

**THE BERMUDA MONETARY AUTHORITY**

**THE ASSESSMENT AND MEASUREMENT OF  
CAPITAL ADEQUACY:**

**BANKS AND DEPOSIT COMPANIES**

August 2006

## **Introduction**

- 1 The requirement that licensed entities should have sufficient capital to support the risks inherent in their business is one of the licensing criteria under the Banks and Deposit Companies Act 1999. The setting and monitoring of firms' capital adequacy standards represents a key element in the framework of prudential controls that is in place to help protect depositors. Capital needs to provide a firm cushion against the losses to which institutions may become exposed as a result of the risks in their business.
- 2 This paper sets out the framework applied by the Bermuda Monetary Authority ("the Authority") in calculating an institution's capital adequacy for supervisory purposes. Capital adequacy involves an assessment of the relationship between an institution's capital base (as defined hereunder) and the total of its assets (on-and off-balance sheet). The Authority sets a capital ratio for each institution, representing the minimum level of capital relative to the institution's positions and risks that it judges acceptable, having regard to the nature and scale of the business, together with the strength of the systems, controls and management resources available to mitigate these risks.

## **General Approach**

- 3 The Authority's approach to the assessment and measurement of capital is consistent with the standards developed by the Basel Committee on Banking Supervision ('the Basel Committee'). In determining capital adequacy, regard is given to all the risks in an institution's business, including in relation to credit risks, market risks and those deriving from foreign exchange, commodities and derivatives positions. A number of different approaches to the detailed measurement of capital may apply, having regard to the nature, scope and balance of the business that is undertaken. For most institutions, the traditional credit-risk based approach involving weighted risk-assets - originally established by the Basel Capital Accord of July 1988 - remains appropriate and will continue to apply until the Authority completes its implementation of the revised framework approved by the Basel Committee in June 2004 ('the Basel 2 framework'). The relevant weighting categories for risk assets are set out in Appendix 1, attached. For the time being, pending introduction of the Basel 2 framework, all banks in Bermuda are required to maintain an 8% ratio at solo level, and 10% on a consolidated basis.
- 4 Where institutions are subject to material risk of losses in on- and off-balance sheet positions arising from movements in market prices ('market risk') they are required to apply the traded market risk framework, enabling the necessary capital cover for the quantum of risks to which they are exposed to be calculated more precisely. In this case, the total amount of regulatory capital comprises the total requirement in relation to credit risk (excluding risks arising from the trading book) plus the requirements for trading book business, together with the capital requirement for the totality of the foreign exchange and commodity derivatives risk, calculated in accordance with Appendix 3 of this paper. The sum of the capital charges calculated under Appendix 3 is multiplied by 12.5 to provide a quantum of trading book notional risk-weighted assets, added to the

total of weighted risk assets arising from the banking book and assessed against the minimum capital ratio set for the institution.

- 5 Institutions need to assess and monitor the scale of their exposure to market risk. This involves the allocation of business between 'banking book' and 'trading book' risks. The definition of the trading book is set out in Appendix 2, together with an explanation of the methodology for calculating its relative importance within an institution's overall book of business. Where an institution's trading book does not normally exceed 5% of its total business (i.e. the ratio calculated in paragraph 8 of Appendix 2 does not normally exceed 5%), it is not required to calculate and report separately its market risks for capital adequacy purposes. Instead, it may continue to calculate and report capital adequacy on the basis of the standard credit risk approach. Where an institution's trading book exceeds 6% of business at any time, the Authority will normally require it to move to full market risk reporting and capital calculation. The Authority reviews regularly with each institution the nature and scope of its trading book business and the continuing appropriateness of the reporting framework that has been applying to it. Institutions need to keep the extent of their market risks under regular review; where the Authority identifies any risk that the nature of business may result in exposure to market risk exceeding de minimis levels, it will agree with the institution concerned arrangements for monitoring and reporting such levels on a periodic basis to enable the situation to be tracked.
- 6 The Authority sets and monitors capital adequacy on both a consolidated and unconsolidated ('solo') basis. Its approach to consolidated supervision is set out in its policy paper 'The BMA's Approach to Consolidated Supervision'. In particular, the Authority takes a broad approach, normally including banking, securities and other relevant financial activities on the basis of a full accounting (or where particular criteria are met, 'pro-rata') basis. Consistent with the Basel framework, the Authority seeks to ensure that, as far as practicable, equivalent business is subject to consistent treatment for capital adequacy purposes whether the positions are held on a principal basis within a deposit-taking institution or an investment firm. Insurance entities are not normally included within consolidation and institutions' equity or other regulatory capital investments in such entities are deducted in measuring regulatory capital. Where the trading book of a banking group as a whole exceeds the de minimis threshold, individual licensed banking subsidiaries which are individually below the threshold, may seek the Authority's approval to remain exempt from trading book capital requirements at the solo level. Where the effect seems likely to be minimal in terms of the resulting capital ratios, the Authority will normally take a pragmatic view. In calculating market risks, where particular positions within different licensed entities within a banking group are managed on a global basis, the Authority is prepared to give consent for offsetting to apply.

## **The Definition of Regulatory Capital**

- 7 For regulatory purposes, capital is split into two main categories: Tier 1 (or “core capital”), and Tier 2 capital (which is itself split into an upper and a lower tier, and is subject to limits). In addition, shorter-term Tier 3 capital may be employed, again subject to limits, but only to provide cover for capital requirements arising from the trading book. The specific requirements are as set out below:

### **Tier 1 capital**

- 8 In order to rank as Tier 1, capital must be fully paid up, have no fixed servicing or dividend costs attached to it, and be freely available to absorb losses ahead of general creditors. Capital also needs to have a very high degree of permanence if it is to be treated as Tier 1.
- 9 Tier 1 capital consists of:
- (a) Permanent share capital – issued, allotted, and fully paid ordinary share capital, together with any perpetual non-cumulative preference shares;
  - (b) General and other reserves created by appropriations of retained earnings, share premiums and other surpluses;
  - (c) Retained profit and loss arising during the current financial year, where verified by an institution’s external auditors; and
  - (d) Minority interests arising from consolidation in permanent shareholders’ equity.
- 10 However, a number of deductions are made from Tier 1, in calculating a bank’s capital base:
- (a) Any holdings of own shares;
  - (b) Goodwill and other intangible assets; and
  - (c) Any unpublished net losses in the current financial year.

### **Tier 2 capital**

- 11 Tier 2 or supplementary capital consists of:
- (a) Reserves arising from the revaluation of tangible fixed assets and fixed asset investments;
  - (b) Fully paid shareholders’ equity issued after 1 January 1992 by the capitalisation of property reserves;
  - (c) General provisions (but cannot exceed 1.25% of the sum of risk weighted assets in the banking book and notional risk weighted assets in the trading book)

- (d) A maximum of 55% of net unrealized gains from the fair valuation of equities held in the “available for sale” financial assets category and any unrealized gains on investment property may be included in Supplementary Capital subject to the Authority’s express approval<sup>1</sup>;
- (e) Minority interests in Tier 2 preferred shares;
- (f) Hybrid capital instruments<sup>2</sup>, being perpetual cumulative preference shares and certain perpetual subordinated debt (as defined in paragraph 12 below); and
- (g) Qualifying subordinated term debt, including dated preference shares.

Items (a) to (f) represent Upper Tier 2 elements; and item (g) is Lower Tier 2.

### **Conditions for Upper Tier 2 subordinated debt**

- 12 In order to qualify as Upper Tier 2, subordinated debt needs to meet a number of specific conditions in addition to meeting the general conditions for subordinated debt set out in paragraph 15 below.
- (a) Specifically, the debt must be perpetual i.e. undated;
  - (b) No repayment may be made without the prior consent of the Authority which would only be given provided the Authority was fully satisfied that capital was likely to remain adequate after the repayment;
  - (c) The debt agreement must also provide for the institution to have the option to defer any interest payment on the debt; and
  - (d) The debt agreement must provide for the debt and unpaid interest to be able to absorb losses, while leaving the institution able to continue trading. (This can be achieved either by providing for automatic conversion of the perpetual debt into share capital or by providing specifically for the principal and interest to absorb losses where the institution would not otherwise be solvent, with the subordinated creditors being treated as if they were holders of a specified class of share capital in any liquidation).

### **Lower Tier 2 capital**

- 13 Elements eligible for inclusion in Lower Tier 2 are:

- (a) Dated cumulative preference shares;
- (b) Perpetual subordinated debt not qualifying as a hybrid capital instrument; or
- (c) Subordinated term (as defined in paragraph 14 below).

In the case of subordinated term debt, the Authority applies straight-line amortisation of 20% per annum to the amount of the debt counted as capital during the final four years of its life.

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<sup>1</sup> Any net unrealized gains on debt securities in the available for sale category should be excluded

<sup>2</sup> Hybrid capital instruments combine the features of debt and equity in that, although structured like debt, they provide certain of the loss absorption and funding flexibility features of equity.

### **Conditions for Lower Tier 2 subordinated term debt**

- 14 In order to qualify for inclusion in the capital base, subordinated term debt needs to meet a number of requirements:
- (a) It must have a minimum original term to maturity of five years.
  - (b) It must be fully paid up;
  - (c) The terms of the agreement must ensure that the claims of the lender are fully subordinated to (i.e. rank behind) those of the unsubordinated creditors;
  - (d) To the fullest extent possible creditors must waive their right to set off any amounts they owe the borrowing institution against subordinated amounts owed to them by the borrowing institution;
  - (e) The only events of default should be non-payment of any amount due and payable under the debt agreement or the winding up of the institution;
  - (f) The only remedies available to the subordinated creditor in the event of default on the subordinated debt should be limited to petitioning for the winding up of the institution; and proving for its debt and claiming in the liquidation;
  - (g) The debt agreement must not contain any clause which might require early repayment of the debt (e.g. cross-default clauses, negative pledges and restrictive covenants) or interest step-up clauses making the debt more expensive in given circumstances; and
  - (h) No early repayment can be made without the Authority's prior consent.

### **Deductions from Tiers 1 and 2**

- 15 A number of deductions are then made from the total of Tier 1 and Tier 2 capital (after Tier 1 deductions outlined in paragraph 10) in determining the regulatory capital base:
- (a) Investments in subsidiaries and associates (including all investments in insurance entities<sup>3</sup> and commercial entities, unless approved by the Authority as non-material);
  - (b) Related party lending of a capital nature<sup>4</sup>; and
  - (c) Holdings of capital instruments issued by other banks and investment firms (to avoid double-gearing).

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<sup>3</sup> For this purpose, insurance entities include only companies in the business of effecting or carrying out insurance contracts.

<sup>4</sup> Exposures to parties related to the licensed institution are reviewed case by case. Where exposures are (either contractually or in practice) long-term in nature, the Authority will review whether or not they should be regarded as being in the nature of capital (i.e. as providing a source of stable long-term funding for the borrower in circumstances in which equivalent alternative funding might be difficult to find). Such exposures will be deducted in calculating regulatory capital unless the Authority can be satisfied that exposures are genuinely short-term in nature or are capable of being readily refinanced on commercial terms. Refer to the capital adequacy guidance notes for definition of related parties.

**Conditions for Tier 3 (Shorter Term) Capital**

- 16 Tier 3 capital must meet the requirements set out in paragraph 14 above for subordinated term debt, except that its initial maturity need not exceed two years and that neither the principal nor interest may be repaid if the effect of such payment would be to leave the institution with less capital than the total required under the Authority's overall capital requirements. However, shorter term debt is not subject to the amortization provisions applying to Tier 2 subordinated term debt. Moreover, where adequate levels of alternative capital are in place, the Authority permits the repayment of such debt on request.

**Other requirements for subordinated debt.**

- 17 Prior to issuing Tier 2 or Tier 3 subordinated debt, institutions should ensure they have taken legal advice as to the effectiveness of the subordination provisions and to obtain assurance that the Authority's conditions have been fully met. Institutions should also write to confirm to the Authority that no early repayment will be made without the Authority's prior written consent; lenders should also be made fully aware of the restrictions on early repayment.
- 18 The Authority would expect that all debt agreements would be governed by and subject to Bermuda Law.

**Limits applying to the capital tiers**

- 19 Because of the lesser level of protection offered to depositors by the elements of Tier 2 and Tier 3 capital, certain restrictions apply to the proportion of capital which they may represent, as follows:
- (a) Total Tier 2 capital used to meet banking book requirements is limited to 100% of the Tier 1 capital used to meet these requirements;
  - (b) Eligible Tier 2 subordinated term debt is limited to 50% of total Tier 1 capital; and
  - (c) Tier 3 capital is limited to 150% of the amount of Tier 1 capital available to meet the trading book requirement.

Any surplus subordinated debt is disregarded in calculating an institution's capital base and treated as part of its long-term funding.

## **Appendix 1**

### **Banking Book: Risk Weight Categories for Capital Adequacy Measurement**

- 1 Banks assets (on and off-balance) sheet are weighted for capital adequacy purposes according to the schedule set out below.

#### **Zero weighting**

- (i) Cash and claims collateralised by cash deposits placed with the lending institution (or Certificates of Deposit (CDs) and similar instruments issued by and lodged with the reporting institution);
- (ii) Gold and other bullion or physical commodities held directly or on an allocated basis;
- (iii) Claims on Zone A<sup>1</sup> central governments and central banks;
- (iv) Claims carrying the explicit guarantee of Zone A central governments or central banks;
- (v) Claims on Zone B<sup>2</sup> central governments or central banks denominated in the local currency and funded by liabilities in the same currency;
- (vi) Claims guaranteed by Zone B central governments or central banks denominated in local currency and funded in that currency; and
- (vii) Certificates of tax deposit.

#### **10% weighting**

- (i) Holdings of fixed interest securities issued or guaranteed by Zone A central governments with a residual maturity of 1 year or less, and floating rate and index-linked securities of any maturity issued or guaranteed by Zone A central governments;
- (ii) Claims collateralised by Zone A central government fixed interest securities with a maturity of 1 year or less, and similar floating rate or index-linked securities of any maturity; and
- (iii) Holdings of securities issued by Zone B central governments with a residual maturity of 1 year or less and denominated in local currency and funded by liabilities in the same currency.

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<sup>1</sup> Refer to Capital Adequacy Guidance notes for list of countries.

<sup>2</sup> Refer to Capital Adequacy Guidance notes for guidance.

