



SUPERVISORY AND REGULATORY GUIDELINES: PU42-0408

Interest Rate Risk

Issued: 13th August, 2012

Revised : 1st December, 2016

GUIDELINES FOR THE MANAGEMENT OF INTEREST RATE RISK

1. INTRODUCTION

- 1.1. The Central Bank of The Bahamas (“the Central Bank”) is responsible for the licensing, regulation and supervision of banks and trust companies operating in and from within The Bahamas pursuant to the Central Bank of The Bahamas Act, 2000 (“the CBA”) and the Banks and Trust Companies Regulation Act, 2000 (“the BTCRA”). Additionally, the Central Bank has the duty, in collaboration with financial institutions, to promote and maintain high standards of conduct and management in the provision of banking and trust services.
- 1.2. All licensees are expected to adhere to the Central Bank’s licensing and prudential requirements, ongoing supervisory programmes and required regulatory reporting, and are subject to periodic on-site examinations. Licensees are also expected to conduct their affairs in conformity with all other Bahamian legal requirements.

2. PURPOSE

- 2.1. These Guidelines highlight the key elements of prudent interest rate risk management and are consistent with the Basel Committee on Banking Supervision’s paper on the *Principles for the Management and Supervision of Interest Rate Risk*, July 2004. The Central Bank anticipates that in implementing the principles outlined in these Guidelines, the board of directors (“the board”) and senior management of licensees will be able to exercise sound oversight of interest rate risk and ensure that interest rate risk exposure is adequately and appropriately identified, measured, monitored, and controlled.
- 2.2. These Guidelines provide the minimum policies and procedures that each licensee should have in place, within their overall corporate governance processes and risk management programmes, to manage interest rate risk present in their business activities. Hence, these Guidelines should be read in

conjunction with the “*Guidelines for the Corporate Governance of Banks and Trust Companies Licensed to do Business within and from within The Bahamas*”.

3. APPLICABILITY

- 3.1. The Central Bank appreciates that the interest rate risk management program will depend to some extent on the range and complexity of activities undertaken by a licensee. Therefore, these Guidelines apply, as appropriate, to all licensees that engage in business activities, particularly the provision of banking services, which give rise to interest rate risk. In the case of branches and subsidiaries, whose respective head office or parent company subscribes to an interest rate risk management programme that is consistent with these Guidelines and make adequate provisions for the branch or subsidiary in question, the Central Bank will consider the merits of such a case and provide an exemption to the institution from establishing a separate interest rate risk programme where appropriate.

4. DEFINITION

- 4.1. Interest rate risk is the exposure of a licensee’s financial condition (earnings and capital) to adverse movements in interest rates. Interest rate risk arises when a licensee’s principal and interest cash flows from assets do not coincide with the principal, interest and benefit cash flows derived from liabilities. Interest rate risk can be broken into four broad categories: (1) re-pricing (or maturity mismatch) risk, (2) yield curve risk, (3) basis risk, and (4) option risk (see further definition in the Appendix A).

THE TRADING BOOK/BANKING BOOK BOUNDARY

- 4.2. Whilst licensees are exposed to interest rate risk both in the trading book and banking book, the Central Bank recognizes the importance of distinguishing between the two books and expects there to be a clear divide between the two. Licensees must document and disclose their policies for the assignment of instruments to the trading book or banking book and make available such documentation to the Central Bank. Licensees must prepare, evaluate and have available specified reports used in their boundary determination decision, including reports on inventory ageing, daily limits, intraday limits (licensees with active intraday trading), market liquidity and any deviations from the presumption lists. Licensees are restricted from switching instruments after initial designation and may be permitted to do so only in exceptional circumstances and subject to approval by the Central Bank.

