VALUATION GUIDELINE FOR INVESTMENT PORTFOLIOS

15 July 2020

INDEX

CHAPTER 1:
USE OF THIS GUIDELINE

1.1 INTRODUCTION

A manager must administer a CIS honestly, fairly, with skill, care and diligence and in the interest of investors and the CIS industry (section 2 of the CISCA).

One of the key administrative duties of a CIS manager is the calculation of portfolio NAV and the pricing of participatory interests. NAV is the total market value of all instruments in a portfolio, taking into account any income accruals and any permissible deductions (as contemplated in section 93 of the CISCA).

The CIS portfolio valuation process is vital to the smooth functioning of the CIS industry as all sales and redemptions of CIS participatory interests are concluded at their NAV.

CIS portfolio instruments that are liquidly traded in an active market, for which price quotes are readily accessible at each valuation point, may be valued by reference to the available market price quotes. However, the difficulty and subjectivity of the valuation process increases for instruments for which price information is not readily available (e.g. structured or otherwise unlisted and thinly-traded instruments). The valuation of these instruments requires the application of bespoke methodologies and valuation techniques.

1.2 PURPOSE OF THE GUIDELINE

At each valuation point, the CIS manager is required to calculate the NAV and determine the price of the participatory interests, for each portfolio. The Financial Sector Conduct Authority ("FSCA") prescribes the requirements applicable to the calculation and pricing of the NAV of a portfolio of a CIS, as set out in the FSCA Conduct Standard 1 of 2020 ("Conduct Standard").

The purpose of this Guideline is to provide guidance on the valuation of instruments held in a CIS portfolio, using best practice concepts and principles that promote fairness, consistency, transparency and accuracy. In achieving this purpose, the IOSCO Principles for the Valuation of Collective Investment Schemes (May 2013 Report) were considered and applied, as appropriate, throughout the content of this Guideline.

This Guideline is intended to be read with the Conduct Standard and covers the following aspects:

- Key principles and recommendations to be considered in establishing a robust valuation framework;
- Guidance to assist users in the selection and development of suitable valuation techniques and market data sources; and
- Identification of specific methods commonly used to value different types of instruments.

The Conduct Standard requires all pricing processes and procedures to conform to generally accepted accounting practice. To assist in achieving this requirement, the content of this Guideline has been developed taking into consideration the requirements and principles of IFRS, except where otherwise noted. Specifically, as the Conduct Standard requires any instrument in a CIS portfolio to be valued at its 'fair market price', particular emphasis has been placed on *International Financial Reporting Standard 13: Fair Value Measurement* ("IFRS 13"), which provides a single framework for the measurement of fair value. As a result, for the purposes of this Guideline, references to 'fair value' may be construed to mean 'fair market price'.

The application of IFRS, an internationally recognised framework, is largely considered to be best market practice (*IOSCO – The Principles for the Regulation of CIS, IOSCO Report, 1999)* for the purposes of achieving consistency:

- In the approach followed in the calculation of NAV, allowing for transparency and meaningful comparison across all CIS;
- In performance reporting across CIS (facilitating performance monitoring and asset allocation decisions); and
- In CIS financial reporting practices, which are required to comply with generally accepted accounting practice (IFRS).

It is not the intention of this Guideline to prescribe or recommend the basis on which instruments are included in the financial statements of a CIS portfolio or CIS manager.

This Guideline is intended to represent current best practice and will be revised, as necessary, to reflect changes in legislation, regulation, accounting standards or market practice.

This Guideline is for general information purposes only and does not impose any obligation on a CIS. This Guideline provides best practice considerations and principles to be taken into account in the valuation of CIS portfolio instruments when calculating the NAV. However, the valuation technique ultimately selected and employed by a CIS is to be determined by the manager, overseen by the trustee, taking into account the specific facts and circumstances surrounding the valuation as well as the nature of the underlying instrument and its risk characteristics.

1.3 SCOPE OF THIS GUIDELINE

Consistent with the Conduct Standard, this Guideline applies to portfolios comprising CIS registered in terms of the CISCA, including CIS in property where applicable, but excluding CIS in participation bonds.