**20% weighting**

- (i) Holdings of fixed interest securities issued or guaranteed by Zone A central governments with a residual maturity of over 1 year;
- (ii) Claims collateralised by Zone A central government fixed interest securities with a residual maturity of over 1 year;
- (iii) Holdings of Zone B central government securities with a maturity of over 1 year denominated in local currency and funded by liabilities in the same currency;
- (iv) Claims on multilateral development banks and claims guaranteed by or collateralised by securities issued by these institutions – comprising: African Development Bank; Asian Development Bank; Caribbean Development Bank; European Bank for Reconstruction and Development; European Investment Bank; European Investment Fund; Inter-American Development Bank; Inter-American Investment Corporation; International Bank for Reconstruction and Development; International Finance Corporation; and Nordic Investment Bank;
- (v) Claims on credit institutions incorporated<sup>3</sup> in Zone A countries and claims guaranteed (or accepted or endorsed) by Zone A incorporated credit institutions;
- (vi) Claims on credit institutions incorporated in Zone B with a residual maturity of 1 year or less and claims of the same maturity guaranteed by Zone B credit institutions;
- (vii) Claims on Zone A public sector entities<sup>4</sup> and claims guaranteed by such entities;
- (viii) Claims on authorised investment firms subject to the European Union (EU) Capital Adequacy Directive or a broadly equivalent regime;
- (ix) Claims on (or directly and unconditionally guaranteed by) certain clearing houses and exchanges, including initial cash margins and surplus variation margins at futures exchanges or clearing houses; and
- (x) Cash items in the process of collection.

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<sup>3</sup> The jurisdiction of incorporation should be considered rather than the location of the branch or parent company/institution.

<sup>4</sup> Public sector entities include regional governments and local authorities, bodies that carry out non-commercial functions on behalf of, and are responsible to, regional government or local authorities and bodies owned by regional governments or local authorities that perform regulatory or other non-commercial functions. Refer to capital adequacy guidance notes for further guidance.

**50% weighting**

- (i) Loans to individuals fully secured by a first priority charge on residential property that is (or is to be) occupied by the borrower or rented;
- (ii) Loans to housing associations which are fully secured by a first priority charge on the housing association residential property which is being rented;
- (iii) Mortgage sub-participations where the risk to the sub-participating bank is fully and specifically secured against residential mortgage loans which would themselves qualify for the 50% weight; and
- (iv) Items in suspense.

**100% weighting**

- (i) Claims on the non-bank private sector;
- (ii) Claims on credit institutions incorporated in Zone B countries with a residual maturity of over 1 year;
- (iii) Claims on (or guaranteed by) Zone B central governments and central banks (unless denominated in the national currency and funded by liabilities in the same currency);
- (iv) Claims on Zone B regional governments, local authorities and public sector entities;
- (v) Claims on commercial entities owned by the public sector;
- (vi) Premises, plant, equipment and other fixed assets;
- (vii) Real estate, trade investments and other assets not otherwise specified;
- (viii) Aggregate net short open foreign exchange position<sup>5</sup>;
- (ix) Gross deferred tax assets; and
- (x) All other assets.

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<sup>5</sup> Where an institution's overall traded market risk (including foreign exchange risk) exceeds de minimis levels, the overall foreign exchange risk needs to be captured within the trading book calculation and can be omitted here

### **Treatment of Off-Balance Sheet Exposures in the Banking Book**

- 3 Not all off-balance sheet exposures expose institutions to the full face value of their contracts. This is most clearly the case with forwards, swaps, purchased options and other derivatives contracts where the exposure is rather to the potential cost of replacing the cash flow (on contracts showing positive value) if the counterparty defaults. Thus, credit equivalent amounts need to be calculated, depending inter alia on the maturity of the contract and on the volatility of the rates and prices of the underlying instruments. Accordingly a series of credit conversion factors apply to the different categories of off-balance sheet exposure, as detailed below.
- 4 Where instruments are traded on exchanges and are subject to daily receipt and payment of cash variation margins, they may be excluded from the calculation. Exchange rate contracts (including cross-currency interest rate swaps, forward foreign exchange contracts, currency futures, and currency options purchased) may be excluded where the original maturity is 14 calendar days or less. Gold contracts are treated in the same way as foreign exchange contracts; however, there is no exclusion for contracts of 14 days or less. Options purchased over-the-counter are included with the same conversion factors as other instruments.
- 5 For contracts with multiple exchange of principal, add-on factors are to be multiplied by the number of remaining payments under the contracts:
  - a) for contracts that are structured to settle outstanding exposure following specified payment dates and where the terms are reset so that the market value of the contract is zero on these specified dates, the residual maturity is equal to the time to the next reset date;
  - b) no potential future credit exposure need be calculated for single currency floating/floating interest rate swaps

### **Credit Conversion Factors**

- 6 Credit conversion factors should be multiplied by the weights applicable to the category of the counterparty for an on-balance sheet transaction. The calculation is: nominal principal x credit conversion factor x counterparty weighting.

#### **100% credit conversion factor**

- (i) Direct credit substitutes, including general guarantees of indebtedness, standby letters of credit serving as financial guarantees, acceptances and endorsements;
- (ii) Sale and repurchase agreements and asset sales with recourse, where the credit risk remains with the reporting institution; and
- (iii) Forward asset purchases, forward deposits placed and the unpaid portion of partly paid shares and securities, together with any other commitments with a certain draw-down.

#### **50% credit conversion factor**

- (i) Transaction-related contingent items not having the character of direct credit substitutes (e.g. performance bonds, bid bonds, warranties and standby letters of credit related to particular transactions);
- (ii) Note issuance facilities and revolving underwriting facilities; and
- (iii) Other commitments with an original maturity of over 1 year (e.g. formal standby facilities and credit lines)

#### **20% credit conversion factor**

- (i) Short-term self-liquidating trade-related contingent items (e.g. documentary credits collateralised by the underlying shipments).

#### **Zero credit conversion factor**

- (i) Endorsements of bills (including per aval endorsements) which have previously been accepted by a bank; and
- (ii) Other commitments (e.g. formal standby facilities and credit lines) with an original maturity of up to 1 year or which can be unconditionally cancelled at any time.

## **Treatments Common to the Banking and the Trading Book**

- 7 In a number of cases, there is a common treatment of counterparty risk, regardless of whether instruments are held in the banking or the trading book. The intention is to capture the risk that at some future date, a party other than the issuer of a security held, fails to complete a contract, resulting in a loss to the institution:

### **A. OTC Derivatives**

- 8 OTC Derivative exposures are treated in a similar way to other off-balance sheet contracts, calculating the proportion of the nominal exposure considered to be at risk – the credit equivalent amount – weighted according to the category of counterparty, as opposed to the issuer of the instrument.
- 9 Exchange rate contracts include: cross-currency swaps, cross-currency interest rate swaps, forward foreign exchange contracts, currency futures, and currency options purchased. Interest rate contracts include: single-currency interest rate swaps, basis swaps, forward rate agreements and products with similar characteristics, interest rate futures and interest rate options purchased.
- 10 Institutions should calculate their weighted exposure under the above contracts according to the current exposure method, involving calculating the current replacement cost by marking contracts to market, then adding a factor (the ‘add-on’) to reflect the potential future exposure over the remaining life of the contract. In order to reflect counterparty risk, the total credit equivalent amount has to be split according to the type of counterparty and weighted at 0%, 20% or 50% as appropriate. (For all such contracts, a 50% counterparty weight is applied to counterparties which would otherwise attract a 100% credit risk weight.)

### **Add-on Factors**

	<b>Residual maturity of contracts</b>		
	<b>1 year or less</b>	<b>1-5 years</b>	<b>Over 5 years</b>
Interest rate related contracts	0.00	0.005	0.015
Foreign exchange and gold contracts	0.010	0.050	0.075
Equity contracts	0.060	0.080	0.100
Precious metals (other than gold)	0.070	0.070	0.080
Other commodities	0.100	0.120	0.150

## **B. Unsettled Transactions and Free Deliveries**

- 11 An unsettled transaction is one where delivery of the instrument is due to take place against receipt of cash, but which remains unsettled five business days after the due settlement date.
- 12 Repos and similar transactions are dealt with under Section C below, not here. There are no capital charges in respect of settlement risk on spot and forward foreign exchange transactions.
- 13 Unsettled transactions, whether in the banking or the trading book, attract a capital charge based on the difference between the amount due and the current market value of the instrument. The capital requirement is this potential loss multiplied by the relevant factor of the table below. The requirement only applies to trades where a loss may arise for the reporting institution in the event that the trade fails to settle; in this instance the capital requirement in respect of such transactions is not multiplied by the counterparty risk weight.

Number of working days After due settlement date	
0-4	nil
5-15	8%
16-30	50%
31-45	75%
46 or more	100%

- 14 A free delivery occurs when an institution has paid away (or received) its side of a transaction and has yet to receive (or pay away) the securities/cash concerned. The institution that has made delivery will have a claim on the other party of the amount of the cash or equivalent to the current market value of the securities, whichever remains outstanding.
- 15 Free deliveries, whether the instruments are in the banking or the trading book, create an immediate exposure where the reporting institution has settled its side of the transaction but has yet to receive the countervalue. This treatment also applies to exchange traded products involving physical delivery. There are no capital charges in respect of delivery risk on spot or forward foreign exchange transactions.
- 16 The capital requirement for free deliveries in the banking book is the counterparty claim multiplied by the counterparty risk weight. In the case of trading book treatment, the capital requirement is the counterparty claim multiplied by the counterparty risk weight multiplied by 8%.

**C. Repurchase agreements, securities lending, reverse repurchase agreements, securities borrowing and equivalent transactions**

17 Similarly to the transactions in a) and b) above, institutions need to be alert to counterparty risk arising in relation to repo-like transactions, whether reported in the banking book or the trading book. Institutions need to calculate the difference between the market value of the securities and the amount borrowed or the market value of the collateral, as appropriate. Accrued interest must be included in calculating the market value of amounts lent or borrowed and collateral. Where daily mark to market and recollateralisation occurs, no capital requirement arises. However, where positive amounts of counterparty risk arise, the capital requirement is calculated as:

- (i) in the banking book, the counterparty claim multiplied by the counterparty risk weight; and
- (ii) in the trading book, the counterparty claim multiplied by the counterparty risk weight multiplied by 8%

Bermuda Monetary Authority

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## **Appendix 2**

### **Definition of the Trading Book**

- 1 An institution's trading book consists of positions in financial instruments and commodities held either with the intention of trading (see paragraph 3 below) or in order to hedge other elements of the trading book. Positions not assigned to the trading book fall into the banking book. To be eligible for trading book capital treatment, financial instruments (as defined under paragraph 2 below) must either be free of any restrictive covenants affecting their tradability or else able to be hedged completely. In addition, trading book positions must be subject to frequent and accurate revaluation, and the portfolio must be actively managed. An institution must have clear and established rules governing the designation of trading and banking book positions. It must have systems to ensure a consistent and appropriate assignment; and it must agree with the Authority a trading book policy statement, approved by its Board of Directors, setting out its general approach to the management of market risks (see paragraph 10 below).
- 2 A financial instrument is any contract that gives rise to both a financial asset in one entity and a financial liability or equity instrument in another entity. Financial instruments include both primary financial instruments (or cash instruments) and derivative financial instruments. Typical examples include transferable securities, money market instruments (e.g. treasury bills, CDs and commercial paper), financial futures contracts, forward rate agreements, interest-rate, currency and equity swaps, as well as options to acquire or dispose of any of the above. A financial asset is any asset that is cash, the right to receive cash or another financial asset; or the contractual right to exchange financial assets on potentially favourable terms, or an equity instrument. A financial liability is the contractual obligation to deliver cash or another financial asset or to exchange financial liabilities under conditions that are potentially unfavourable.
- 3 Positions held with the intention of trading<sup>1</sup> are those held expressly for short-term resale and/or with the intention of benefiting from actual or expected short-term price movements, or to lock in arbitrage profits, and may include proprietary positions, positions arising from client servicing (e.g. matched principal broking) and market making.
- 4 A hedge is a position that materially<sup>2</sup> or entirely offsets the component risk elements of another trading book position or portfolio. Trading book exposures may be hedged with positions, which in their own right would not normally qualify for inclusion in the trading book. Such positions must be marked to

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<sup>1</sup> Cash held in money market funds should be excluded from the definition of a trading book.

<sup>2</sup> The effectiveness of a hedge should be defined within the accounting framework adopted by the reporting institution for financial reporting.

- market daily and will attract both counterparty risk and general position risk capital requirements.
- 5 In order to be eligible for trading book capital treatment, positions must be subject to the following requirements:
- a) institutions must have a clearly documented trading strategy, approved by senior management, covering the relevant positions, instruments and portfolios, and including details of expected holding horizons
  - b) clearly defined policies and procedures must be in place for the active management of the positions, including:
    - positions to be managed on a trading desk
    - position limits to be in place and regularly monitored for appropriateness
    - dealers must have autonomy to enter into/manage the position within agreed limits and in accordance with agreed strategy
    - positions must be marked to market on at least a daily basis and, when marking to model, the parameters must be assessed on a daily basis
    - positions must be reported to senior management as an integral part of the institution's risk management process
    - positions must be actively monitored with reference to market information sources, and assessment made of market liquidity or the ability to hedge positions or the portfolio risk profiles. This includes assessing the quality and availability of market inputs to the valuation process, level of market turnover, sizes of positions traded in the market, etc.
  - c) clearly defined policy and procedures relating to the monitoring of positions against trading book strategy, including the monitoring of turnover and stale positions in the institution's trading book.
- 6 Trading book treatment also applies to exposures arising from unsettled transactions, free deliveries and over the counter (OTC) derivatives. Exposures arising from repurchase/reverse repurchase agreements and securities lending and borrowing arrangements, are subject to particular requirements in order to qualify for trading book treatment. Transactions should, wherever possible, be governed by an acceptable market standard agreement. There must also be a collateralisation policy on the part of the institution in place, which is satisfactory to the Authority. There must also be the possibility of daily adjustment of collateral to take account of:
- (i) any material changes in the values of securities involved
  - (ii) provision for the claims of the institution to be automatically and immediately set-off against the claims of its counterparty in the event of the latter's defaulting

- (iii) confinement of such agreements or transactions to their accepted and appropriate use, excluding artificial transactions, especially those not of a short term nature
- 7 Certain exposures in the form of fees, commissions, interest, dividends and margin in relation to exchange traded derivatives directly related to items included in the trading book may also be included in calculating the trading book.

### **De Minimis Threshold**

- 8 In assessing the proportion of an institution's trading book business relative to its total business, the following formula is used:

$$\frac{\text{total trading book open position}}{(\text{total trading book open position}) + (\text{on and off-balance assets not part of the trading book})}$$

- 9 For the purpose of calculating the total open position in the trading book, long and short positions are summed, regardless of whether they are positive or negative. Debt instruments are valued at their market prices or principal values, and equities and commodities at their market prices. Where a derivative is based on an underlying security, it is valued according to the market value of that security or commodity. Otherwise the notional principal amount underlying the derivative should be used. Underwriting positions (which always belong in the trading book) are valued according to the full market value of the underlying securities. Forward foreign exchange contracts are (for this purpose only) treated as banking book business; however, FX futures and options (since they are financial instruments) are, unless hedging the banking book, treated as trading book items.

