-up. Thus, the longer build-up period will not create significant risk to the solvency of the fund over that period.

Recommendation 9: To keep prices low, the average annual premium should be 3 bps of insured deposits over a 10-11 year build-up period.

3.2 Risk-based Pricing

3.2.1 As discussed in section 2.15 of the MAS Consultation Paper, there are two typical approaches for setting premiums for deposit insurance: uniform and risk-based. The main advantage of uniform premium assessment is that it is simple. However, uniform pricing results in cross-subsidisation between the safest and riskiest institutions in the deposit insurance system. Additionally, uniform

premiums do little to reduce moral hazard or set incentives to reduce risk to the fund.

3.2.2 Risk-based pricing mitigates both the cross-subsidisation and moral hazard issues while setting financial incentives to reduce risk to the scheme.

Recommendation 10: Risk-based pricing should be preferred to uniform pricing.

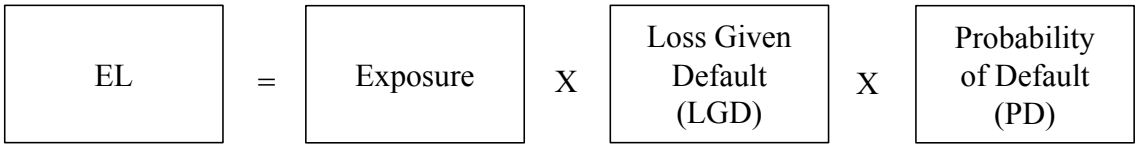
3.2.3 Given the goal of risk-based pricing and the target average premium of 3 bps, the key question is how to levy premiums across institutions in order to achieve the 3 bps average price. Specifically, decisions are required on four issues:

- Overall methodology for pricing
- Base for premium assessment
- Risk factors to be considered in differentiating premiums
- Premium schedule

Pricing to Risk

3.2.4 The first step in determining the risk-based pricing structure is to define risk. The risk to the fund is the expected loss that each bank poses to the fund.[18] The basic equation for expected loss is as follows:

FIGURE 7: Calculation of Expected Loss (EL)



3.2.5 In defining the risk-based pricing structure, the factors used in the pricing approach should relate to the size of the exposure, the probability of default of the institution, and loss given default.

3.2.6 It is important to note that during the build-up stage (and to a lesser extent thereafter[19]), pricing will be higher than expected loss. Thus, pricing will not be set to match expected loss, but rather premium rates among banks will be set in relation to relative differences in expected loss across those institutions.

Assessment Base: Exposure

3.2.7 The exposure to the fund posed by any bank is related to the insured deposit base of that institution. Losses incurred by the fund will be driven by the size of the insured deposit base and the LGD.

[18] While other measures of risk that incorporate volatility are possible, the expected loss approach is consistent with a view of actuarially fair pricing.

[19] If the growth of insured deposits exceeds the rate of return on the fund, the premiums will need to grow in line with this difference, implying greater than EL pricing.

3.2.8 Some countries use total deposits as the premium assessment base for their deposit insurance schemes because this is administratively easier to calculate. However, given that insured deposit base is a better measure of exposure and that the size of the insured deposit base can be assessed through reporting requirements, the insured deposit base should be used.

Recommendation 11: The insured deposit base should be used as the premium assessment base for deposit insurance pricing.

Factors for Differentiating Risk

3.2.9 To determine the factors that go into the risk-based pricing approach, two questions must be answered:

- What are the key drivers of PD and LGD under the scheme?
- What means will be available to the scheme to assess these drivers?

3.2.10 Based upon insights from the fund modelling and asset maintenance analyses, two factors would be appropriate: a 'rating' factor that focuses on probability of default (but may include elements of LGD) and an asset coverage factor (the AM ratio) that assesses differences in LGD due to the level of available assets over insured deposits.

Rating Factor

3.2.11 A risk 'rating' process typically uses quantitative models or qualitative approaches to assess the likelihood of loss, taking as inputs contributing factors to solvency risk. The process produces a 'rating' that can then be calibrated to the probability of default or expected loss for the institution. Credit agency ratings, model based ratings and supervisory ratings are all examples of ratings approaches.