The guidance provided in this Guideline is focused on the considerations and processes relevant to the determination of the clean price of an instrument held in a CIS portfolio at the valuation point. However, paragraph 4(2) of the Conduct Standard indicates that the accounting for a portfolio and the determination of the NAV price should be performed on an accrual basis. It is therefore critical to ensure that all accruals are taken into account, in conjunction with the clean price of an instrument, in determining the portfolio NAV and NAV price.

The content of this Guideline is pertinent to paragraph 5 of the Conduct Standard: '*Valuation and recording of assets (asset valuation)*'.

The determination of the following items is beyond the scope of this Guideline:

- Income receipts or accruals;
- Expense payments or accruals;
- Allocation of proportionate values to participatory interests (i.e. participatory interest pricing); and
- Distributions (including the processing thereof).

The appendices to this Guideline provide specific valuation guidance relevant to a selection of instruments, including certain equity, fixed-income and derivative instruments. The list of instruments covered is not exhaustive. Specifically, the following types of instruments are not covered:

- Non-financial instruments, including immovable property; and
- Unlisted or illiquid interests in non-financial instruments, including property interests, of any form.

Although the scope of this Guideline is specific to the formal valuation of portfolio instruments for participatory interest pricing purposes, the valuation of instruments held in a CIS portfolio is used for a number of other purposes. For instance, the valuation of portfolio instruments assists with investment limit monitoring, risk management, financial reporting, performance reporting and fee charge computations.

The use of this Guideline for these alternative purposes should be carefully assessed for appropriateness and compliance with the relevant underlying legislation, regulation or other requirements.

The contents of this Guideline may be considered, but are not directly applicable to a CIS portfolio that is in the process of being wound up or otherwise executing a forced sale of some or all instruments held in the portfolio. In such circumstances, it may be considered necessary to adopt alternative bases or premises of valuation over which and appropriate supervision is required, including suitable review by the trustee and the Authority, as appropriate.

This Guideline does not address circumstances in which the repurchase of participatory interests are suspended or default scenarios (either by the CIS itself or with respect to the underlying instruments held in the portfolio).

1.4 USE OF THE GUIDELINE

This Guideline provides an overview of key considerations relevant to the valuation of instruments held in a CIS portfolio and the broader valuation process. Note that the terms 'pricing' and 'valuation' (and relative derivations) are used interchangeably in this Guideline.

This chapter defined the purpose and scope of this Guideline.

The remaining chapters of this Guideline have been structured as follows:

- **Chapter 2: Governance Considerations**
  Chapter 2 provides a broad overview of key governance considerations specifically relevant to the valuation function of a CIS portfolio. The CIS valuation principles should be aimed at ensuring that investors are treated fairly at all times.

- **Chapter 3: Valuation Principles Overview**
  Chapter 3 specifically focuses on the definition of 'fair value' and provides tools and considerations to assist in the assessment of the most suitable approach to be applied in the determination of fair value at the valuation point, for each instrument held in a CIS. Two main categories of instrument valuations are relevant:

  - Instruments that may be valued by reference to a quoted market price:
    Where it is concluded that an instrument is frequently traded, in an active market and complete price information is readily accessible, the value of the instrument may be determined by reference to the quoted market price at the valuation point.
  - Instruments that must be valued by the application of an alternative valuation technique:
    In instances where an instrument is unlisted or the quoted market price is not considered to be representative of 'fair value', the development and application of an appropriate valuation technique, using relevant market data, is required.

  Once each instrument in a CIS has been appropriately classified as described above, Chapter 3 provides practical considerations relevant to the selection criteria for market data sources.

- **Appendix 1: Valuation Policy Outline**
  This appendix applies the principles of Chapter 2 and provides an outline of the scope, content and considerations required in developing the CIS valuation policy (as required by paragraph 5(3) of the Conduct Standard.

  The outline provided is for guidance only. The suggestions listed are not intended to be comprehensive and conversely, may not all be appropriate in each individual case.