### **Trading Book Policy Statement**

- 10 Each licensed institution must agree a trading book policy statement with the Authority. This includes the case of institutions seeking exemption from the detailed market risk calculations since exemption is dependent on receipt by the Authority of such a statement. Statements should be approved by an institution's Board, and should be reviewed at least annually and updated as necessary. Where statements are prepared on a consolidated basis for a banking group, they need to make clear the application to each deposit-taking or licensed investment business subsidiary within the group. The policy statement should be in two parts. The first should:
- a) List the activities the institution normally considers as trading and constituting part of the trading book, together with a list of excluded activities and the rationale for the classification;
  - b) Identify the process used in valuing positions, including in particular those for which market prices are not readily available;

- c) Specify the procedures used for the transfer of risk or instruments between the banking and trading books;
  - d) Comment on the treatment of deposit-taking subsidiaries to be excluded from the market risk calculation; and
  - e) Explain the procedures in place to monitor adherence to the threshold limits for exempted entities within the group.
- 11 The second part of the statement should identify the methodology which the institution intends to adopt for calculating capital requirements for its trading book risk. Institutions have certain choices as to methods for calculating various of the position risk capital requirements (e.g. for interest-rate risk they may choose between simplified methods, standard methods or the use of models). Back-testing models may be used for calculating foreign exchange risk.
- 12 Where institutions intend to seek exemption under the de minimis threshold and continue to calculate their capital adequacy on the basis of banking book risk-weighted assets, their trading book policy statement need only include the details listed under 10 a) and 10 e) above.
- 13 A number of matters require specific Authority approval before institutions may proceed to make use of them within their trading books:
- a) collateralisation policies in respect of repurchase/reverse repurchase/ stock lending/stock borrowing transactions
  - b) approval of alternative valuation methods
  - c) approval of underwriting
  - d) permission for the use of models
- 14 Institutions making use of the market risk calculation methodology should discuss with their external auditors to ensure that:
- a) The criteria used for the allocation of positions are reasonable and in accordance with their accounting policies; and
  - b) Their policy for the valuation of positions is acceptable and in accordance with best accounting practice.
- 15 Institutions' trading book policy statements must be reviewed frequently (at least annually), and, where necessary, updated subject to agreement with the Authority. Updated statements need to be reviewed and approved by the institution's Board of Directors.

### **Hedging Exposures**

- 16 A trading book exposure may be hedged completely or partially by an instrument that in its own right would not normally be considered eligible for inclusion in the trading book. Any such trading book position, whether of financial or non-financial instruments, must be subject to daily mark-to-market provisions and valued on a prudent and consistent basis. The trading book positions of non-financial instruments will attract both counterparty risk requirements (as may be adjusted for use in the trading book) and general market risk requirements on the mark-to-market valuation. However, specific risk requirements will not apply.
- 17 If a financial instrument is used to hedge an exposure in an institution's banking book, it should be removed from the trading book for the period of the hedge and be included instead in the banking book. It is then risk-weighted in accordance with the normal provisions of Appendix 1.
- 18 General market risk arising from the trading book may hedge banking book positions without reference to individual financial instruments. There must always be underlying positions in the trading book. The positions in the banking book which are being hedged must remain in the banking book, although the general market risk exposure associated with them should be incorporated within the calculation of general market risk requirements for the trading book. Such transfers require specific agreement from the Authority. Detailed documentation must also be maintained to ensure that it can be established through audit verification that the item is being correctly treated.

### **Valuation of Trading Book Positions**

- 19 Positions held in the trading book must be marked to market daily, including recognizing accrued interest, dividends and other benefits deriving from them. Valuation approaches must be applied consistently. Institutions must have, and discuss with the Authority, a written policy statement regarding the valuation of trading book positions, developed in conjunction with internal and external auditors. Where a market determined price is not available, an institution may generate its own mark-to-market valuation, consistently with its documented policies.
- 20 Positions may be market to market using either a close-out valuation based on two-way prices (i.e. long positions should be valued at spot 'bid' prices and short positions at spot 'offer' prices), or alternatively using mid-market prices but making provision for the spread between bid and offer prices for the relevant instruments. Regard must be had to the liquidity of the position and to any special factors which may adversely impact the closure of the position. New instruments should be valued at the issue price.

21 Where approval has been given for the use of a risk assessment model in the calculation of capital requirements for options, options may be valued using the values derived from that model. Where a model is not employed and there are no published prices for option positions held, market value must be determined in the following way:

(i) for purchased options, the mark-to-market value is the product of the 'in the money' amount and the quantity underlying the option; and

(ii) for written options, the mark-to-market value is the initial premium received for the option plus the product of the amount by which the current 'in the money' amount exceeds either the 'in the money' amount at the time the option was written, or zero, where the contract was 'out of the money' at the time the option was written; and the quantity underlying the option.

In the case of swaps and FRAs, the value should be calculated having regard to the net present value of the future cash flows under the contract, using current interest rates relevant to the periods in which the cash flows will arise.

22 Where an institution conducts market-making in an instrument, the valuation should be its own bid or offer price, reflecting its exposure to the market as a whole and its views on future prices. Particular prudence is needed where an institution is the sole market-maker.

23 Where only indicative prices are available, they should be adjusted to arrive at a prudent valuation. The same applies where only mid-market or single values are available.

Bermuda Monetary Authority

August 2006

## **Appendix 3**

### **CALCULATION OF CAPITAL CHARGES IN RELATION TO MARKET RISKS**

#### **Introduction**

- 1 The calculation of capital in respect of an institution's market risks involves an assessment of the different risks pertaining to trading book positions in interest-rate related instruments and in equities, together with foreign exchange and commodities' positions held throughout the institution's business. All transactions, including forward sales and purchases must be included in the assessment, as from the transaction date. Two broad methodologies may be applied. First, the so-called 'standardised' approach involves a building-block approach under which the different risk elements are separately calculated and summed arithmetically. The particular measurement frameworks for the calculations are set out in sections A-E of this Appendix. Alternatively, an 'internal models' approach may be applied, subject to the fulfillment of certain conditions detailed in section F of this Appendix and subject in each case to the prior consent of the Authority.
- 2 Internal models frequently seek to calculate institutions' general market risk, leaving specific risk (i.e. exposures to specific issuers of equity or debt securities) to be measured through separate credit risk measurement systems. Where models do not capture specific risk, a separate capital charge for that element must be calculated and applied.
- 3 In measuring the price risk on options under the standardized approach, a number of alternatives with varying degrees of sophistication are permitted. The greater the volume of options written, the more sophisticated the measurement method needs to be. Where significant amounts of options are written, comprehensive value-at-risk models, consistent with the criteria set out in section F must be used.
- 4 In managing their market risks, institutions must be able to monitor their positions on a continuous basis and, in particular, to determine at the close of each trading day that they remain in compliance with stipulated capital requirements. They must also have effective risk management systems in place enabling them to track exposures on an intra-day basis. The effectiveness of their monitoring and reporting processes must be subject to regular review by internal audit. Where any breach of capital requirements is identified, this must be reported forthwith to the Authority, together with an explanation of the reasons for the breach and of the steps taken to restore compliance.

- 5 In assessing required capital cover for the position risk on traded debt instruments or equities (or debt or equity derivatives), two separate components must be addressed: the general market risk component and the specific risk component. **General** risk is the risk of a price change in the instrument due (in the case of traded debt instruments or debt derivatives) to a change in the level of interest rates or (in the case of equities or equity derivatives) to a broad equity market movement unrelated to the specific attributes of individual securities. **Specific** risk components relate to the risk of a price change in the instrument concerned due to factors related to its issuer or, in the case of a derivative, to the issuer of the underlying instrument. The aggregate capital requirement for interest rate risk comprises the sum of the general market interest rate risk capital requirements across currencies and the specific risk capital requirements.

### **Netting**

- 6 The excess of an institution's long (short) positions over its short (long) positions in the same equity, debt and convertible issues and in identical financial futures, options and warrants represents its net position in each of those different instruments. Instruments will be considered the same where the issuer is the same, they have equivalent ranking in a liquidation, and the currency, coupon and maturity are the same. Positions in derivative instruments are to be treated as positions in the underlying (or notional) security or securities. Netting is not permitted between a convertible instrument and an offsetting position in the instrument into which the security may be converted. Net positions are to be calculated separately for each currency in which they are denominated, with the capital requirement for general and specific risk calculated separately in each individual currency. Before aggregation, all net positions, irrespective of their signs, must be converted on a daily basis into the institution's reporting currency at the prevailing spot exchange rate.

## **Section A - Interest Rate Risk**

- 7 In calculating interest rate risk, the minimum capital requirement comprises the sum of two separate components, one representing specific risk, the other for general market risk. Sections A-I and A-II below set out the bases for the respective calculations. Section A-III deals with certain concessionary treatments that may be available in calculating position risk requirements arising from underwriting of debt and equity instruments.

### Section A-I: The Calculation of Specific Risk

- 8 The capital charge for specific risk is designed to provide cover against a movement in the price of an individual instrument, reflecting factors specific to the issuer. In measuring specific risk, institutions may net, by value, long and short positions in the same instrument (including positions in derivatives). The specific risk capital requirement is calculated (see Table 1 overleaf) by weighting the current market value of each individual net position, long or short, according to its allocation, according to its residual maturity, among the following five broad categories:

i) eligible central government debt instrument	0.00%
ii) qualifying items with residual maturity up to 6 months	0.25%
iii) qualifying items with residual maturity 6-24 months	1.00%
iv) qualifying items with residual maturity over 24 months	1.60%
v) non-qualifying items	8.00%

where eligible and qualifying items represent securities qualifying for 0% or 20% weighting according to the standard credit risk banking book methodology, together with other securities that have been rated investment grade by at least two internationally recognised credit rating agencies.

- 9 Holdings of an institution's own bonds, bills or other paper should be excluded in calculating specific risk.

Table 1: Specific Risk – Traded Debt Instruments  
 and Derivatives on Traded Debt Instruments

		Central Government Items	Qualifying Items			Other Items
			Up to 6 months	7 to 24 months	Over 24 months	
Line A	Long Position					
Line B	Short Position					
Line C	Line A + Line B	0	0	0	0	0
Line D	Weighting Factor	0.00%	0.25%	1.00%	1.60%	8.00%
Line E	Line C x Line D	0	0	0	0	0

Sum of Line E = Capital Requirement: 0

#### Section A-II: Calculation of General Market Risk

- 10 Capital requirements for general market risk are designed to cover the risk of loss from changes in market interest rates – i.e. the risk of either parallel or non-parallel shifts in the yield curve. A choice between two methods of measuring general market risk is permitted – a ‘maturity’ method and a ‘duration’ method’. Institutions must opt for one method and may not make use of a combination of the two methods. In each case, the capital charge is made up of the following components:
- a) the net long or short position within the trading book
  - b) a proportion of the matched positions in each time-band (the ‘vertical disallowance’)
  - c) a larger proportion of the matched positions across different time-bands (the ‘horizontal disallowance’) and
  - d) a net charge for positions in options, as appropriate
- 11 Separate maturity/duration ladders must be used for each currency, with capital charges being calculated for each currency separately. However, where an institution holds positions in a variety of currencies but where their volume and value are insignificant, the Authority may permit aggregate reporting within a single maturity ladder, but with no netting of long and short positions. The results are then summed, using prevailing foreign exchange spot rates, and with no off-setting between positions of opposite sign.

## Maturity method

- 12 Individual long or short positions in interest-rate related instruments, including derivatives, are placed into a maturity ladder comprising thirteen time-bands (or fifteen time-bands in the case of zero-coupon and deep-discount instruments - defined as those bearing a coupon of 3% or less), on the following basis:
- fixed rate instruments are allocated according to their residual term to maturity (ignoring embedded puts and calls), and whether their coupon is above or below 3%;
  - floating rate instruments are allocated according to the residual term to the next repricing date;
  - positions in derivatives, together with all position in repos, reverse repos and similar products are broken down into their components within each time-band;
  - opposite positions (same amount in the same issue by the same issuer) whether actual or notional, can be netted within their relevant time-bands (i.e. omitted from the maturity framework). The same applies to closely matched swaps, forwards, futures and forward rate agreements (FRAs) meeting certain conditions set out in paragraphs 36 and 37.

Where the treatment of particular complex instruments is unclear, guidance from the Authority as to their reporting must be sought.

Table 2 – *Maturity method: time-bands and risk weights*

	Coupon > 3%	Coupon < 3%	Risk weight
<b>Zone 1</b>	<b>1 month or less</b>	<b>1 month or less</b>	<b>0.00%</b>
	<b>1 to 3 months</b>	<b>1 to 3 months</b>	<b>0.20%</b>
	<b>3 to 6 months</b>	<b>3 to 6 months</b>	<b>0.40%</b>
	<b>6 to 12 months</b>	<b>6 to 12 months</b>	<b>0.70%</b>
<b>Zone 2</b>	<b>1 to 2 years</b>	<b>1 to 1.9 years</b>	<b>1.25%</b>
	<b>2 to 3 years</b>	<b>1.9 to 2.8 years</b>	<b>1.75%</b>
	<b>3 to 4 years</b>	<b>2.8 to 3.6 years</b>	<b>2.25%</b>
<b>Zone 3</b>	<b>4 to 5 years</b>	<b>3.6 to 4.3 years</b>	<b>2.75%</b>
	<b>5 to 7 years</b>	<b>4.3 to 5.7 years</b>	<b>3.25%</b>
	<b>7 to 10 years</b>	<b>5.7 to 7.3 years</b>	<b>3.75%</b>
	<b>10 to 15 years</b>	<b>7.3 to 9.3 years</b>	<b>4.50%</b>
	<b>15 to 20 years</b>	<b>9.3 to 10.6 years</b>	<b>5.25%</b>
	<b>&gt; 20 years</b>	<b>10.6 to 12 years</b>	<b>6.00%</b>
		<b>12 to 20 years</b>	<b>8.00%</b>
	<b>&gt; 20 years</b>	<b>12.50%</b>	

- 13 The market values of the individual long and short net positions in each maturity band are multiplied by the respective risk-weightings set out in Table 2 above.

14 Where a maturity band has both weighted long and short positions, the extent to which the one offsets the other is termed the **matched weighted position**. The excess of the weighted long or short positions within the band is termed the **unmatched weighted position** for that band. Where a zone has both unmatched weighted long and short positions for the various bands, the extent to which the one offsets the other is termed the matched weighted position for that zone. The excess of the weighted long or short positions within a zone is termed the unmatched weighted position for that zone. The unmatched weighted long or short position in zone 1 may be offset against the unmatched weighted short or long position in zone 2. The extent to which the unmatched weighted positions in zones 1 and 2 are offsetting is described as the matched weighted position between zones 1 and 2. After offsetting unmatched weighted short or long positions between zones 1 and 2, any residual unmatched weighted long or short position in zone 2 may be matched by offsetting the unmatched weighted long or short position in zone 3. The extent to which the unmatched positions in zones 2 and 3 are offsetting is described as the matched weighted position between zones 2 and 3. (The above calculations may also be carried out in reverse order, offsetting unmatched positions between zones 2 and 3, followed by offsetting between zones 1 and 2.) Following the above steps, any residual unmatched weighted long or short position in zone 1 may be matched by offsetting the unmatched weighted long or short position in zone 3. The extent to which the unmatched positions in zones 1 and 3 are offsetting is described as the matched weighted position between zones 1 and 3. Any residual unmatched weighted positions, following the matching within and between maturity bands and zones as described above, are to be summed.