-
- 4.3. Banking book instruments are those that do not meet the definition of the trading book and include any unlisted equity, instrument designated for securitisation warehousing, real estate holdings, equity investment in a fund (including a hedge fund) where the licensee cannot look through the fund daily or where the licensee cannot obtain real prices for its equity investment in the fund or derivative instrument with the preceding instruments types as underlying assets¹.
 - 4.4. Trading book instruments are financial instruments and commodities held either with trading intent or in order to hedge other elements of the trading book. To be eligible for trading book capital treatment, financial instruments must either be free of any restrictive covenants on their tradability or able to be hedged completely. In addition, positions should be frequently and accurately valued, and the portfolio should be actively managed. Positions held with trading intent are those held intentionally for short-term resale and/or with the intent of benefiting from actual or expected short-term price movements or to lock in arbitrage profits, and may include, for example, proprietary positions, positions arising from client servicing (e.g. matched principal broking) and market making. Licensees should have a policy that specifies which items are allocated to its trading book.

5. EFFECTS OF INTEREST RATE RISK

- 5.1. Changes in interest rates can have adverse effects on both a licensee's earnings and economic value. Interest rate risk exposure can therefore be assessed from separate but complementary perspectives as highlighted below:

Earnings Perspective

- 5.2. Under the earnings perspective (or income effect), the focus of the analysis is on the impact of interest-rate changes on accruing or reported earnings. As reduced earnings or outright losses can threaten the financial viability of a licensee by undermining its capital and by reducing market confidence, licensees should assess the impact of interest rate changes on net interest income (i.e. the difference between total interest income and total interest expense). Additionally, licensees should assess the impact of interest rate changes on activities that generate fee-based and other non-interest income such as loan servicing and asset securitization programmes, which can be highly sensitive to market interest rates.

¹ Licensees are encouraged to consult the Basel Committee's paper, "Standards for interest rate risk in the banking book", April 2016 for further guidance on the management of interest rate risk in the banking book. The standards contained therein, are expected to be implemented by 2018.

Economic Value Perspective

- 5.3. Variations in market interest rates can affect the economic value of licensee's assets, liabilities and off-balance sheet positions. The economic value of an instrument represents an assessment of the present value of its expected net cash flows, discounted to reflect market rates. As fluctuations in interest rates will affect a licensee's earnings, they will also affect its net worth. Under the economic value perspective, licensees should assess the potential long-term effects of changes in interest rates on a licensee's overall position.

6. BOARD AND SENIOR MANAGEMENT OVERSIGHT

- 6.1. Effective supervision by the board and senior management is critical for sound interest rate risk management. It is essential that these individuals are aware of their responsibilities with regard to interest rate risk management and that they adequately perform their roles in overseeing and managing interest rate risk.
- 6.2. The formality and sophistication with which the board and senior management fulfil their responsibilities may vary significantly among licensees, depending on the level of the licensee's risk and complexity of its holdings and activities. Licensees with non-complex activities and relatively short-term balance sheet structures presenting relatively low risk levels may be able to rely on a relatively basic and less formal interest rate risk management process provided their procedures for managing and controlling risks are communicated clearly and are well understood by all relevant parties. More complex organizations and those with higher interest rate risk exposure or holding of complex instruments with significant interest-rate option characteristics may require more elaborate and formal interest rate risk management processes. Regardless of the size of the licensee, the board and senior management should ensure that there is adequate separation of duties in key elements of the risk management process to avoid potential conflicts of interest. Therefore, licensees should have risk measurement, monitoring, and control functions with clearly defined duties that are sufficiently independent from its position-taking functions, which report risk exposures directly to senior management and the board of directors.
- 6.3. The board may delegate responsibility for establishing interest rate risk policies and strategies to the Asset and Liability Committee². Larger or more

² The Asset and Liability Committee oversees the licensee's operations relating to interest-rate risk, market risk and liquidity risk and, in particular, ensures that the organization has adequate funds to meet its obligations. Other functions of the committee are dependent on the organization's lines of business and asset/liability mix.

complex licensees should have such committees, responsible for the design and administration of interest rate risk management.