- **Appendix 2 to Appendix 5**
  Portfolio instruments that must be valued by the application of a valuation technique are the focus area of these appendices.

  - **Appendix 2: Valuation Fundamentals** - identifies and describes foundational valuation concepts applicable to any fair value assessment. Commonly used valuation inputs and relevant methodologies are identified and described.
  - **Appendix 3: Fixed Income Instruments** – identifies a selection of fixed income instruments commonly included in CIS portfolios and provides practical guidance for the development of suitable valuation methodologies, based on the risks and characteristics of each instrument.
  - **Appendix 4: Derivative Instruments** – identifies a selection of derivative instruments commonly included in CIS portfolios and provides practical guidance for the development of suitable valuation methodologies, based on the risks and characteristics of each instrument.
  - **Appendix 5: Equity Instruments** – provides an overview of the general characteristics of equity instruments and the considerations required in selecting and applying a suitable valuation technique.

  The valuation formulae and guidance provided in the abovementioned appendices are intended to illustrate the fundamental valuation principles for a selection of instruments. Simplifying assumptions regarding the nature and characteristics of each instrument have been made. As a result, the use of the guidance in these appendices should be adapted, as appropriate, to take into account the specific terms and conditions of the instrument being valued, as well as current market best practice.

  In applying the valuation guidance set out in these appendices, it is important that the fair value measurement principles introduced in Chapter 3 are consistently applied. This may require the application of additional valuation adjustments to the result obtained in order to quantify an appropriate fair value measure for an instrument.

- **Appendix 6: Glossary**
  Any word or expression to which a meaning has been assigned in the CISCA or the Conduct Standard has that meaning and, unless the context otherwise indicates, the terms listed in the Glossary bear the meanings as indicated for the purposes of this Guideline.

- **Appendix 7: References**
  References used in the development of the Guideline and that may be consulted for further guidance, as relevant, are listed in this appendix.

Please note that the appendices form an integral part of this Guideline, and any reference to the "Guideline" includes the appendices.

CHAPTER 2:
GOVERNANCE CONSIDERATIONS

2.1 INTRODUCTION

Accurate, fair and timely valuation is a cornerstone to the efficient operation of a CIS and the broader industry. Essential for a number of purposes, the valuation of a portfolio:

- Determines the price at which CIS participatory interest transactions are executed and related investor reporting;

- Informs a manager's investment and risk management decisions;

- Forms the basis of performance analysis and fee calculations; and

- Determines the extent of applicability of various regulatory requirements based on pre-determined valuation thresholds.

The key objective of the valuation process is to ensure the equitable treatment of all investors. The absence of a sound governance framework within which the valuation process functions can lead to misstatements of a CIS portfolio's value or misappropriation of portfolio instruments.

This chapter provides an overview of best practices to be considered in developing and establishing a robust governance framework over the valuation process. The guidance provided is aimed at developing a system of interconnected processes, controls and accountability structures that set the tone for the CIS and assist in ensuring that the calculation of the NAV and NAV pricing is valid, accurate and complete, at all times.

The considerations provided in this chapter are, however, neither exhaustive nor applicable to every CIS. The specific governance structure and processes designed and adopted will be unique to each CIS and will be driven by a number of factors, including the nature, size and complexity of the CIS business, the underlying portfolio instruments and the valuation techniques applied in measuring fair value. The manager, with oversight by the trustee, should ensure that the processes and controls established are sufficient and appropriate, taking into account all surrounding facts and circumstances, to address the risks of inappropriate NAV calculation and NAV pricing.

Consistent with the Conduct Standard, a manager is required to develop and adopt a valuation policy. The valuation policy represents a focal point for defining and setting the tone for the governance of the CIS. Appendix 1 to the Guideline summarises the points raised in this chapter and provides a list of items that may be considered for inclusion in the valuation policy.