15 The general interest rate capital requirement is the sum of:

- (a) 10% of the sum of the matched weighted positions in all maturity bands;
- (b) 40% of the matched weighted position in zone 1
- (c) 30% of the matched weighted position in zone 2
- (d) 30% of the matched weighted position in zone 3
- (e) 40% of the matched weighted position between zones 1 and 2
- (f) 40% of the matched weighted position between zones 2 and 3
- (g) 100% of the matched weighted position between zones 1 and 3
- (h) 100% of the residual unmatched weighted positions.

Item (a) represents the vertical disallowance; items (b) to (d) the first set of horizontal disallowances and items (e) to (g) the second set of horizontal disallowances.

16 An example of the calculation of the capital requirement under this method is given in Table 3 on the next page.

**TABLE 3 - WORKED EXAMPLE OF MATURITY METHOD OF CALCULATING GENERAL INTEREST RATE RISK**

Zone	Maturity Band		Individual Net Positions		Weighting Factor	Weighted net Positions		By Band		By Zone		Between Zones	Between Zones		
	A	B Coupon => 3 %	C Coupon <3 %	D Long		E Short	F	G (D x F) Long	H (E x F) Short	I Matched	J Unmatched	K Matched	L Unmatched	M Matched	N Matched
1	1 month or less	1 month or less	\$100	(\$50)	0.00%	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$1.30	Zones 1 & 2		
	1 to 3 months	1 to 3 months	\$200	(\$100)	0.20%	\$0.40	(\$0.20)	\$0.20	\$0.20	(T)					
	3 to 6 months	3 to 6 months	\$300	(\$200)	0.40%	\$1.20	(\$0.80)	\$0.80	\$0.40						
	6 to 12 months	6 to 12 months	\$400	(\$300)	0.70%	\$2.80	(\$2.10)	\$2.10	\$0.70						
2	1 to 2 years	1 to 1.9 years	\$100	(\$200)	1.20%	\$1.20	(\$2.40)	\$1.20	(\$1.20)	\$0.00	(\$5.20)	\$1.30	Zones 1 & 3	\$0.00	
	2 to 3 years	1.9 to 2.8 years	\$200	(\$300)	1.75%	\$3.50	(\$5.25)	\$3.50	(\$1.75)	(U)		(W)			
	3 to 4 years	2.8 to 3.6 years	\$300	(\$400)	2.25%	\$6.75	(\$9.00)	\$6.75	(\$2.25)			Zones 2 & 3			
3	4 to 5 years	3.6 to 4.3 years	\$100	(\$100)	2.75%	\$2.75	(\$2.75)	\$2.75	\$0.00	\$4.50	\$8.25	\$3.90	(Z)		
	5 to 7 years	4.3 to 5.7 years	\$200	(\$200)	3.25%	\$6.50	(\$6.50)	\$6.50	\$0.00	(V)		(X)			
	7 to 10 years	5.7 to 7.3 years	\$300	(\$100)	3.75%	\$11.25	(\$3.75)	\$3.75	\$7.50						
	10 to 15 years	7.3 to 9.3 years	\$100	(\$200)	4.50%	\$4.50	(\$9.00)	\$4.50	(\$4.50)						
	15 to 20 years	9.3 to 10.6 years	\$200	(\$100)	5.25%	\$10.50	(\$5.25)	\$5.25	\$5.25						
	Over 20 years	10.6 to 12 years	\$300	(\$300)	6.00%	\$18.00	(\$18.00)	\$18.00	\$0.00						
		12 to 20 years	\$0	\$0	8.00%	\$0.00	\$0.00	\$0.00	\$0.00						
	Over 20 years	\$0	\$0	12.50%	\$0.00	\$0.00	\$0.00	\$0.00							
Total of Columns			\$2,800	(\$2,550)				\$55.30			\$4.35				
								(S)	(Y)						
General Interest Rate Risk Capital Requirement								\$5.53		\$1.35	\$4.35	\$2.08			
Total General Interest Rate Risk Capital Requirement = 10%S + 40%T + 30%(U+V) + 40%(W+X) + 100%Y + 100%Z =												\$13.31			

Note: For Instruments the maturity of which is on the boundary of two maturity bands, the instrument should be placed into the earlier maturity band. For example, instruments with a maturity of exactly one year are placed into the 6 to 12 months band.

**Duration method**

17 Where institutions are able to do so, they are encouraged to adopt the duration method, instead of the maturity method, in calculating the sensitivity of their positions to changes in market yields, other than in circumstances where it is clearly less suitable for the generality of the instruments held. The various time-bands and assumed changes in yield are set out below

**Table 4: Duration method: time-bands and assumed changes in yield**

	<b>Assumed change in yield (%)</b>		<b>Assumed change in yield (%)</b>
<b>Zone 1</b>		<b>Zone 3</b>	
1 month or less	1.00	3.6 to 4.3 years	0.75
1 to 3 months	1.00	4.3 to 5.7 years	0.70
3 to 6 months	1.00	5.7 to 7.3 years	0.65
6 to 12 months	1.00	7.3 to 9.3 years	0.60
<b>Zone 2</b>		9.3 to 10.6 years	0.60
1.0 to 1.9 years	0.90	10.6 to 12 years	0.60
1.9 to 2.8 years	0.80	12 to 20 years	0.60
2.8 to 3.6 years	0.75	over 20 years	0.60

18 Under the duration method, an institution determines the Yield to Maturity (YTM) for each individual net position in fixed rate and floating rate instruments, based on current market values. Individual net positions are calculated in the same way as for the maturity approach. The YTM for fixed rate instruments is determined without regard to whether the instrument is coupon-bearing or has embedded options. In all cases, YTM for fixed rate instruments reflects final maturity date, and for floating rate instruments, the next repricing date.

- 19 For each debt instrument, the modified duration (M) is calculated on the basis of the following formula:

$$M = \frac{D}{(1+r)}$$

$$D \text{ (duration)} = \frac{\sum_{(t=1)}^m \frac{C t}{(1+r)^t}}{\sum_{(t=1)}^m \frac{C}{(1+r)^t}}$$

r = YTM% per annum expressed as a decimal  
 C = Cash flow at time t  
 t = time at which cash flows occur, in years  
 m = time to maturity, in years (in decimals)

- 20 Individual net positions are allocated to the time-bands set out in Table 4 above, based on their modified duration. The modified duration weighted position for each individual net position is then calculated by multiplying its current market value by the modified duration and the assumed change in yield.
- 21 Where a time-band has both weighted long and short positions, the extent to which one offsets the other is termed the matched weighted position. The remainder (the excess of weighted long or short positions within the band) is termed the unmatched weighted position for that band. Where a zone has both unmatched weighted long and short positions for various bands, the extent to which the one offsets the other is termed the matched weighted position for that zone. The remainder (the excess of weighted long or short positions) is termed the unmatched weighted position for that zone. The unmatched weighted long or short position in zone 1 may be offset against the unmatched weighted long or short position in zone 2. The extent to which the unmatched weighted positions in zones 1 and 2 are offsetting is described as the matched weighted position between zones 1 and 2. After offsetting between zones 1 and 2, any residual unmatched weighted long or short position in zone 2 may be matched by offsetting the unmatched weighted long or short position in zone 3. The extent to which the unmatched positions in zones 2 and 3 are offsetting is described as the matched weighted position between zones 2 and 3. (The above calculations may be conducted in the reverse order – i.e. offsetting zones 2 and 3, followed by zones 1 and 2.) After the above offsetting, any residual unmatched weighted long or short position in zone 1 may be matched by offsetting the unmatched weighted short or long position in zone 3. The extent to which the unmatched positions in zones 1 and 3 are offsetting is described as the matched weighted

position between zones 1 and 3. Any residual unmatched weighted positions, following the matching within and between maturity bands and zones as described above, are to be summed.

- 22 The general market risk capital requirement is the sum of
- a) 5% of the sum of the matched weighted positions in all maturity bands
  - b) 40% of the matched weighted position in zone 1
  - c) 30% of the matched weighted position in zone 2
  - d) 30% of the matched weighted position in zone 3
  - e) 40% of the matched weighted position between zones 1 and 2
  - f) 40% of the matched weighted position between zones 2 and 3
  - g) 100% of the matched weighted position between zones 1 and 3
  - h) 100% of the residual unmatched weighted positions.

Item (a) represents the vertical disallowance; items (b) to (d) the first set of horizontal disallowances; and items (e) to (g) the second set of horizontal disallowances.

### **Calculation of positions in interest rate derivatives**

- 23 Where institutions intend to measure the interest rate inherent in derivatives through the use of internal models, the relevant requirements and conditions, including for seeking the Authority's prior consent, are set out later in this Appendix. Where such an interest rate sensitivity model is employed, the output of that model, using the duration method, is applied to calculate the general market risk. Where a model is not used, the techniques described in the following paragraphs apply. The measuring system must include all interest rate derivatives and off-balance sheet instruments in the trading book, which react to changes in interest rates (e.g. forward rate agreements, other forward contracts, bond futures, interest rate and cross-currency swaps, options and forward foreign exchange contracts). Derivative positions attract specific risk only where they are based on an underlying instrument or security. Thus, where the underlying exposure is an interest rate exposure, there is no specific risk. However, where for example a swap is based on a bond yield, the credit risk of the issuer of the underlying bond generates a specific risk capital requirement. Future cash flows derived from positions in derivatives generate counterparty risk requirements related to the counterparty in the trade, in addition to position risk requirements (specific and general market risk) related to the underlying security.
- 24 Derivatives are converted into positions in the underlying instrument and are subject to capital requirements for general and specific risks, by inclusion within the relevant net position bands. Reported amounts reflect the market values of the principal amounts of the underlying or of the effective amounts of the notional underlying security.

### **Foreign Exchange Forwards**

- 25 A forward foreign exchange position is broken down into separate legs representing the paying and receiving currencies. Each of the legs is treated as if it were a zero coupon bond in the relevant currency, with 0% specific risk, and included in the measurement framework as follows:
- i) if the maturity method is used, each leg is included at the notional amount;
  - ii) if the duration method is used, each leg is included at the present value of the notional zero coupon bond.

### **Interest Rate Futures, Forward-Rate Agreements (FRAs) and Similar Commitments**

- 26 Interest-rate futures, FRAs and similar commitments are, as with foreign exchange forwards, split into separate long and short legs, each treated as a zero coupon bond with 0% specific risk. For interest-rate futures, the size of each leg is the notional amount of the underlying money market exposure; for FRAs it is necessary additionally to discount to present value where the duration method is used. The Authority will consider allowing the capital requirement for an exchange-traded future to be equal to the margin required by the exchange where it can be satisfied that this provides an accurate measure of the risk associated with the future.

### **Bond Futures and Forward Bond Transactions**

- 27 Bond futures, forward bond transactions and the forward leg of repos, reverse repos and similar stock borrowing/lending transactions also use the two-legged approach. A forward bond transaction includes all transactions for which settlement is set at a period longer than that prevailing in the market. The first leg is a zero coupon bond with 0% specific risk. Its maturity is the time to expiry of the futures or forward contract. Its size is the cash flow on maturity (discounted to present value where duration methodology is applied). The second leg is the underlying bond. Its maturity is that of the underlying bond (for fixed rate bonds) or the time to the next rate reset (for floating rate bonds). For forward bond transactions, the underlying bond and amount is used at the spot price. For bond futures, the principal amounts for each of the two legs is calculated as the futures price multiplied by the notional underlying bond amount. Where a range of instruments may be delivered to fulfil a futures contract (at the option of the 'short'), the 'long' may use one of the deliverable bonds or the notional bond on which the contract is based; however, this notional long leg may not be offset against a short cash position in the same bond. The 'short' may treat the notional underlying bond as if it were one of the deliverable bonds, and it may be offset against a short cash position in the same bond. For futures contracts based on a corporate bond index, the positions are included at the market value of the notional underlying portfolio of securities.

- 28 A repo (or stock lend/ sell-buy) involving exchange of a security for cash is represented as a cash borrowing – i.e. a short position in a government bond with maturity equal to the repo and coupon equal to the repo rate. A reverse repo (or stock borrow/ buy-sell) is represented as a cash loan – i.e. a long position in a government bond with maturity equal to the reverse repo and coupon equal to the repo rate. These positions are referred to as ‘cash legs’. It should be noted that, where a security that is owned (and included in the market risk calculation) is repo’d, it must continue to figure in the interest rate or equity position risk calculation as appropriate. A forward commitment to buy a debt instrument shall be treated as a combination of a borrowing maturing on the delivery date and a long (spot) position in the debt instrument itself.

### **Swaps**

- 29 Swaps are treated as two notional positions in government securities with the relevant maturities. Interest rate swaps are broken down into two legs, with each leg allocated to the maturity band equating to the time remaining to repricing or maturity. Thus, for example, an interest rate swap in which an institution is receiving floating rate interest and paying fixed is treated as a long position in a floating rate instrument of maturity equivalent to the period until the next interest fixing and a short position in the fixed rate instrument of maturity equivalent to the residual life of the swap. For swaps that pay or receive a fixed or floating interest rate against another reference price (e.g. a stock index) the interest rate component should be allocated to the appropriate repricing or maturity category, with the equity component included in the equity risk measurement framework.
- 30 For cross-currency swaps, the separate legs are included in the interest rate risk measurement for the currencies concerned, as having a fixed/floating leg in each currency. Alternatively, they may be split into their separate forward foreign exchange components and treated accordingly. In some cases, it may be necessary to adjust underlying notional principal amounts of a swap or the notional maturity of one or both legs in order to deal with its particular characteristics. In the case of a deferred swap (i.e. where the commencement of the interest rate calculation periods is more than two business days from the transaction date and where one or more of the legs have been fixed at the time of the commitment), the fixed leg(s) are sub-divided into the time to the commencement of the leg and the actual swap leg with fixed or floating rate. However, in the case of a deferred swap where neither leg has been fixed, while there is a counterparty exposure, there is no interest rate exposure.
- 31 Institutions with large swap books may, subject to prior discussion with the Authority, use alternative methodologies for calculating positions to be included in the maturity or duration ladder. For example, the cash flows required by the swaps may be converted into their present values, discounting each cash flow using the zero coupon yields, and a single net figure for the present value of the

cash flows entered into the appropriate time-band, using the procedures applying to zero or low coupon instruments. Alternatively, the sensitivity of the net present value implied by the change in yield used in the duration method could be allocated into the appropriate time-bands.