Board of Directors' Responsibilities

- 6.4. The board has the ultimate responsibility for understanding the nature and the level of interest rate risk exposure taken by the licensee. It must ensure that the licensee implements sound fundamental principles that facilitate the identification, measurement, monitoring, and control of interest rate risk. Further, the board should encourage discussions between its members and/or senior management - as well as between senior management and staff - regarding the licensee's interest rate risk exposures and management process.
- 6.5. Generally, the broad responsibilities of the board are to:
- i. establish and define the licensee's tolerance for interest rate risk, including approving relevant risk limits and other key policies;
 - ii. ensure that senior management has full understanding of the interest rate risks incurred by the licensee;
 - iii. provide clear guidance to management regarding the board's tolerance for risk;
 - iv. approve in advance broad objectives and strategies and major policies governing interest rate risk management;
 - v. approve policies that identify lines of authority and responsibility for managing interest rate risk exposures;
 - vi. ensure that adequate resources are devoted to interest rate risk management;
 - vii. to periodically review information that is sufficient in detail and timeliness to allow it to understand and assess the performance of senior management in monitoring and controlling interest rate risks in compliance with the bank's board-approved policies;
 - viii. assess the performance of senior management in monitoring and controlling interest rate risks in compliance with approved strategies and policies;
 - ix. assess periodically compliance with approved policies, procedures, and risk limits; and
 - x. re-evaluate significant interest rate risk management policies, procedures and risk limits at least annually.

Senior Management's Responsibilities

- 6.6. Senior management should ensure that the licensee's operations and level of interest rate risk are effectively managed and that appropriate risk

management policies and procedures are established and maintained. Senior management must also ensure that resources are available to evaluate and control interest rate risk, which allows the licensee to conduct its activities in a safe and sound manner.

- 6.7. In managing the licensee's activities, senior management should:
- i. develop and implement policies and procedures that translate the board's goals, objectives, and risk limits into operating standards that are well understood by the licensee's staff and that are consistent with the board's intent;
 - ii. ensure that appropriate policies and procedures are established to control and limit interest rate risks;
 - iii. ensure adherence to the lines of authority and responsibility that the board has approved for managing, measuring, and reporting interest rate exposures;
 - iv. oversee the implementation and maintenance of management information and other systems that measure, monitor, control and report the licensee's interest rate risk;
 - v. establish and maintain effective internal controls over the interest rate risk management process;
 - vi. monitor the licensee's overall interest rate risk profile and ensure that the level of interest rate risk is maintained at prudent levels;
 - vii. ensure that the licensee's operations and activities are conducted by competent staff with technical knowledge and experience consistent with the nature and scope of their activities;
 - viii. provide the board with periodic reports and briefings on the licensee's interest - risk related activities and risk exposures; and
 - ix. review periodically the licensee's risk management systems, including related policies, procedures, and risk limits.

7. RISK MANAGEMENT POLICIES, PROCEDURES AND CONTROLS

7.1. The specifics of interest rate risk management program will differ between licensees depending on the size, nature and complexities of their asset and liability position, their interest rate risk position, their risk tolerance and their risk profile. Nonetheless, a comprehensive interest rate risk management program requires the following:

- i. appropriate board and senior management oversight;
- ii. adequate risk management policies and procedures;
- iii. appropriate risk identification, measurement, monitoring and control functions; and

-
- iv. comprehensive internal controls and independent audits.
- 7.2 The use of hedging techniques is one method of managing and controlling interest rate risk. There are several financial instruments, which can be used for hedging purposes, the most common one being derivative instruments. Examples include foreign exchange contracts, foreign currency and interest rate future contracts, foreign currency and interest rate options, and foreign currency and interest rate swaps. Each licensee should consider which instruments and techniques are appropriate for the nature and extent of its interest rate risk activities, the skills and experience of management, and the capacity of the interest rate risk reporting and control systems.
- 7.3 Separate calculations should be undertaken by licensees where 5% or more of the banking book assets or liabilities are denominated in different currencies using an interest rate shock. Remaining exposures should be aggregated and subjected to a 200 basis point shock. An exception however, can be made in cases where currencies such as the Bahamian dollar whose dollar value is on par with the US dollar, has proven to be stable and there is no foreseeable impediments. The Central Bank will have due regard to licensees that adopt other scenarios such as yield curve twists, inversions and other relevant scenarios within a standardized rate shock assessment that is appropriate for the nature and scale of risks involved.