2.2 CORE VALUATON PRINCIPLES

The Conduct Standard requires that the process of calculating the NAV and NAV pricing adheres to the following core principles:

- **Fairness**
  Ensuring investors are treated fairly at all times, including that processes are free from bias or discrimination;

- **Consistency**
  Valuations of portfolio instruments are performed consistently, in accordance with the valuation policy and over time (unless there is a change in circumstances), including that processes are applied consistently at all times. In addition, structures, processes and controls should be consistent across all portfolios administered by a CIS manager;

- **Transparency**
  The valuation of portfolio instruments are performed transparently at each valuation point, including that processes are clearly documented and that data is readily available for review in sufficient detail to enable analysis and auditing; and

- **Accuracy**
  Adequate controls are implemented to prevent errors in the valuation process and if required, to detect and correct errors on a timely basis. This includes ensuring that processes for accuracy are designed and appropriately implemented.

A manager should consider and integrate these core principles into every aspect of the valuation process, from the assignment of roles and responsibilities to the actual fair value calculation of each portfolio instrument.

2.3 ROLES AND RESPONSIBILITIES

All stakeholders in the valuation process are required to demonstrate high standards of integrity and fair dealing, in addition to possessing an appropriate level of skill and experience commensurate with their roles and responsibilities.

2.3.1 CIS MANAGER (OR FUND ADMINISTRATOR)

The manager is responsible for the day-to-day operation of all aspects of the CIS. In particular, the manager is ultimately responsible for the entire valuation process, including the resolution of pricing issues, with appropriate oversight by the manager's board of directors and the trustee. The manager should ensure that fair, appropriate and transparent valuation methodologies are applied by the CIS valuation function, in accordance with a documented valuation policy (approved by the manager's board of directors).

The manager is required to act with due skill, care and diligence, and employ effectively the resources and procedures which are needed for the proper management of the CIS. Staff should have an appropriate level of skills and experience for their respective roles, particularly those involved in the valuation of portfolio instruments for NAV pricing purposes. In addition, the manager is responsible to ensure that any potential conflicts of interest are appropriately identified and continuously managed to ensure the integrity of the valuation process. It is further suggested that well defined procedures should be in place to ensure the retention of complete and accurate records relating to the valuation process and outcomes in order to demonstrate compliance with relevant legislation and regulation.

Depending on the nature of the CIS, the underlying portfolio instruments and staff skills and experience, the manager may consider the formation of a valuation committee to support the manager in executing its duties and to maintain the integrity of the valuation function (refer to section 2.3.3 of this chapter).

In some instances, certain duties of the CIS manager may be delegated to external service providers (e.g. a valuation service provider). It is recommended that a robust due diligence process is followed in this regard (refer to section 2.12 of this chapter for further considerations in this regard).

2.3.2 TRUSTEE (OR RELEVANT EQUIVALENT)

The trustee is functionally independent of the manager and has a broad scope of responsibilities, as defined in the CISCA, which extend across various aspects of the operations of a CIS and the manager's activities. In particular, for the purposes of this Guideline, the trustee is required to ensure that the selling or repurchase price of participatory interests is calculated in accordance with the CISCA and the trust deed (section 70(1)(b) of the CISCA). To satisfy this obligation the trustee should therefore establish appropriate mechanisms to facilitate its oversight of the entire valuation process and outcomes, including the resolution of any pricing issues.

The degree of the trustee's oversight role over the valuation process is influenced by a number of factors, which may include, for example, the nature of the portfolio's instruments, the complexity of the valuation techniques applied, the level of the trustee's valuation expertise and the strength of the internal controls within the manager's valuation function. The extent of the trustee's involvement is therefore a matter of the trustee's professional judgment in executing the duties of a trustee in terms of the CISCA. In general, the greater the influence or involvement of the manager in the valuation process, the greater the need to manage any actual or perceived conflicts of interest.

In some instances, it may be concluded that the trustee lacks the specific valuation experience required to provide meaningful oversight. In these circumstances, the trustee may engage expert advice and support, by a suitably qualified person (independent to the manager - refer to section 2.3.4 of this chapter) or establish a valuation committee to provide ongoing support and oversight over the valuation process (refer to section 2.3.3 of this chapter). The trustee is, however, not divested of its responsibilities in terms of the CISCA through the appointment of a representative and should ensure an appropriate level of involvement and oversight is maintained.