3.2.12 In the context of risk-based pricing for deposit insurance, each of the potential approaches listed above was considered. MAS supervisory assessments are preferred to either of the other two approaches. The MAS has better insights into the institutions' operations in Singapore and incorporates publicly available information, such as credit agency ratings, into its assessments. In addition, supervisory assessments can cover all institutions while credit rating agencies do not provide universal coverage. [20]

3.2.13 The MAS is in the process of refining its supervisory rating process. In line with similar systems in other countries, the ratings will incorporate assessments of capital and earnings (for locally incorporated banks), strength of parent support (for branches of foreign entities), as well as other supervisory considerations. Once they

[20] Model-based approaches were also considered and rejected. Model-based approaches work poorly for financial institutions (especially in Singapore) due to issues of comparability; specifically, comparisons are problematic given business and geographical mix differences, and variations in the accounting standards in the home country of institutions.

are refined, supervisory ratings will be one of the two dimensions in the risk-based pricing schedule.

Asset Maintenance Factor

3.2.14 As previously noted, for LGD there are two separate risks: the risk of principal loss and the funding cost. In the event of any failure, there will (in almost all cases) be a funding cost as the depositors are paid immediately and recoveries only occur as the value of the assets is realised through the recovery process. This funding cost is likely to be consistent across institutions. The principal loss, the chance that the value of assets is insufficient to cover insured deposits, will not.

3.2.15 As discussed in the section on AM, the key differentiating factor in the principal loss is the level of assets to insured deposits that will be available to Singapore depositors. For a foreign bank branch, the minimum AM requirement creates the expectation that there will be no principal loss, but does not assure this. The higher the AM ratio, the higher a total loss must be to impact the insured deposits. Thus, the AM ratio is a determinant of risk and will be used to differentiate risk for foreign bank branches.

3.2.16 The foreign bank branches are divided into categories of high, medium and low AM ratios according to levels of relative risk. The thresholds for the categories reflect the level of principal risk imposed upon the system. The threshold for the high AM category was set such that the likelihood of loss would be comparable to that of Singapore-incorporated institutions. The cut-off between the low and medium categories was chosen at the point at which a substantive probability of principal loss arises. The cut-offs chosen are as follows:

TABLE 5: Definition of Asset Maintenance Categories

CATEGORY	ASSET MAINTENANCE RATIO
HIGH	5:1 +
MEDIUM	2:1 to 5:1
LOW	1:1 to 2:1

Recommendation 12: The two factors used in the pricing schedule will be supervisory ratings and the AM Ratios.

3.2.17 The corresponding pricing schedule[21] is shown in Table 6.

TABLE 6: Pricing Schedule

SUPERVISORY RATINGS	SINGAPORE-INCORPORATED INSTITUTIONS/ HIGH AM BRANCHES	MEDIUM AM BRANCHES	LOW AM BRANCHES
HIGH			
MEDIUM			
LOW			

Premium Schedule: Level of Differentiation

3.2.18 Given the pricing dimensions described in the previous section, and the goal of 3 bps average pricing, the final step is to assess the relationships between each cell within the grid. To do so, it is necessary to assess the risk relationship between both the rows and columns of the pricing grid:

- Relationships between supervisory rating categories – the relationships between supervisory ratings are set based upon the implied probability of default of institutions within each rating. The implied probabilities of default are found through establishing the relationship between supervisory ratings and credit ratings.

- Relationship between high, medium and low AM Ratios – the relationship is based upon an assessment of the increased risk of LGD within the three categories. The relative LGDs are assessed using the basic LGD parameters and volatilities described in section 2.1.

3.2.19 The relationships developed through this exercise are then used to create the pricing schedule. The premium rates in the schedule are capped at 30 bps, which was considered to be the maximum feasible premium level. Given the current supervisory ratings, the following pricing schedule is constructed:

TABLE 7: Pricing Schedule (bps)

SUPERVISORY RATINGS	SINGAPORE-INCORPORATED INSTITUTIONS/ HIGH AM BRANCHES	MEDIUM AM BRANCHES	LOW AM BRANCHES
HIGH	2.5	4	7
MEDIUM	5	7	15
LOW	25	30	30

[21] In all of the indicative pricing schedules shown, a higher supervisory rating indicates lower risk.

3.2.20 The pricing grid shown in Table 7 was developed based upon today's supervisory ratings. Refinements to the supervisory rating process are likely to impact the number of rating categories, the 'riskiness' implied by each category, and the assessments of each institution. While the logic for the level of differentiation will not be affected, the level of differentiation between the cells in the grid may change. Thus, the pricing schedules shown are indicative of how the final schedules may look.