8. RISK IDENTIFICATION, MEASUREMENT AND DISCLOSURE

- 8.1. Accurate and timely identification and measurement of interest rate risk are necessary for the effective functioning of an interest rate risk management programme of a licensee. Interest rate risk may be identified through the analysis of the various sources of interest rate risk exposure, namely repricing or maturity mismatch risk, basis risk, yield curve risk and option risk. Once identified, licensees should devise interest rate measurement systems that capture all material sources of interest rate risk. The system should provide meaningful measures of a licensee's current levels of interest rate risk exposure, and should be capable of identifying exposure that may arise.
- 8.2. The integrity and timeliness of data on current positions is also a key component of the risk measurement process. A licensee should have adequate information systems for measuring, monitoring, controlling and reporting interest rate risk. Reports must be provided on a timely basis to the licensee's board, senior management and where appropriate, individual business line managers.
- 8.3. The risks to which licensees are exposed and the techniques that licensees use to identify, measure, monitor and control those risks are important factors market participants consider in their assessment of an institution. In this

regard, licensees are required to publicly disclose their interest rate risk in the banking book strategies, processes and risk reporting and measurement systems in accordance with the Pillar III market discipline provisions of Basel II. Additionally, licensees are required to disclose their policies for hedging and other risk mitigation and processes for monitoring the effectiveness of hedges and mitigants.

Interest Rate Risk Measurement Systems

- 8.4. There are several techniques which licensees may use to measure the interest rate exposure of both earnings and economic value to changes in interest rates. These techniques range from very simple calculations to statistical simulation models of a wide range of scenarios. The methods vary in their ability to capture the different forms of interest rate exposure. The simplest methods are intended primarily to capture the risks arising from maturity and repricing mismatches, while the more sophisticated methods can more easily capture the full range of risk exposures
- 8.5. The nature and mix of a licensee's business lines and the interest rate risk characteristics of its activities will dictate the type of measurement system required. The three most common risk measurement systems used to quantify a licensee's interest rate risk exposure are repricing maturity gap reports, net income simulation models, and economic valuation or duration models. Licensees may consult the Basel Committee's paper, *Principles for the Management and Supervision of Interest Rate Risk*, July 2004, for further guidance on the establishment and maintenance of an interest rate risk management system and the brief highlights at Appendix B of these Guidelines.
- 8.6. At a minimum, a licensee's internal system must meet the following criteria:
- (a) All material interest rate risk associated with a licensee's assets, liabilities and off balance sheet positions in the banking book must be assessed. Internal systems must accurately incorporate all interest rate sensitive on-and off-balance-sheet holdings.
 - (b) Generally accepted financial concepts and risk measurement techniques must be utilized. In particular, internal systems must be capable of measuring risk using both an earnings and economic value approach. The monitoring of interest rate risk in the banking book for supervisory purposes should be based on the risk as measured by the economic value approach.
 - (c) Data inputs are adequately specified (commensurate with the nature and complexity of a licensee's holdings) with regard to rates, maturities, re-pricing, embedded options, and other details to provide a

reasonably accurate representation of changes in economic value or earnings.