### **Options**

- 32 Options on interest rates, debt instruments, equities, equity indices, financial futures, swaps and foreign currencies are treated as if they were positions equal in value to the amount of the underlying instrument to which the option refers, multiplied by its delta. The resulting delta weighted positions may be netted off against any offsetting positions in the identical underlying securities or derivatives. The delta used is that of the exchange concerned or, where that is not available or for OTC options, that calculated by the institution, subject to the Authority being satisfied that the methodology used is reasonable.
- 33 Since delta does not cover the entire risk associated with options positions, institutions are required to calculate an additional capital charge in respect of other options risks, such as exposures to changes in delta (Gamma risk) or volatility (Vega risk). This requirement will be determined separately for each bank as part of the Authority's review of the use of models (see Section F).
- 34 The Authority may allow the capital requirement against a written exchange-traded option to be equal to the margin required by the exchange if it is fully satisfied that it provides an accurate measure of the risk associated with the option and that it is at least equal to the capital requirement against an option that would result from a calculation made using the method set out in this Section. In addition, the Authority may allow the capital requirement on a bought exchange-traded or OTC option to be the same as that for the instrument underlying it, subject to the constraint that the resulting capital requirement does not exceed the market value of the option. The capital requirement against a written OTC option is set in relation to the instrument underlying it.

### **Warrants relating to debt instruments and equities**

- 35 These are treated in the same way as options – see above.

### **Offsetting of derivative positions**

- 36 Long and short positions (both actual and notional) may be excluded from the interest rate calculation where they are in identical instruments with exactly the same issuer, coupon, currency and maturity. A matched position in a future or forward and its corresponding underlying may also be fully offset; however the leg representing the time to expiry of the future must be included in the calculation. Where the future or forward comprises a range of deliverable instruments, offsetting of positions in the futures or forward is only permitted where there is a readily identifiable underlying security which is most profitable for the trader with a short position to deliver (the ‘cheapest-to-deliver’). No offsetting is permitted between positions in different currencies.
- 37 Additionally, in certain circumstances, closely matched positions may be offset for general market risk purposes only, where they relate to the same underlying instruments, are of the same nominal value, are denominated in the same currency and fulfil the following conditions:
- a) in the case of futures: offsetting positions in notional or underlying instruments to which the futures contract relates are for identical products and mature within seven days of each other;
  - b) for swaps and FRAs: the reference rate (for floating rate positions) is identical and the coupons are within 15 basis points of each other; and
  - c) for swaps, FRAs and forwards: the next interest fixing date (or for fixed coupon positions or forwards, the residual maturity) meets the following limits:
    - i) less than 1 month – same day
    - ii) between 1 month and 1 year – within 7 days
    - iii) over 1 year – within 30 days.

### **A-III Underwriting**

- 38 With the Authority’s prior approval, certain reductions in the position risk requirements arising from underwriting positions in debt or equity instruments are permitted.
- 39 Where consent is given, the following procedure may be used in calculating the capital requirement arising from the underwriting of new securities (or securities which are new to the market) and where the institution has given a commitment to an issuer to purchase, underwrite, sub-underwrite or distribute those securities or is a member of a syndicate for the underwriting or sub-underwriting or distribution of those securities.
- 40 First, the net positions are calculated by deducting any underwriting positions which are subscribed or sub-underwritten by third parties on the basis of formal

agreements. Then, the resulting net positions may be reduced by the following factors:

**Table 5: Reduction of capital requirements for underwriting**

<b>Time Band</b>	<b>Bond type issues</b>		<b>Equity type issues</b>	
	<b>Specific Risk</b>	<b>General Risk</b>	<b>Specific Risk</b>	<b>General risk</b>
Up to and including Working Day 0	100%	0%	90%	90%
Working Day 1	90%	0%	90%	90%
Working Day 2	75%	0%	75%	75%
Working Day 3	75%	0%	75%	75%
Working Day 4	50%	0%	50%	50%
Working Day 5	25%	0%	25%	25%
After Working Day 5	0%	0%	0%	0%

where ‘working day zero’ is the working day on which an institution becomes unconditionally committed to accepting a known quantity of securities at an agreed price; and ‘working days 1-5’ are the days of the offer period. If the offer period is less than 5 days the reduction factors apply only up to the day prior to the last day of the offer period.

## **Section B Equity position risk**

- 41 The requirements in this section apply to positions and exposures (including forward positions) of the following instruments held in the trading book:
- a) common stocks, whether voting or non-voting, including in depository receipt form;
  - b) convertible preference securities;
  - c) convertible debt securities which convert into equities;
  - d) commitments to buy or sell equity securities; and
  - e) derivatives based on the above instruments.
- 42 Convertible debt securities must be treated as equities where the first conversion date is less than 3 months ahead or (where the first date has passed) the next such date is less than 1 year ahead **and** the convertible is trading at a premium of less than 10% (i.e. current mark to marked value of the convertible less mark to market value of the underlying equity as a percentage of the latter). In other cases, convertibles should be treated as either equity or debt, based on their market behaviour.
- 43 For instruments which differ to some extent from those listed above or that could be considered complex, institutions must determine and agree treatment with the Authority, and include reference within the trading book policy statement.
- 44 As with interest rate related instruments, the minimum capital requirement for equities is expressed as the sum of two separately calculated charges, one applying to the specific risk of holding a long or short position in an individual equity, and the other to the general market risk of holding a long or short position in the market as a whole.
- 45 Where institutions propose to use internal models to measure general and specific equity risk, the prior approval of the Authority for the use of the model is required (see section F below). Institutions that do not use internal models must adopt the standardised approach to calculate the equity position risk capital requirement as set out in this section.
- 46 Long and short positions in the same equity instrument, whether arising directly or through derivatives, may be netted in determining the individual net position in that instrument. For example, a future in a given equity may be offset against an opposite cash position in the same equity; however, the interest rate risk arising out of the future must be calculated separately. Long and short positions in one tranche of an equity instrument may be netted against another tranche only where the relevant tranches rank *pari passu* in all respects **and** will become fungible within 180 days such that thereafter equity instruments of either tranche can be

- delivered in settlement of the other. Positions in depository receipts may only be netted against positions in the underlying if the stock is freely deliverable against the depository receipt. Positions in depository receipts may be offset against positions in the underlying in different markets (i.e. arbitrage) provided any costs on conversion are fully taken into account. Moreover, any foreign exchange risk needs to be included as appropriate within the relevant measurement framework.
- 47 Equity positions, whether arising directly or through derivatives, should be allocated to the country of listing. Where listed in more than one country, the reporting institution may make a choice between countries, provided it can be satisfied that the stock is adequately liquid in the respective markets.
- 48 Specific risk reflects the gross equity positions (i.e. the sum of all long equity positions and of all short equity positions), and is calculated for each country or equity market. For each national market in which equities are held, the market values of each individual net position must be summed, irrespective of whether they are long or short, in order to produce an overall gross equity position for that market. The capital charge for specific risk is 8%, unless the portfolio is both liquid and well-diversified, in which case the capital charge is 4%. In order to qualify for a 4% charge, the following requirements must be met:
- a) the portfolio must comprise securities listed on a recognised stock exchange;
  - b) no individual equity position must exceed 10% of the gross value of the country portfolio; and
  - c) the total value of equity positions individually comprising between 5% and 10% of the gross value of the country portfolio must not exceed 50% of the gross value of the portfolio.
- 49 The general market risk is the difference between the sum of the long positions and the sum of the short positions (i.e. the overall net position) in each national equity market. The general market risk measure is 8% of the overall net position in each national market.
- 50 For the purpose of calculating the specific and general market risk by the standardised approach, equity derivatives positions are converted into notional underlying equity positions, whether long or short. All equity derivatives and off-balance sheet positions that are affected by changes in equity prices must be included in the measurement framework. This includes futures and swaps on both individual equities and on stock indices.
- 51 The approach to be taken in calculating positions in different categories of equity derivatives is as follows:

- a) futures and forward contracts relating to individual equities should generally be included in the calculation at current market prices;
- b) futures relating to stock indices should be included at mark to market value of the notional underlying equity portfolio i.e. as a single position based on the sum of the current market values of the underlying instruments;
- c) equity swaps are treated as two notional positions. For example an equity swap in which one party receives an amount based on the change in value of one particular equity or stock index, and pays a different index, is treated as a long position in the former and a short position in the latter. Where one of the swap legs involves receiving/paying a fixed or floating interest rate, that exposure should be allocated to the appropriate time-band for interest rate related instruments. The stock index leg should be dealt with in accordance with the equity treatment outlined above;
- d) equity options and stock index options are either carved out, together with the associated underlying instruments, or are incorporated within the general market risk measurement framework, based on the delta-plus method (see description of options treatment in section E below).

Where institutions are unclear as to the appropriate treatment for complex instruments, they must seek guidance from the Authority.

### **Equity Indices**

- 52 Positions in highly liquid equity indices, whether arising directly or through derivatives, attract a 2% capital charge in addition to the general market risk, intended to cover such factors as execution risk. For positions in equity indices that are not regarded as highly liquid, the specific risk capital charge is set at the highest specific risk charge applying to any of its individual components. In the case of certain futures-related arbitrage strategies, the specific risk charge described above may be applied to only one index, with the opposite position exempt from a specific risk capital charge. This is the case where an opposite position in exactly the same index is taken at different dates or in different market centres, or where opposite positions are taken in contracts at the same date in indices which, although different, contain at least 90% common components.
- 53 Where, as part of an arbitrage strategy, a futures contract on a broadly-based index matches a basket of stocks, both positions may be carved out from the standardised methodology provided the trade represents a deliberate, controlled strategy and the composition of the basket of stocks represents at least 90% of the index when split into its notional components. In such a case the minimum capital requirement is limited to 4% (i.e. 2% of the gross value of the positions on each side, to reflect divergence and execution risks. This applies even if all the stocks comprising the index are held in identical proportions. Any excess value

of the stocks comprising the basket over the value of the futures contract or vice versa is treated as an open long or short position.

- 54 Derivative positions may of course also generate counterparty risk exposure related to the counterparty in the trade in addition to the (specific and general) position risk requirements related to the underlying instrument. There may, for example, be margin payments, fees or settlement exposures that need to be taken into account as part of the credit risk capital requirements.

## **Section C Foreign Exchange Risk**

### **Introduction**

- 55 An institution which has net open positions (whether long or short) in foreign currencies is exposed to the risk that exchange rates may move against it. The open positions may be either trading positions or simply exposures resulting from its overall book of assets and liabilities.
- 56 This section describes the standardised method for calculation of foreign exchange risk and the capital required against that risk. The measurement of the foreign exchange risk involves, as a first step, the calculation of the net open position in each individual currency (including gold, which is dealt with here since its volatility is more in line with that of foreign currencies than of commodities). This is followed by the measurement of the risks inherent in the particular mix of long and short positions in different currencies.
- 57 Open positions and capital requirements in this regard are calculated with regard to the totality of the business, both banking book and trading book combined. Open positions are calculated with reference to the Bermuda dollar as base currency. In addition to foreign exchange risk, positions in foreign currencies may be subject to interest rate and credit risk, which must be treated separately.
- 58 Where institutions wish to use internal models for the measurement of foreign exchange risk, and hence for the calculation of the capital requirement, the Authority's prior consent must be sought (see section F below).
- 59 An institution's exposure to foreign exchange risk in any currency is its net open position in that currency, and is calculated by summing the following items:
- i) the net spot position in the currency (i.e. all asset items less all liability items, including accrued interest, other income and expenses, denominated in the currency in question. Assets are included gross of provisions for bad and doubtful debts, other than where the provisions are maintained in the same currency as the underlying assets);
  - ii) the net forward position in the currency (i.e. all amounts to be received less all amounts to be paid in the particular currency under forward foreign exchange contracts, including currency futures and the principal on currency swaps not included in the spot position);
  - iii) guarantees and similar off-balance sheet contingent items that are certain to be called and are likely to be irrecoverable, where the provisions, if any, are not maintained in the same currency;

- iv) net future income/expenses not yet accrued but already fully hedged by forward foreign exchange contracts, provided the anticipatory hedging is part of a formal written policy and items are included on a consistent basis;
- v) profits (i.e. the net value of income and expense accounts) held in the currency in question;
- vi) specific provisions held in the currency in question where the underlying asset is in a different currency, net of assets held in the currency in question where a specific provision is held in a different currency;
- vii) the net delta-based equivalent of the total book of foreign currency options (subject to a separate charge for gamma and vega or other methods described in section F below).

60 All assets and liabilities as described above are to be included at closing mid-market spot exchange rates. Mark-to-market items should be included at the current market value of the positions. However, where net present values are used for normal management accounting purposes, forward currency and gold positions should be measured on a net present value basis, discounted using current interest rates. Forward currency and gold positions must always be valued at current spot market exchange rates and not at forward exchange rates. Net positions in composite currencies may either be broken down into their component parts and included in the net open positions for the individual currencies or treated as a separate currency. A currency swap is treated as a combination of a long position in one currency and a short position in the second currency or calculating the net open position in gold, the net position (spot plus forward) should first be expressed in a standard unit of measurement (i.e. ounces or grams), and then converted at current spot rate into the base currency. Where gold is part of a forward contract (i.e. quality of gold to be received or delivered), any interest rate or foreign currency exposure from the other leg of the contract must also be suitably treated.

61 Positions of a structural nature may be excluded from the calculation of the net open currency positions. Structural positions are of a non-dealing nature, and typically reflect:

- a) positions taken deliberately to hedge, partially or totally, against the adverse effects of exchange rate movements on the capital adequacy ratio;
- b) positions related to items deducted from capital in calculating capital base e.g. investments in non-consolidated subsidiaries; and
- c) retained profits held with the intention of upstreaming to parent.

In such cases, the Authority is prepared to grant exclusion from the net open position calculation on satisfactory evidence of the structural nature of the positions and of their consistent treatment.

- 62 The capital charge is 8% of the overall net open position. It applies to the higher of either the sum of the net long currency positions or the net short currency positions **plus** the net position in gold.

## **Section D Commodities Risk**

- 63 This section sets out the minimum capital requirements to cover the risk of holding or taking on positions in commodities (including precious metals, but excluding gold which is treated alongside foreign exchange risk).
- 64 The commodities position risk and capital charges are calculated by reference to the entire business- i.e. the banking and trading books combined.
- 65 The price risk in commodities is often more complex and more volatile than that associated with currencies and interest rates. Commodity markets may also be less liquid than those for interest rates and currencies, with supply and demand changes consequently having more dramatic effects on price and volatility. It may prove difficult to close out a short position, leaving institutions vulnerable to being squeezed by the market.
- 66 For spot or physical trading, the directional risk arising from a change in the spot price is the most important risk. However, the use of portfolio strategies involving forward or derivative contracts can involve a variety of additional – and potentially larger – risks. These include:
- ‘basis risk’ – i.e. the risk that the relationship between the prices of similar commodities alters over time;
  - interest rate risk – i.e. the risk of a change in the cost of carry for forward positions and options; and
  - forward gap risk – i.e. the risk that the forward price may change for reasons other than a change in interest rates.
- 67 The capital charges for commodities risk set out in this section are intended to provide cover against the above risks. In addition, however, there are credit counterparty risks on over-the-counter derivatives which must be included within credit risk capital requirements. Moreover, the funding of commodities positions may well create interest rate or foreign exchange risk which needs to be captured appropriately within the measurement framework.
- 68 Institutions intending to use internal models for the measurement of their commodities risks must seek the prior consent of the Authority (see section F below). Internal models must capture the directional risk, forward gap and interest rate risks, together with the basis risk. They must also take proper account of market characteristics, notably the delivery arrangements and the scope available to traders to close out positions.