Interim Pricing Approach

3.2.21 It is critical that risk is measured accurately for risk-based pricing to be successfully implemented, as otherwise, risk-based pricing would not reduce moral hazard or provide incentives, and would be unfair across institutions. While supervisory ratings are being refined, an interim pricing approach is required. In the interim, the pricing will be related only to the AM ratio dimension of the proposed pricing schedule. The proposed schedule is as follows:

TABLE 8: Interim Pricing Schedule (bps)

SINGAPORE-INCORPORATED INSTITUTIONS/ HIGH AM BRANCHES	MEDIUM AM BRANCHES	LOW AM BRANCHES
3	4	8

Recommendation 13: An interim pricing schedule that differentiates only on the basis of AM ratio (and place of incorporation) should be used until the full risk-based approach is implemented.

Steady-state

3.2.22 Once the fund has reached the target size of 30 bps, the required level of pricing to achieve/maintain the fund at 30 bps drops substantially (given minimal or no losses to the fund). The premiums need to cover the expected growth of the insured deposit base (plus administrative costs) in excess of returns earned by investments of the fund. The required pricing should be around 0.5 bps on average, and should continue to be risk-based.[22]

[22] Assuming a 5% expected growth in insured deposits, an expected return of 3% on fund investments and relatively small administrative costs, the required premiums would need to be 2% of the fund size (of 30 bps) or 0.6 bps. Thus, once the target is achieved, the average price can be reduced by 80%, from 3 bps to 0.6 bps.

3.2.23 To minimise the potential for free-riding and cross-subsidisation, should there be new entrants to the deposit insurance scheme after the fund has been built-up, the new entrants should be charged a higher premium. New-entrant pricing should be consistent with the prices charged to institutions during the build-up period.

Recommendation 14: Steady-state pricing should be set significantly lower than build-up pricing and should continue to be differentiated across institutions.

Ex-post Pricing

3.2.24 While the expectation is that it is extremely unlikely that there would be a loss greater than the size of the fund (once it reaches the target), there remains the possibility of such a loss. In the event of such a loss, the scheme will need the ability to increase premium rates.

3.2.25 Thus, the fund will be given the discretion to charge premiums in excess of build-up levels to recapitalise the fund. The per annum ex-post rate should be capped at 30 bps (consistent with the cap used in the indicative pricing schedule), to ensure that it does not impose an unreasonable burden on institutions.

3.3 Liquidity

3.3.1 In the event of failure, there might be a need for liquidity if the size of the failed institution's insured deposit base were larger than the fund. Liquidity for the fund needs to be arranged ex-ante because the fund will need to pay insured depositors quickly; it is unlikely that a liquidity facility can be arranged at the time of failure. Without liquidity, the fund would not be able to provide credible coverage for, or timely payment to, depositors in the event of a failure.

3.3.2 Both the private sector and government could provide liquidity to the fund. A privately funded option, (e.g. a facility provided by a consortium of banks), will be considered if it can be achieved at a reasonable price. In the event of a large bank failure however, it is possible that the remaining banks may be unable to provide sufficient liquidity. The MAS may need to be the liquidity-provider at least on a backstop basis.

4. SUMMARY OF RECOMMENDATIONS

TABLE 9: Summary of Recommendations

ELEMENT	APPROACH
Membership and Coverage	• Mandatory membership for Full Banks and finance companies • S$20,000 • Singapore dollar deposits held by individuals
Funding	• Primarily ex-ante funding
Deposit Priority	• Insured deposits given priority ahead of other deposits
Asset Maintenance	• Requirement for foreign branches to maintain ratio of approved assets (post-haircut) to insured deposits of at least 1:1 • Average haircuts for Singapore dollar loans of 35% (adjusted for retail mortgages), 40% for property, and 50% for core assets • Marketable assets can be pledged on a voluntary basis reducing haircut substantially
Target Fund Size	• 30 basis points of total insured deposits
Fund Build-up	• Fund built up over 10-11 years with 3 bps average pricing
Pricing Approach	• Risk-based pricing
Premium Assessment Base	• Insured deposits
Risk Bucketing	• Grid approach with AM ratio and supervisory ratings
Pricing	• Build-up pricing beginning at 2.5 bps, average 3 bps • Significantly lower steady-state risk-based pricing • Interim approach while ratings are refined using only AM Ratio • Ex-post pricing contingency
Liquidity	• A private liquidity option should be explored for smaller losses • MAS may need to provide backstop liquidity