- (d) The system's assumptions used to transform positions into cash flows must be reasonable, properly documented and stable over time. This is especially important for assets and liabilities whose behavior differs markedly from contractual maturity or repricing, and for new products. Material changes to assumptions should be documented, justified and approved by senior management.
 - (e) Interest rate risk measurement systems must be integrated into the licensee's daily risk management practices. The output of the systems should be used in reporting the level of interest rate risk to senior management and the Boards of Directors (or the relevant Committee).
 - (f) The interest rate shock (or equivalent parameters) identified below has been properly incorporated into the internal systems.
- 8.7. When measuring interest rate risk exposure, licensees should pay special attention to the treatment of positions where behavioural maturity differs from contractual maturity and the treatment of positions denominated in different currencies. Savings and sight deposits may have contractual maturities or may be open-ended, but depositors generally have the option to make withdrawals at any time. As such, changes in interest rates may affect the value of the positions as well as the timing of cash flows in ways which may be difficult to predict.
- 8.8. Where material positions are held in different currencies, licensees should consider the different interest rate risk exposure in each currency. Licensees may also choose to include in the risk measurement process, methods to aggregate exposures in different currencies using assumptions about the correlation between interest rates in different currencies. Licensees that use such correlation assumptions should periodically review the stability and accuracy of those assumptions and evaluate the potential risk exposure in the event such correlations break down.

Limits

- 8.9. Licensees should establish and enforce operating limits and other practices that maintain exposures within levels consistent with their internal policies. A system of interest rate risk limits should set prudent boundaries for the level of interest rate risk exposure for the licensee. Limits should be consistent with the licensee's underlying approach to interest rate risk measurement and should be based on capital levels, earnings, performance, and the risk tolerances. The limits should also address the potential impact of changes in market interest rates on reported earnings and the licensee's economic value of equity. Positions exceeding limits or predetermined levels should receive

prompt senior management attention. Additionally, interest rate risk limits should be reassessed on a regular basis to reflect changes in the institution's overall risk philosophy or risk profile.

Stress Testing

- 8.10. Licensees should measure their vulnerability to loss in stressed market conditions by conducting stress tests. Licensees should use interest rate scenarios that are sufficiently varied to encompass different stressful market conditions. Stress tests should include "worst case" scenarios in addition to more probable scenarios. In conducting stress tests, special consideration should be given to instruments or positions that may be difficult to liquidate or offset in stressful situations. Board and senior management should consider the results of stress tests when establishing and reviewing strategies policies and limits for interest rate risk.
- 8.11. As part of its assessment of licensees' interest rate risk arrangements, the Central Bank will expect licensees to provide such results expressed in terms of the threat to economic value, using a standardized interest rate shock. At a minimum, the standardized rate shock should include either of the following:
- An upward and downward 200 basis point parallel rate shock; or
 - 1st and 99th percentile of observed interest rate changes using a one-year (240 working days) holding period and a minimum five years of observations.
- 8.12. Licensees whose interest rate risk in the banking book leads to an economic value decline of more than 20% of the sum of Tier 1 and Tier 2 following the use of the standardized interest rate shock or its equivalent, will be required immediately to either reduce its risk, hold an additional amount of capital to support the level of risk, or a combination of both.

Sensitivity Analysis

- 8.13. Licensees should use interest rate scenarios to estimate the impact of changes in interest rates on the net interest margin. Assumptions regarding the replacement of maturing assets and liabilities are made to simulate the impact of future changes in rates and/or balance sheet composition. Simulation tools serve as the primary means to gauge interest rate exposure, for example the use of net interest margin simulation and asset/liability net present value sensitivity analyses. These analyses provide an understanding of the range of potential impacts on net interest revenue and portfolio equity caused by interest rate movements. Board and senior management should consider the

results of such analyses when establishing and reviewing strategies policies and limits for interest rate risk.