## **Netting**

- 69 Each commodity position (spot and forward) must first be expressed in terms of the standard unit of measurement (e.g. barrels, kilograms etc). Long and short positions in a commodity are reported on a net basis in calculating the net open position in that commodity. For markets with daily delivery dates, any contracts maturing within 10 days of one another may be offset. The net position in each commodity is then converted, at spot rates, into the reporting currency.
- 70 Positions in different commodities cannot be offset in calculating the open positions. However, where two or more sub-categories of the same category are deliverable against each other, netting between those sub-categories is permitted. In addition, if two or more sub-categories can be considered as close substitutes, with a minimum correlation co-efficient of 0.9 between their price movements over a minimum period of 1 year, institutions may seek the Authority's consent to net positions.
- 71 All commodity derivatives and off-balance sheet positions that are affected by changes in commodity prices should be included in the measurement framework for commodities risks. This includes commodity futures, commodity swaps and options, where the 'delta plus' method is used. In order to calculate the risks, commodity derivatives are converted into notional commodities positions and assigned maturities as follows:
- a) futures and forward contracts relating to individual commodities are incorporated into the measurement framework as notional amounts of barrels, kilograms etc and assigned a maturity by reference to their expiry date;
  - b) commodity swaps where one leg is a fixed price and the other is the current market price should be incorporated as a series of positions equal to the notional amount of the contract, with one position corresponding to each payment on the swap, and slotted into the maturity time-bands accordingly. The positions are long where the institution is paying fixed and receiving floating, and short position if vice versa. (If one of the legs involves receiving/paying a fixed or floating interest rate, that exposure should be allocated to the appropriate repricing maturity band for the calculation of interest rate risk);
  - c) commodity swaps where the legs are in different commodities should be incorporated into the measurement framework of the respective commodities separately, without any offsetting (other than where the specific conditions in paragraph 70 above are met).

72 To calculate commodities risk:

- i. the net positions in individual commodities, expressed in terms of the standard unit of measurement are first placed in the maturity ladder. Physical stocks are allocated to the first time-band. A separate maturity ladder is used for each commodity, and the net positions are calculated;
- ii. long and short positions in each time-band are matched. The sum of the matched long and short positions is multiplied first by the spot price of the commodity and then by a spread rate of 1.5% for each time-band as set out in the following table. This represents the capital charge in order to capture forward gap and interest rate risk within a time-band.

<u>Time-bands*</u>
0-1 months
1-3 months
3-6 months
6-12 months
1-2 years
2-3 years
over 3 years

\* Instruments with a maturity on the boundary of two maturity bands should be placed into the earlier maturity band.

- iii. the residual (unmatched) net positions from nearer time-bands are carried forward to offset opposite positions (i.e. long against short, and vice versa) in time-bands that are farther out. However, a surcharge of 0.6% of the net position carried forward is added in respect of each time-band to which the net position is carried forward, in recognition of the imprecise hedging between different time-bands. The surcharge is in addition to the capital charge for each matched amount created by carrying net positions forward;
- iv. for the remaining long or short position after step (iii) above, a capital charge of 15% applies. The Authority reserves the right to substitute a higher charge where institutions seek to run significant open commodities positions.

### **Simplified Approach**

- 73 As an alternative to the above standardized maturity ladder approach, a simplified measure may be used. Both the standardized approach and the simplified approach are appropriate where only limited amounts of commodities business are conducted. Where greater amounts are proposed, a models based approach will be required.
- 74 Under the simplified approach, a capital charge of 15% of the net position, long or short, in each commodity is applied to capture directional risk. An additional charge of 3% of the institution's gross positions, long plus short, is then applied to deal with basis risk, interest rate risk and forward gap risk. Gross positions in commodity derivatives must be valued using current spot prices.

## **Section E Options**

- 75 The measurement of price risk on options is inherently complex and is further complicated by the diversity of institutions' options activities. Institutions which solely purchase options may use the simplified (carve-out) approach described in this section. Where institutions also write options, they must use either the delta-plus (buffer) approach or the scenario approach, or alternatively use a comprehensive risk management model. The treatment of models is set out in section F below.
- 76 The scenario or internal models approaches are generally more satisfactory for managing and measuring options risk, as they assess risk over a range of outcomes, rather than focusing on the point estimate used in the delta-plus approach. The more significant the level or complexity of an institution's options trading activities, the more sophisticated the approach that it should take to the measurement of the relevant risks.
- 77 To the extent that written option positions are hedged by perfectly matched long positions in exactly the same options, no capital charge for market risk is required.

### **Simplified approach**

- 78 Under the simplified approach, positions for options, together with their associated underlying (hedges), cash or forward, are omitted entirely from the calculation of capital charges in the standardised methodology, and are instead 'carved out' and subject to separately calculated capital charges that incorporate both general market risk and specific risk. These alternative capital charges are added to the capital charges for the relevant risk category, i.e. for interest rate related instruments, equities, foreign exchange risk and commodities as described in the respective sections of this paper.
- 79 The capital charges for the carved out positions are shown in Table 6. A similar methodology applies to options whose underlying is in a foreign currency, an interest rate related instrument or a commodity.

**Table 6: Simplified approach: Capital charges**

Position	Treatment
Long cash and long put or Short cash and long call (i.e., hedged positions)	The capital charge is: [Market value of underlying instrument <sup>1</sup> x Sum of specific and general market risk charges <sup>2</sup> for the underlying] <i>minus</i> [Amount, if any, the option is in the money <sup>3</sup> ] The capital charge calculated as above is bounded at zero, i.e., it cannot be a negative number.
Long call and/ or Long put (i.e., naked option positions)	The capital charge is the lesser of: i) Market value of the underlying instrument x Sum of specific and general market risk charges for the underlying; and ii) Market value of the option <sup>4</sup> .

Notes to table:

1. In some cases such as foreign exchange, it may be unclear which side is the "underlying instrument"; this should be taken to be the asset which would be received if the option were exercised. In addition, the nominal value should be used for items where the market value of the underlying instrument could be zero, e.g., caps and floors, swap options etc.
2. Some options (e.g., where the underlying is an interest rate, a currency or a commodity) bear no specific risk, but specific risk is present in the case of options on certain interest rate related instruments (e.g., options on a corporate debt security or a corporate bond index - see Section A for the relevant capital charges), and in the case of options on equities and stock indices (see Section B for the relevant capital charges). The capital charge for currency options is 8% and for options on commodities is 15%.
3. For options with a residual maturity of more than six months, the strike price should be compared with the forward, not the current, price. An institution unable to do this should take the "in the money" amount to be zero.
4. Where the position does not fall within the trading book options on certain foreign exchange and commodities positions not belonging to the trading book), it is acceptable to use the book value instead of the market value.

### **Delta-plus (buffer) approach**

- 80 Institutions that write options may include delta-weighted option positions within the standardised methodology set out in preceding sections. Each option must be reported as a position equal to the market value of the underlying multiplied by the delta. The delta should be calculated by an appropriate model. The Authority expects to review relevant documentation of the process and surrounding control environment, in order to determine the effectiveness of the model used.
- 81 Since delta does not sufficiently cover the risks associated with options positions, there will be additional capital buffers to cover gamma (which measures the rate of change of delta) and vega (which measures the sensitivity of the value of an option with respect to a change in volatility), in order to assess the total capital charge. The gamma and vega buffers should be calculated according to an approved exchange model or to the institution's proprietary options pricing model. Again, the Authority expects to review relevant documentation in order to determine the appropriateness of the model used.
- 82 The treatment of the delta-weighted positions, for the calculation of the capital charges arising from delta risk, is as follows:-

- a) where the underlying is a debt security or an interest rate

The delta-weighted option positions are slotted into the interest rate time-bands as set out in section A-II above. A two-legged approach should be used as for other derivatives, requiring one entry at the time the underlying contract takes effect and a second at the time the underlying contract matures. For example, a bought call option on a June three-month interest rate future is, in April, considered, on the basis of its delta-equivalent value, to be a long position with a maturity of five months and a short position with a maturity of two months. Similarly, a written option with the same underlying as in the first example above, is included in the measurement framework as a long position with a maturity of two months and a short position with a maturity of five months. A two months call option on a bond future, where delivery of the bond takes place in September, is recorded in April as being long the bond and short a five months deposit, both positions being delta-weighted.

Floating rate instruments with caps or floors are treated as a combination of floating rate securities and a series of European-style options. For example, the holder of a three-year floating rate bond indexed to six month LIBOR with a cap of 10% will treat it as a debt security that reprices in six months, together with a series of five written call options on an FRA with a reference rate of 10%, each with a negative sign at the time the underlying FRA takes effect and a positive sign at the time the underlying FRA matures.

The rules applying to closely matched positions, as set out in section A-II, paragraph 37 also apply here.

b) where the underlying is an equity instrument

The delta-weighted positions are incorporated in the measure of market risk described in the section on equity position risk above. For the purposes of this calculation, each national market is treated as a separate underlying.

c) options on foreign exchange and gold positions

The net delta-based equivalent of the foreign currency and gold options are incorporated in the measurement of the exposure for the respective currency or gold position, as described in section C above.

d) options on commodities

The delta-weighted positions are incorporated in the measurement of the commodities risk by the simplified approach or the maturity ladder approach, as described in section D above.

#### Calculation of the gamma and vega buffers

83 As explained in paragraph 81 above, in addition to the capital charges to cover delta risk calculated in accordance with paragraph 80, institutions using the delta-plus method must calculate additional capital charges to cover the gamma and vega risks. These additional capital charges are calculated as follows:

#### Gamma

(a) For each individual option position (including hedge positions), a gamma impact is calculated according to the following formula derived from the Taylor series expansion:

$\text{Gamma impact} = 0.5 \times \text{Gamma} \times \text{VU}$   
where VU = variation of the underlying of the option, calculated as in (b) below

(b) VU is calculated as follows:

(i) for interest rate options, where the underlying is a bond, the market value of the underlying is multiplied by the risk weights shown in Table 3 above. An equivalent calculation is carried out where the

underlying is an interest rate, based on the assumed changes in yield as set out in Table 4;

(ii) for options on equities and equity indices, the market value of the underlying is multiplied by 8%;

(iii) for foreign exchange and gold options, the market value of the underlying is multiplied by 8%;

(iv) for commodities options, the market value of the underlying is multiplied by 15%.

NB: For interest rate and equity options, the above provisions do not capture specific risk in calculating gamma charges.

(c) In calculating the gamma buffer, the following positions are treated as the same underlying:

(i) for interest rates, each time-band as set out in Table 3. Positions should be slotted into separate maturity ladders by currency. Where the duration method is used, the time-bands from Table 4 apply;

(ii) for equities and stock indices, each individual national market;

(iii) for foreign currencies and gold, each currency pair and gold; and

(iv) for commodities, each individual commodity, defined consistently with the approach taken in section D.

(d) Each option on the same underlying will have a gamma impact that is either positive or negative. These individual gamma impacts are summed, resulting in a net gamma impact for each underlying that is either positive or negative. Only those net gamma impacts that are negative are included in the capital calculation.

(e) The total gamma capital charge is the sum of the absolute value of the net negative gamma impacts calculated for each underlying as explained in (d) above.

### Vega

(f) For volatility risk (vega), institutions are required to calculate the capital charges by multiplying the sum of the vegas for all options on the same underlying, as defined above, by a proportional shift in volatility of  $\pm 25\%$ .

(g) The total vega capital charge is the sum of the absolute value of the individual vega capital charges calculated for each underlying.

84 The capital charges for delta, gamma and vega risks described above are in addition to the specific risk capital charges which are determined separately by multiplying the delta-equivalent of each option position by the specific risk weights set out in the sections on interest rate risk, equity position risk, foreign exchange risk and commodities risk, as appropriate.

85 Accordingly, capital requirements for, e.g. OTC options, using the delta-plus method involve:

- (a) counterparty risk capital charges (on purchased options only), calculated in accordance with the credit risk regulations; plus
- (b) specific risk capital charges (as per paragraph 84 above) plus
- (c) delta risk capital charges (set out in paragraph 82 above) plus
- (d) gamma and vega capital buffers (set out in paragraph 83 above).

### **Scenario approach**

- 86 As noted earlier, institutions which have a significant level of options trading activities, or have complex options trading strategies, are expected to use more sophisticated methods for measuring and monitoring the options risks. Those with the appropriate capability will be permitted, with the prior approval of the Authority, to base the market risk capital charge for options portfolios and associated hedging positions on scenario matrix analysis. Before giving its approval, the Authority will closely review the accuracy of the analysis that is constructed. Furthermore, as with internal models, the use of scenario analysis as part of the standardised methodology will also be subject to external validation, and to those of the relevant requirements set out in section F below.
- 87 The scenario matrix analysis involves specifying a fixed range of changes in the option portfolio's risk factors and calculating changes in the value of the option portfolio at various points along this "grid" or "matrix". For the purpose of calculating the capital charge, the options portfolio is revalued using matrices for simultaneous changes in the option's underlying rate or price and in the volatility of that rate or price. A different matrix is established for each type of underlying as categorized in paragraph 82 above. As an alternative, in respect of interest rate options, institutions which are significant traders in such options are permitted to base the calculation on a minimum of six sets of time-bands. When using this alternative method, not more than three of the time-bands defined for interest rate risk measurement purposes in Section A may be combined into any one set.
- 88 The first dimension of the matrix involves a specified range of changes in the option's underlying rate or price. The range specified for each risk category, is as follows:
- (a) Interest rate related instruments: the range for interest rates is consistent with the assumed changes in yield used for the duration method in the general market risk calculation. Those institutions using the alternative method of grouping time-bands into sets (see the previous paragraph) should use, for each set of time-bands, the highest of the assumed changes in yield applicable to the individual time-bands in that group. If, for example, the time-bands 3 to 4 years, 4 to 5 years and 5 to 7 years are combined, the highest assumed change in yield of these three bands (i.e. 0.75) is applicable to that set.
  - (b) Equity instruments: the range is  $\pm 8\%$ .
  - (c) Foreign exchange and gold: the range is  $\pm 8\%$ .
  - (d) Commodities: the range is  $\pm 15\%$ .

For all risk categories, at least seven observations (including the current observation) should be used to divide the range into equally spaced intervals.