9. INTERNAL REVIEWS AND INDEPENDENT AUDITS

- 9.1. A fundamental component of the internal control system involves regular independent reviews and evaluations of the effectiveness of the interest rate risk management system. Licensees should conduct periodic reviews of their risk management process for interest rate risk to ensure its integrity, accuracy and reasonableness. Internal reviews should assess whether personnel are following established policies and procedures, as well as ensuring that the procedures that were established actually accomplish the intended objectives. Internal reviews should also assess the assumptions, parameters, and methodologies used in interest rate risk measurement systems.
- 9.2. Management should ensure that internal reviews and evaluations are conducted regularly by personnel who are independent of the function they are assigned to review. Institutions with more complex profiles and measurement systems should have their internal models or calculations audited or validated by an external reviewer or auditor. In such independent reviews/audits, the quantity of interest rate risk and the quality of interest rate management should be assessed.
- 9.3. The following factors should be considered by the internal reviewer or the independent auditor in making their risk assessments:
- i. the volume and price sensitivity of various products;
 - ii. the vulnerability of earnings and capital under differing rate changes including yield curve changes;
 - iii. the exposure of earnings and economic value to various forms of interest rate risk, including basis and option risks;
 - iv. the extent of the board and senior management involvement in the risk control process;
 - v. the adequacy with which an institution documents internal policies, controls and procedures concerning interest rate risk and the extent to which they are complied with;
 - vi. the adequacy of, and personnel's compliance with, the institution's risk measurement system;
 - vii. the appropriateness of the licensee's risk measurement system given the nature, scope and complexity of its activities;
 - viii. the accuracy and completeness of the data inputs into the licensee's risk measurement system, data accurately processed and data aggregation is proper and reliable;

- ix. the reasonableness and validity of scenarios used in the risk measurement system. The validity of the risk measurement calculations is often tested by comparing actual versus forecasted results.

The scope, formality and frequency of conducting internal reviews or independent audits will depend on the size and complexity of the institution. The findings of the review or audit should be reported to the board.

10. CAPITAL & REPORTING REQUIREMENTS

- 10.1. In addition to adequate systems and controls, capital has an important role to play in mitigating and supporting interest rate risk. In cases where licensees undertake significant interest rate risk in the course of their business strategy, capital should be allocated specifically to support this risk. The appropriate level of capital in support of interest rate risk should be at the discretion of the board and senior management of a licensee. However, if the Central Bank is of the view that a licensee's level of interest rate risk exposures is high in relation to its capital, it will discuss this concern with senior management of the licensee. Depending on the circumstances, the Central Bank may require a licensee to strengthen its capital position or reduce its level of interest rate risk exposure.
- 10.2. Licensees are required to have in place a process for assessing their overall capital adequacy in relation to their risk profile and a strategy for maintaining their capital levels. This process as referred to under Basel Pillar II requirements is the Internal Capital Adequacy Assessment Process (ICAAP). The Central Bank expects all licensees to develop and implement their own ICAAP for the purpose of setting internal capital targets and developing strategies to achieve those internal targets that are in line with their business plans, risk profile and operating environment. A well-documented ICAAP plays an important role in a licensee's risk management program and therefore should produce a level of capital commensurate with the nature and level of the licensee's risk.
- 10.3. With regards to the interest rate risk in the banking book, the ICAAP should include all of the licensee's material interest rate risk positions and consider all relevant repricing and maturity data. The process should have well-documented assumptions and techniques. A licensee should be able to support its assumptions about the behavioural characteristics of non-maturity and other assets and liabilities, especially those exposures characterized by embedded optionality. Given uncertainty in such assumptions, stress testing and scenario analysis should be used in the analysis of interest rate risk.

- 10.4. Notwithstanding the above, licensees that are subject to the ERS reporting are still required to report their interest rate risk exposures in the Interest Rate Sensitivity Form. By means of this form and licensees' ICAAP, the Central Bank will monitor the impact of potential interest rate changes on a licensee's financial performance and economic value to satisfy itself that licensees have in place effective and appropriate arrangements for measuring, monitoring and controlling interest rate risk.

END

APPENDIX A

Sources of Interest Rate Risk

1. **Repricing (or maturity mismatch) risk** is the most obvious source of interest rate risk for a licensee. It is caused by timing differences in the maturity (for fixed rate) and repricing (for floating rate) of a licensee's assets, liabilities and off-balance sheet positions. While such repricing mismatches are fundamental to the business of banking, they can expose a licensee's income and underlying economic value to unanticipated fluctuations as interest rates vary.
2. **Yield Curve risk** materializes when unanticipated changes in the yield curve have adverse effects on a licensee's income or economic value. Yield curve risk involves changes in the relationship between interest rates of different maturities of the same index or market. Along the yield curve, there are changing interest rate relationships across the spectrum of maturities. Repricing mismatches can also expose the institution to yield curve risk by changing the slope and shape of the yield curve.
3. **Basis risk** arises from imperfect correlation in the adjustment of the rates earned and paid on different instruments with otherwise similar repricing characteristics. Basis risk occurs when market rates for different financial instruments or the indices used to price assets and liabilities, change at different times or by different amounts. As a result of these differences, interest rate changes can give rise to unexpected changes in the cash flows and earnings spread between assets, liabilities and off-balance sheet instruments of similar maturities or repricing frequencies.
4. **Option risk** results from (implicit) options embedded assets, liabilities and off-balance sheet items. Option risk arises when an institution or an institution's customer has the right to alter the level and timing of the cash flows of an asset, liability, or off-balance sheet instrument. Options may be stand-alone instruments such as exchange-traded bond options and over the counter contracts such as caps and floors or they may be embedded within otherwise standard instruments.

APPENDIX B

A variety of techniques and models are used by institutions to analyze interest rate risk, both in terms of economic value and in terms of earnings. These models vary from very simple calculations to statistical simulation models of a wide range of scenarios. The most commonly used techniques for analyzing the interest rate risk in the banking book are gap analysis, earnings at risk (EaR), duration analysis and the economic value of equity (EVE). These techniques are outlined below, together with the advantages and disadvantages of each method.

1. Gap Analysis:

Gap analysis measures the arithmetic difference between the interest-sensitive assets and liabilities of the banking book in absolute terms.

Based upon the contractual maturities of financial instruments or assumptions regarding them, gap analysis shows the cash flows, including on a cumulative basis, of a portfolio, sub portfolio or product by maturity segment (e.g. <1 month, 1-3 months, 6-12 months, 1-2 years...10-15 years, >15 years). The gap report shows the exposure that is released during a particular time period and the exposure that is outstanding during a particular time period.

Using gap analysis, the earnings sensitivity of the banking book to interest rate movements can be derived. When the value of interest-sensitive liabilities exceeds that of interest-sensitive assets, including off-balance-sheet positions, there is a negative or liability-sensitive gap. This means that if market interest rates rise, net interest income is adversely affected. Conversely, a positive or asset sensitive gap means that if market interest rates fall, net interest income is adversely affected. An advantage of gap analysis is that it is a simple method, which is fairly easy to communicate to management.

Gap analysis is subject to limitations. Gap analysis does not capture basis risk or investment risk. It is generally based on parallel shifts in the yield curve, does not incorporate future growth or changes in the mix of business, and does not account for the time value of money. It is based on the assumption that all positions within a particular maturity segment mature or are repriced simultaneously.

Particularly for larger institutions, gap analysis is nothing more than the first step (in this case, the distribution of the relevant assets and liabilities according to maturity) in analyzing the interest rate risk in the banking book. The following techniques play a much more crucial role in the control and monitoring of interest rate risk.

2. Earnings at Risk (EaR):

EaR measures the loss of net interest income resulting from upward/downward interest rate movements, either gradual movements or as a one-off large interest rate shock) over a particular time horizon. EaR is a simulation method that analyses the interest rate risk in the banking book in terms of earnings (accrual basis). Compared to the gap, duration and EVE techniques, which are based upon a snapshot in time of the interest rate risk, the EaR method is more dynamic in nature. It evaluates the risk exposure of the banking book over a particular time horizon (1 to 2 years), taking account of projected changes in maturities and/or repricing relationships and/or the size of the banking book.