- 89 The second dimension of the matrix entails a change in the volatility of the underlying rate or price. A single change in the volatility of the underlying rate or price equal to a shift in volatility of  $\pm 25\%$  is applied.
- 90 The Authority monitors closely the need to reset the parameters for the amounts by which the price of the underlying instrument and volatility must be shifted to form the rows and columns of the scenario matrix. (For the time being, the above parameters will reflect only general market risk.
- 91 After calculating the matrix, each cell contains the net profit or loss of the option and the underlying hedge instrument. The general market risk capital charge for each underlying is then calculated as the largest loss contained in the matrix.
- 92 In addition to the capital charge calculated as above, the specific risk capital charge is determined separately by multiplying the delta-equivalent of each option position by the specific risk weights set out in sections A-D as appropriate.
- 93 Thus, capital requirements for e.g. OTC options, using the scenario approach are as follows:
- (a) counterparty risk capital charges (on purchased options only), calculated in accordance with the credit risk regulations; plus
  - (b) specific risk capital charges (as per paragraph 18 above); plus
  - (c) directional and volatility risk capital charges (i.e., the worst case loss from a given scenario matrix analysis).
- 94 Institutions doing business in certain classes of complex exotic options (e.g. barrier options involving discontinuities in deltas etc.), or in options at the money that are close to expiry, are required to use either the scenario approach or the internal models approach, both of which can accommodate more detailed revaluation approaches. Institutions are expected to liaise closely with the Authority in producing an agreed methodology, within the framework of these rules. If scenario matrix analysis is used, an institution must be able to demonstrate that no substantially larger loss could fall between the nodes.
- 95 In applying the delta-plus and the scenario approaches, the above rules do not attempt to capture specific risk other than the delta-related elements. It is recognized that that introduction of those other specific risk elements would complicate appreciably the measurement framework. At the same time, the simplifying assumptions used in these rules will result in a relatively conservative treatment of certain options positions.
- 96 In addition to the options risks described earlier in this section, additional risks do arise with options e.g., rho or interest rate risk (the rate of change of the value of the option with respect to the interest rate) and theta (the rate of change of the

- value of the option with respect to time). While no specific measurement system for those risks is currently proposed, institutions undertaking significant options business must at least monitor such risks closely. Those wishing to incorporate rho into their capital calculations for interest rate risk are permitted to do so.
- 97 Because of the factors set out in paragraphs 95 and 96 above, the treatment of options in the calculation of market risk capital charges will remain under periodic review.

## **Section F Use of Internal Models**

### Introduction

- 98 As explained in the Introduction to this Appendix, as an alternative to the standardised approach to the measurement of market risks, and subject to the explicit prior approval of the Authority, institutions are permitted to use risk measures derived from their own internal models.
- 99 This section describes the various sets of conditions that must be met before consent is given for the internal models approach. These comprise:
- (a) general criteria regarding the adequacy of the risk management system;
  - (b) qualitative standards for internal oversight of the use of models, notably by senior management;
  - (c) guidelines for specifying an appropriate set of market risk factors (i.e., the market rates and prices that affect the value of a bank's positions);
  - (d) quantitative standards setting out the use of common minimum statistical parameters for measuring risk;
  - (e) guidelines for stress testing;
  - (f) validation procedures for external oversight of the use of models; and
  - (g) rules for institutions which use a mixture of the internal models approach and the standardised approach.
- 100 The standardised methodology, described in sections A-E of this Appendix, employs a "building-block" approach in which the specific risk and the general market risk arising from debt and equity positions are calculated separately. The focus of most internal models is the measurement of general market risk exposure, typically leaving specific risk (i.e., exposures to specific issuers of debt securities and equities) to be measured largely through separate credit risk measurement systems. Institutions using models are subject to separate capital charges, calculated in accordance with the standardized methodology, for the specific risk not captured by their models. (See also the capital charge for institutions modelling specific risk, later in this section.)
- 101 The models recognition criteria described in this section are intended primarily for comprehensive Value-at-Risk (VaR) models. However, the same set of criteria is applied, as appropriate, to other pre-processing or valuation models the output of which is fed into the standardised measurement system, e.g., interest rate sensitivity models (from which the residual positions are fed into the duration ladders) and option pricing models (for the calculation of the delta, gamma and vega sensitivities).
- 102 As a number of strict conditions (including external validation) are required to be met before internal models can be recognised, institutions which are contemplating using internal models should submit detailed written proposals for

the Authority's review and approval, before seeking to report on that basis. It should be noted that, since the model approval process involves a review of both the model and its operating environment, a commercially produced model which is recognised for one institution may not automatically be recognised for another.

### **General criteria**

103 The Authority gives approval for the use of internal models to measure market risks only if, in addition to the detailed requirements described later in this section, it is satisfied that the following general criteria are met:

- (a) that the institution's risk management system is conceptually sound and is implemented with integrity;
- (b) that the institution has, in the Authority's view, sufficient numbers of staff skilled in the use of sophisticated models, not only in the trading area but also in the risk control, audit and the back office areas;
- (c) that the institution's models have, in the Authority's view, a proven track record of reasonable accuracy in measuring risk. The Authority recognises that the use of internal models represents a new development for the Bermuda market and that it may be difficult to establish a track record of reasonable accuracy. The Authority requires a period of initial monitoring and live testing of an internal model before it is used for supervisory capital purposes; and
- (d) that the institution regularly conducts stress tests and backtesting as described later in this section.

### **Qualitative standards**

104 In order to ensure that those institutions using models have market risk management systems that are conceptually sound and implemented with integrity, the following qualitative criteria must be met before permission is given to move to a models-based approach. The extent to which the qualitative criteria are met also helps to determine the level of the multiplication factor that is set for an institution, as described later in this section. Only those with models that, in the Authority's judgment, are in full compliance with the qualitative criteria are eligible for application of the minimum multiplication factor of 3.

105 The qualitative criteria involve the following:

- (a) the institution should have an independent risk management unit that is responsible for the design and implementation of the overall risk management system. The unit should produce and analyse daily reports on the output of the risk measurement model, including an evaluation of the relationship between the measures of risk exposure and the trading limits. This unit must be independent from the business trading units and should report directly to senior management.

- (b) the independent risk management unit should conduct a regular backtesting programme, i.e. an ex-post comparison of the risk measure generated by the model against the actual daily changes in portfolio value over longer periods of time, as well as hypothetical changes based on static positions.
- (c) the board of directors and senior management should be actively involved in the risk management process and must regard such process as an essential aspect of the business to which significant resources need to be devoted. In this regard, the daily reports prepared by the independent risk management unit must be reviewed by a level of management with sufficient seniority and authority to enforce both reductions of positions taken by individual traders and reductions in the overall risk exposure.
- (d) the internal model must be closely integrated into the day-to-day risk management process of the institution. Its output should, accordingly, be an integral part of the process of planning, monitoring and controlling its market risk profile.
- (e) the risk measurement system should be used in conjunction with the internal trading and exposure limits. In this regard, the trading limits should be related to the risk measurement model in a manner that is consistent over time and that is well-understood by both traders and senior management.
- (f) a routine and rigorous programme of stress testing should be in place as a supplement to the risk analysis based on the day-to-day output of the risk measurement model. The results of stress testing should be reviewed periodically by senior management and should be reflected in the policies and limits set by management and the board of directors. Where stress tests reveal particular vulnerability to a given set of circumstances, prompt steps should be taken to manage those risks appropriately (e.g., by hedging against that outcome or reducing the size of the institution's exposures).
- (g) the institution should have a routine in place for ensuring compliance with a documented set of internal policies, controls and procedures concerning the operation of the risk measurement system. The risk measurement system must be well documented, for example, through a risk management manual that describes the basic principles of the risk management system and that provides an explanation of the empirical techniques used to measure market risk.
- (h) an independent review of the risk measurement system should be carried out regularly in the institution's own internal auditing process. This review should include both the activities of the business trading units and of the

independent risk management unit. A review, by the internal auditor, of the overall risk management process should take place at regular intervals (ideally not less than once every six months) and should specifically address, at a minimum:

- (i) the adequacy of the documentation of the risk management system and process;
- (ii) the organisation of the risk management unit;
- (iii) the integration of market risk measures into daily risk management;
- (iv) the approval process for risk pricing models and valuation systems used by front- and back-office personnel;
- (v) the validation of any significant changes in the risk measurement process;
- (vi) the scope of market risks captured by the risk measurement model;
- (vii) the integrity of the management information system;
- (viii) the accuracy and completeness of position data;
- (ix) the verification of the consistency, timeliness and reliability of data sources used to run internal models, including the independence of such data sources;
- (x) the accuracy and appropriateness of volatility and correlation assumptions;
- (xi) the accuracy of valuation and risk transformation calculations;
- (xii) the verification of the model's accuracy through frequent backtesting.

### **Specification of market risk factors**

106 An important part of an institution's internal market risk measurement system is the specification of an appropriate set of market risk factors, i.e. the market rates and prices that affect the value of its trading positions. The risk factors contained in a market risk measurement system should be sufficient to capture the risks inherent in the institution's portfolio of on- and off-balance sheet trading positions. Guidelines on the specification of risk factors for internal models are set out below. Where difficulties arise in specifying the risk factors for any currency or market within a risk category, in accordance with the guidelines, the Authority must immediately be notified, so that alternative methods of calculating risks not captured by the model may be determined.

(a) For interest rates:

- i) there should be a set of risk factors corresponding to interest rates in each currency in which the institution has interest-rate-sensitive on- or off-balance sheet positions.

- ii) the risk measurement system should model the yield curve using one of a number of generally accepted approaches, for example, by estimating forward rates of zero coupon yields. The yield curve should be divided into various maturity segments in order to capture variation in the volatility of rates along the yield curve; there will typically be one risk factor corresponding to each maturity segment. For material exposures to interest rate movements in the major currencies and markets, institutions must model the yield curve using a minimum of six factors. However, the number of risk factors used must ultimately reflect by the nature of the trading strategies. For instance, an institution which has a portfolio of various types of securities across many points of the yield curve and which engages in complex arbitrage strategies requires a greater number of risk factors to capture interest rate risk accurately.
- iii) the risk measurement system must incorporate separate risk factors to capture spread risk (e.g. between bonds and swaps). A variety of approaches may be used to capture the spread risk arising from less than perfectly correlated movements between government and other fixed-income interest rates, such as specifying a completely separate yield curve for non-government fixed-income instruments (for instance, swaps or municipal securities) or estimating the spread over government rates at various points along the yield curve.

(b) For exchange rates (including gold):

- i) the risk measurement system should incorporate risk factors corresponding to the individual foreign currencies in which the institution's positions are denominated. Since the value-at-risk figure calculated by the risk measurement system will be expressed in the institution's reporting currency, any net position denominated in a currency other than the reporting currency will introduce a foreign exchange risk. Thus, there must be risk factors corresponding to the exchange rate between the reporting currency and each other currency in which there is a significant exposure.

(c) For equity prices:

- i) there should be risk factors corresponding to each of the equity markets in which significant positions are held.
- ii) at a minimum, there should be a risk factor that is designed to capture market-wide movements in equity prices (e.g., a market index). Positions in individual securities or in sector indices may

be expressed in ‘beta-equivalents’ relative to this market-wide index. (A ‘beta-equivalent’ position would be calculated from a market model of equity position risk by regressing the return on the individual stock or sector index or the risk-free rate of return and the return on the market index.)

- iii) a somewhat more detailed approach would be to have risk factors corresponding to various sectors of the overall equity market (for instance, industry sectors or cyclical and non-cyclical sectors). As above, positions in individual stocks within each sector could be expressed in ‘beta-equivalents’ relative to the sector index.
- iv) the most extensive approach would be to have risk factors corresponding to the volatility of individual equity issues.
- v) the sophistication and nature of the modelling technique for a given market should correspond to the institution’s exposure to the overall market as well as its concentration in individual equity issues in that market.

(d) For commodity prices:

- i) there should be risk factors corresponding to each of the commodity markets in which significant positions are held.
- ii) for institutions with relatively limited positions in commodity-based instruments, a straightforward specification of risk factors is acceptable. Such a specification might typically entail one risk factor for each commodity price to which there is exposure. In cases where the aggregate positions are reasonably small, it may be acceptable to use a single risk factor for a relatively broad sub-category of commodities (for instance, a single risk factor for all types of oil).
- iii) for more active trading, the model should also take account of variation in the ‘convenience yield’ between derivatives positions such as forwards, swaps and cash positions in the commodity. (The ‘convenience yield’ reflects the benefits of direct ownership of the physical commodity – e.g. the ability to profit from temporary market shortages – and is affected by both market conditions and factors such as physical storage costs.)

## **Quantitative standards**

- 107 The following minimum quantitative standards apply for the calculation of the capital charge.
- (a) "Value-at-risk" must be computed on a daily basis.
  - (b) In calculating the value-at-risk, a 99th percentile, one-tailed confidence interval is to be used.
  - (c) In calculating the value-at-risk, an instantaneous price shock equivalent to a 10-day movement in prices is to be used, i.e., the minimum "holding period" will be ten trading days. Institutions may use value-at-risk numbers calculated according to shorter holding periods scaled up to ten days by the square root of time (for the treatment of options, see also (h) below).
  - (d) The minimum historical observation period (sample period) for calculating value-at-risk is one year. For institutions which use a weighting scheme or other methods for the historical observation period, the "effective" observation period must be at least one year (i.e., the weighted average time lag of the individual observations cannot be less than 6 months). Exceptionally, institutions may be required to calculate their value-at-risk using a shorter observation period where a significant upsurge in price volatility becomes evident.
  - (e) Data sets must be updated no less frequently than once every week and must also be reassessed whenever market prices are subject to material changes.
  - (f) No particular type of model is prescribed. So long as each model used captures all the material risks run, institutions are free to use models based, for example, on variance-covariance matrices, historical simulations, or Monte Carlo simulations.
  - (g) Institutions have discretion to recognise empirical correlations within broad risk categories (i.e., interest rates, exchange rates, equity prices and commodity prices, including related options volatilities in each risk factor category). They are not permitted to recognise empirical correlations across broad risk categories without prior approval. Applications may be made, on a case-by-case basis, for empirical correlations across broad risk categories to be recognized, where the Authority is satisfied as to the soundness and integrity of the institution's system for measuring those correlations.

- (h) Models must accurately capture the unique risks associated with options within each of the broad risk categories. The following criteria apply to the measurement of options risk:
  - i) models must capture the non-linear price characteristics of options positions;
  - ii) institutions are expected to move towards the application of a full 10-day price shock to options positions or positions that display option-like characteristics. In the interim, they may adjust their capital measure for options risk through other methods, e.g., periodic simulations or stress testing;
  - iii) each institution's risk measurement system must have a set of risk factors that captures the volatilities of the rates and prices underlying the option positions, i.e., vega risk. Those with relatively large and/or complex options portfolios should have detailed specifications of the relevant volatilities. This means that institutions should measure the volatilities of options positions split by different maturities.
- (i) each institution must meet, on a daily basis, a capital requirement expressed as the higher of (a) and (b) below, multiplied by a multiplication factor (see (j) below):
  - (a) its previous day's value-at-risk number measured according to the parameters specified in (a) to (h) above; and
  - (b) an average of the daily value-at-risk measures on each of the preceding sixty business days.
- (j) the multiplication factor is set by the Authority, separately for each individual institution, on the basis of an assessment of the quality of the risk management system, and subject to an absolute minimum of 3. Institutions are required to add to the factor set by the Authority, a "plus factor" directly related to the ex-post performance of the model, thereby introducing a built-in positive incentive to maintain the predictive quality of the model. The plus factor will range from 0 to 1 based on the outcome of the institution's backtesting. If the backtesting results are satisfactory and all of the qualitative standards set out above, a plus factor of zero may apply.
- (k) as noted earlier, institutions using models will also be subject to a capital charge to cover specific risk (as defined under the standardised approach) of interest rate related instruments and equity instruments. The manner in which the specific risk capital charge is to be calculated is set out later in this section.