As in the case of the gap report, all of the relevant assets and liabilities are allocated to maturity buckets by maturity and type of instrument. A crucial role is played by the assumptions regarding retail products with embedded optionality relating to factors such as interest sensitivity, prepayment and/or savings behaviour. Using this simulation method, a base interest rate scenario is defined under which the net interest income of the banking activities is calculated under the current or the forecast interest rate environment, based upon an assumed interest rate sensitivity of customer rates and forecast volumes of assets and liabilities.

The advantages of the EaR method are:

- It analyses the interest rate risk profile of the banking book in a detailed way tailored to the bank's specific circumstances. In that sense it is a meaningful method, providing management with a complete picture of the earnings risk resulting from interest rate movements; and
- It is a dynamic method that takes account of the interest rate sensitivity of retail products.

The disadvantages of the EaR method are:

- It only analyses the short-term earnings effect (accrued interest) resulting from interest rate fluctuations and not the long-term economic value effects (capital gains/losses); and
- It can be complex and non-transparent as a result of the underlying assumptions.

3. Duration Analysis:

Duration is the time-weighted average maturity of the present value of the cash flows from assets, liabilities and off-balance sheet items. It measures the relative sensitivity of the value of these instruments to changing interest rates and

therefore reflects how changes in interest rates will affect the institution's economic value. Duration is generally viewed as a very simple form of static simulation.

Under this method, the maturity of an investment is used to provide an indication of interest rate risk. The longer the term to maturity of an investment, the greater the chance of interest rates movements (i.e. unfavourable price changes).

One benefit of the duration method is that it analyses the economic value impact of a particular change in interest rates relating to a particular class of assets and/or liabilities and/or the balance sheet in a simple way.

There are a number of disadvantages associated with the duration method, i.e.:

- It only applies to parallel shifts of the yield curve and it cannot be used to measure basis or yield curve risk;
- It only applies to marginal shifts of the yield curve. Relatively large movements in interest rates, and therefore convexity, cannot be measured accurately;
- It takes no account of the change in expected cash flows resulting from interest rate movements;
- It is a static method in the sense that it shows a snapshot in time of the risk based upon the current composition of the portfolio or balance sheet.

Limitations in using duration analysis arise from the fact that matching the average term of duration of asset and liability cash flows does not eliminate all interest rate risk. For this reason, duration analysis should be used along with additional interest rate risk measures of cash flow mismatch and cash flow dispersion. These additional measurement techniques are essential if the institution is to control interest rate risks that cannot be summarized adequately in a single risk measure.

4. Economic Value of Equity (EVE):

The EVE measures the change in the market value of equity resulting from upward and/or downward interest rate shocks, taking account of changes in positions, e.g. as a result of optionality. As in the case of the EaR, under this method the value of equity under alternative interest rate scenarios is compared with the value under a base scenario. This base interest rate scenario is the present value of the assets less the liabilities under the current or the forecast interest rate environment. The balance sheet is then revalued under the alternative interest rate scenarios and the difference between the value of equity.

The accuracy of the valuation of the balance sheet positions is extremely dependent upon the cash flows calculated and the discount rates used. When selecting the discount rates used it should be checked whether the risk and the duration match those of the cash flows. When the cash flows are calculated, account needs to be taken of the fact that the size and the timing of the cash flows may differ under the various scenarios as a result of customer behaviour regarding the growth of deposits and also that of prepayment. This customer behaviour is modeled by specifying a relationship between the interest rate scenario and the extent of prepayment and/or growth of deposits.

The benefits of EVE models are:

- Interest rate risk is measured in terms of economic value;
- The duration method, this method enables basis and yield curve risk as well as
- Convexity to be measured properly.

The disadvantages of the EVE model are:

- Most of the assets and liabilities relating to the banking book cannot be traded and are therefore difficult to value at market prices. Most assets and liabilities are valued on a mark-to-model basis (using theoretical pricing models); and
- It is a static method in the sense that it shows a snapshot in time of the risk based upon the current portfolio or balance sheet composition. It cannot make allowance for the market valuation of future (forecast) growth in existing or new business activities.