## **Backtesting**

- 108 The following are the key requirements to be met by institutions' backtesting approaches in assessing the accuracy and robustness of internal models for measuring market risk capital requirements. These backtesting procedures typically consist of a periodic comparison of the daily value-at-risk measures with the subsequent daily profit or loss ('trading outcome').
- 109 The procedure involves calculating and identifying the number of times over the prior 250 business days that observed daily trading losses exceed the one-day, 99% confidence level VaR estimate (so-called 'exceptions'). Based on the number of exceptions identified from the backtesting procedures, institutions are classified among three exception categories for the determination of the "scaling factor" to be applied to the market risk measure generated by their internal models. The three categories, termed as zones and distinguished by colours into a hierarchy of responses, are listed below:
- (a) Green zone
  - (b) Yellow zone
  - (c) Red zone
- 110 The green zone corresponds to backtesting results that do not themselves suggest a problem with the quality or accuracy of an institution's internal model. The yellow zone encompasses results that raise certain questions in that regard, but where such a conclusion is not definitive. The red zone indicates a backtesting result that almost certainly indicates a problem with the risk model.
- 111 The corresponding 'scaling factors' applicable to institutions falling into particular zones based on their backtesting results are shown below:

**Table 7: Back-testing - Scaling Factors**

<b>Zone</b>	<b>Number of Exceptions</b>	<b>Increase in Scaling Factor</b>	<b>Cumulative Probability</b>
Green Zone	0	0.00	8.11%
	1	0.00	28.58%
	2	0.00	54.32%
	3	0.00	75.81%
	4	0.00	89.22%
Yellow Zone	5	0.4	95.88%
	6	0.5	98.63%
	7	0.65	99.60%
	8	0.75	99.89%
	9	0.85	99.97%
Red Zone	10 or more	1.00	99.99%

**Notes:**

The table defines the green, yellow and red zones that supervisors will use to assess backtesting results in conjunction with the internal models approach to market risk capital requirements. The boundaries shown in the table are based on a sample of 250 observations. For other sample sizes, the yellow zone begins at the point where the cumulative probability equals or exceeds 95%, and the red zone begins at the point where the cumulative probability equals or exceeds 99.99%.

The cumulative probability is simply the probability of obtaining a given number or fewer exceptions in a sample of 250 observations when the true coverage level is 99%. For example, the cumulative probability shown for four exceptions is the probability of obtaining between zero and four exceptions.

**Stress testing**

- 112 Institutions using the internal models approach for calculating market risk capital requirements must have in place a rigorous and comprehensive stress-testing programme. Stress testing to identify events or influences that could greatly impact the institution is a key component of its assessment of its capital position.
- 113 Stress scenarios need to cover a range of factors that can create extraordinary losses or gains in trading portfolios, or make the control of risk in those portfolios very difficult. These factors include low-probability events in all major types of risks, including the various components of market, credit and operational risks. Stress scenarios need to shed light on the impact of such events on positions that display both linear and non-linear characteristics (i.e., options and instruments that have option-like characteristics).
- 114 Stress tests should be both of a quantitative and qualitative nature, incorporating both market risk and liquidity aspects of market disturbances. Quantitative criteria should identify plausible stress scenarios to which institutions could be exposed. Qualitative criteria should reinforce the fact that two major goals of stress testing are to evaluate the capacity of the institution's capital to absorb potential large losses and to identify steps it can take to reduce its risk and conserve capital. This assessment is integral to setting and evaluating management's risk strategy, and the results of stress testing should be routinely communicated to senior management and, periodically, to the bank's board of directors.
- 115 Institutions should combine the use of stress scenarios as set out at (a), (b) and (c) below by the Authority, with stress tests developed by them to reflect their specific risk characteristics. The Authority asks banks to provide information on stress testing in three broad areas:

- (a) Scenarios requiring no simulation by the institution

Institutions should have information on the largest losses experienced during the reporting period available for review. This loss information is compared with the level of capital that results from the internal

measurement system, enabling identification, for example, of the number of days of peak day losses that would have been covered by a given value-at-risk estimate.

(b) Scenarios requiring simulation by the institution

Institutions should subject their portfolios to a series of simulated stress scenarios and provide the Authority with the results. These scenarios could include testing the current portfolio against past periods of significant disturbance, incorporating both the large price movements and the sharp reduction in liquidity associated with stress events. A second type of scenario evaluates the sensitivity of market risk exposure to changes in the assumptions about volatilities and correlations. Applying this test would require an evaluation of the historical range of variation for volatilities and correlations and evaluation of the current positions held against the extreme values of the historical range. Due consideration should be given to the sharp variation that, at times, has occurred in a matter of days in periods of significant market disturbance. On such occasions, correlations within risk factors approaching the extreme values of 1 and (-1) have in the past been experienced for several days at the height of the disturbance.

(c) Scenarios developed by the institution to capture the specific characteristics of its portfolio

In addition to the general scenarios identified in (a) and (b) above, an institution should also develop its own stress scenarios which it identifies as most adverse based on the characteristics of its portfolio. The Authority should be provided with a description of the methodology used to identify and carry out the scenarios as well as with a description of the results derived from these stress tests.

- 116 Once a stress scenario has been identified, it should be used for conducting stress tests at least once every quarter, as long as the scenario continues to be relevant to the portfolio.
- 117 The results of all stress tests should be reviewed by senior management within 15 days from the time they are available, and should be promptly reflected in the policies and limits set by management and the board of directors. Moreover, if the testing reveals particular vulnerability to a given set of circumstances, the institution is expected to take prompt steps to manage those risks appropriately (e.g., by hedging against that outcome or reducing the size of its exposures).

### **External validation of models**

- 118 Before granting approval for the use of internal models, the Authority requires that models are validated by both the internal and external auditors of the bank. It reviews the validation procedures performed by the internal and external auditors, and may independently carry out further validation procedures.
- 119 The internal auditor's review of the overall risk management process should take place at regular intervals (not less than once every six months). The internal auditor must make a report to senior management and the board of directors, in writing, of the results of the validation procedures. The report must also be made available to the Authority on a timely basis for its review.
- 120 The validation of models by the external auditors should include, at a minimum, the following steps:
- (a) verifying and ensuring that the internal validation processes described above are operating satisfactorily;
  - (b) ensuring that the formulae used in the calculation process as well as for the pricing of options and other complex instruments are validated by a qualified unit, which in all cases should be independent from the trading area;
  - (c) checking and ensuring that the structure of the internal models is adequate with respect to the institution's activities and geographical coverage;
  - (d) checking the results of the institution's backtesting of its internal measurement system (i.e., comparing value-at-risk estimates with actual profits and losses) to ensure that the model provides a reliable measure of potential losses over time; and
  - (e) making sure that data flows and processes associated with the risk measurement system are transparent and accessible.
- 121 The external auditors should carry out their validation/review procedures, at a minimum, once every year. Based on the above procedures, the external auditors should report, in writing, on the accuracy of the models, including all significant findings of their work. The report should be addressed to the senior management and/or the board of directors, and a copy of it should be made available to the Authority. The results of any additional validation procedures carried out by the external auditors during the year, should also be made available promptly to the Authority.
- 122 Institutions must ensure that external auditors and the Authority are in a position to have easy access, whenever they judge it necessary, to the models'

specifications and parameters as well as to the results of, and the underlying inputs to, their value-at-risk calculations.

### **Model Recognition**

- 123 Institutions seeking to use internal models for the calculation of their market risk capital requirements must submit detailed proposals to the Authority. Once it has determined that the models meet all the criteria for recognition set out earlier in this section, and after satisfying itself with the results of validation procedures the Authority will provide written confirmation of model recognition to the institution.
- 124 The Authority's confirmation will include full details of the products covered, the method for calculating capital requirements on the products and the conditions attaching to model recognition. In the case of pre-processing models, the Authority will also specify how the output of recognised models should feed into the processing of other interest rate, equity, foreign exchange and commodities risk. The conditions of model recognition may include additional reporting requirements. The Authority's prior written approval must be obtained for any modifications proposed to be made to models previously recognised by the Authority. In cases where it is proposed to apply the model to new but similar products, the Authority's prior consent is also required.
- 125 The approval granted for any institution's model may be withdrawn if the Authority concludes that the conditions based on which the approval was granted are no longer valid or have changed significantly.

### **Combination of internal models and the standardised methodology**

- 126 Other than where exposure to a particular risk factor is insignificant, the internal models approach in principle requires institutions to have an integrated risk measurement system that captures the broad risk factor categories (i.e., interest rates, exchange rates (which includes gold), equity prices and commodity prices, with related options volatilities being included in each risk factor category). Thus, institutions which start to use models for one or more risk factor categories are expected, over a reasonable period of time, to extend the models to all their market risks.
- 127 An institution which has obtained the Authority's approval for the use of one or more models will no longer be able to revert to measuring the risk measured by those models according to the standardised methodology. However, the Authority does not apply a fixed period time within which institutions using a combination of internal models and the standardised methodology must move to a comprehensive model. Rather, this is determined having regard to the particular circumstances of each case. For institutions which, for the time being, are using

a combination of internal models and the standardised methodology, the following conditions apply:

- (a) each broad risk factor category must be assessed using a single approach (either internal models or the standardised approach), i.e., no combination of the two methods is, in principle, permitted within a risk factor category or across different entities for the same type of risk;
- (b) all of the criteria set out in this section apply to the models that are used;
- (c) institutions may not modify the combination of the two approaches they are using without the Authority's prior written approval;
- (d) no element of market risk may escape measurement, i.e. the exposure for all the various risk factors, whether calculated according to the standardised approach or internal models, must be captured; and
- (e) the capital charges assessed under the standardised approach and under the models approach should be aggregated using the simple sum method.

#### **Treatment of specific risk**

128 Institutions using models are permitted to base their specific risk capital charge on modelled estimates provided they meet all of the qualitative and quantitative requirements for general risk models as well as the following additional criteria. Those unable to meet the additional criteria are be required to base their specific risk capital charge on the full amount of the specific risk charge calculated by the standardised methodology.

129 The criteria for applying modelled estimates of specific risk require that a model:

- i) explain the historical price variation in the portfolio<sup>1</sup>;
- ii) demonstrably capture concentration (magnitude and changes in composition)<sup>2</sup>;
- iii) be robust to an adverse environment<sup>3</sup>; and

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<sup>1</sup> The key measurement of model quality are "goodness-of-fit" measures which address the question of how much of the historical variation in price value is explained by the model. One measure of this type which can often be used is an R-squared measure from regression methodology. If this measure is to be used, the model would be expected to be able to explain a high percentage, such as 90%, of the historical price variation or to explicitly include estimates of the residual variability not captured in the factors included in this regression. For some types of model, it may not be feasible to calculate a goodness-of-fit measure. In such an instance, an institution is expected to contact the Authority to define an acceptable alternative measure which would meet this regulatory objective.

<sup>2</sup> The institution should be expected to demonstrate that the model is sensitive to changes in portfolio construction and that higher capital charges are attracted for portfolios that have increasing concentrations.

<sup>3</sup> The institution should be able to demonstrate that the model will signal rising risk in an adverse environment. This could be achieved by incorporating in the historical estimation period of the model at least one full credit cycle and

- iv) be validated through backtesting aimed at assessing whether specific risk is being accurately captured.

In addition, the institution must be able to demonstrate that it has methodologies in place which allow it to adequately capture event and default risk for its traded debt and equity positions.

130 Institutions which meet the criteria set out above for models but do not have methodologies in place to adequately capture event and default risk are required to calculate their specific risk capital charge based on the internal model measurements plus an additional prudential surcharge as set out below. The surcharge is designed to treat the modelling of specific risk on the same basis as a general market risk model that has proven deficient during backtesting. This means that the equivalent of a scaling factor of four applies to the estimate of specific risk until such time as an institution can demonstrate that the methodologies it uses adequately capture event and default risk. Thereafter, the minimum multiplication factor of three can be applied. Nonetheless, a multiplication factor of four on the modelling of specific risk remains possible if future backtesting results indicate a serious deficiency in the model.

131 For institutions applying the surcharge, the total market risk measure equals a minimum of three times the internal model's general and specific risk measure plus a surcharge in the amount of either:

- (a) the specific risk portion of the value-at-risk measure which should be isolated<sup>4</sup>; or, at the bank's option,
- (b) the value-at-risk measures of sub-portfolios of debt and equity positions that contain specific risk<sup>5</sup>.

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ensuring that the model would not have been inaccurate in model at least one full the downward portion of the cycle. Another approach for demonstrating this is through simulation of historical or plausible worst-case environments.

<sup>4</sup> Techniques for separating general market risk and specific risk would include the following:

**Equities:**

The market should be identified with a single factor that is representative of the market as a whole, for example, a widely accepted broadly based stock index for the country concerned.

Institutions that use factor models may assign one factor of their model, or a single linear combination of factors, as their general market risk factor.

**Bonds:**

The market should be identified with a reference curve for the currency concerned. For example, the curve might be a government bond yield curve or a swap curve; in any case, the curve should be based on a well-established and liquid underlying market and should be accepted by the market as a reference curve for the currency concerned.

Institutions may select their own technique for identifying the specific risk component of the value-at-risk measure for purposes of applying the multiplier of 4. Techniques would include:

- Using the incremental increase in value-at-risk arising from the modelling of specific risk factors;
- Using the difference between the value-at-risk measure and a measure calculated by substituting each individual equity position by a representative index; or
- Using an analytic separation between general market risk and specific risk by a particular model.

<sup>5</sup> This would apply to sub-portfolios containing positions that would be subject to specific risk under the standardized approach.

Institutions using option (b) above are required to identify their sub-portfolios structure ahead of time and may not make changes without the Authority's prior written consent.

- 132 Institutions which apply modelled estimates of specific risk are required to conduct backtesting aimed at assessing whether specific risk is being accurately captured. The methodology to be used for validating the specific risk estimates involves performing separate backtests on sub-portfolios using daily data on sub-portfolios subject to specific risk. The key sub-portfolios for this purpose are traded debt and equity positions. However, if the trading portfolio is decomposed into finer categories (e.g., emerging markets, traded corporate debt, etc.), these distinctions should be employed for sub-portfolio backtesting purposes.
- 133 Institutions must have in place a process to analyse exceptions identified through the backtesting of specific risk. This process is intended to serve as the fundamental means by which models of specific risk can be corrected in the event they become inaccurate. There is a presumption that models incorporating specific risk are not acceptable if the results at the sub-portfolio level produce a number of exceptions commensurate with the Red Zone referred to in paragraph 111 above. In such cases, immediate action should be taken to correct the problem in the model and to ensure that there is a sufficient capital buffer to absorb the risk that appears not to have been adequately captured.