2.3.3 VALUATION COMMITTEE

For a CIS with portfolio holdings in complex, unlisted or otherwise illiquid instruments, inherent subjectivity is introduced into the valuation process with respect to the determination of appropriate valuation assumptions, inputs and methodologies. These characteristics introduce a heightened risk of inappropriate valuation conclusions.

A valuation committee may be formed when the trustee or the manager concludes that it lacks resources, the required valuation expertise or where the nature of portfolio assets and the valuation process warrant the need for regular review by an oversight body.

In many circumstances, the trustee or the manager may delegate oversight of the valuation process to a separate committee, usually known as a valuation committee. The mandate of a valuation committee generally extends across all portfolios of a CIS manager, with relevant sub-committees formed for individual portfolios, if and when required.

The functions of a valuation committee may include:

- Supporting the manager's board of directors in the evaluation and review of the valuation policy for approval (upon adoption by the CIS and on a regular basis to ensure continued relevance);
- Ensuring that the valuation processes employed by each CIS portfolio are consistent with the valuation policy and approve any deviations from the valuation policy (e.g. exceptional circumstances such as the temporary suspension in trading of a portfolio instrument);
- Reviewing the valuation approach and results of instruments subject to significant estimation uncertainty (e.g. instruments for which price quotes are either not available or are not considered representative of 'fair value' (such as stale prices or suspended trading circumstances)) or large value fluctuations;
- Considering whether price overrides (or management overlays) are required to ensure alignment of an instrument's value to fair value (e.g. in exceptional circumstances causing market disruption);
- Reviewing and assessing the valuations performed by a third party for appropriateness (e.g. an independent valuation expert or valuation service provider); and
- Approving the use / assessing the performance of service providers relevant to the valuation function (e.g. market data vendors, service providers to which specified administration functions have been delegated);
- Reviewing and assessing any pricing errors and the resolution thereof, including the nature of remedial action undertaken; and
- Assessing internal and / or external audit reports or other operational reports relevant to the valuation function and determining the need for corrective action to address weaknesses or challenges identified.

A valuation committee should have a clearly established charter covering roles, responsibilities, number of members, composition and frequency of meetings. In addition, the charter should specify the requirements for a quorum and the level of support required for committee decisions (e.g. majority approval may be required for decisions).

The membership of the committee should comprise of suitably skilled and experienced individuals with relevant valuation, risk and compliance expertise. It is further recommended that the majority of the committee members should comprise of individuals independent of the investment decision process and that are not remunerated based on fund performance (in order to avoid the introduction of any potential bias to the committee's activities). Members of a valuation committee should be required to declare any conflicts of interest and a consistent process for managing such conflicts should be established (e.g. a member may be recused from making decisions on methodologies or valuations where a conflict exists).

In some instances, particularly in the case of unlisted or structured instruments held by a portfolio, the individuals responsible for making the investment decisions of the CIS may be best placed to critically assess the fair value measurement of an instrument for NAV calculation purposes. The involvement of these individuals in the valuation committee should be appropriately balanced to avoid any undue influence over the other members of the valuation committee (e.g. these members may be non-voting).

The complexity of the underlying instruments held by the portfolio will drive the composition of the valuation committee. The valuation committee should have the resources and the authority to discharge its duties and responsibilities, including the authority to retain internal and external advisors (including, but not limited to, independent valuation firms or experts), as deemed appropriate.

The valuation committee can assist in maintaining appropriate oversight over the integrity of the valuation process by performing many of the functions noted in this chapter for the responsibility of the manager and / or the trustee. It is, however, important to note that notwithstanding the decisions of a valuation committee, the manager and the trustee remain ultimately responsible for ensuring the NAV calculation and determination of the NAV price is fair and accurate, in accordance with the duties outlined in the CISCA.

2.3.4 INDEPENDENT VALUATION EXPERT OR VERIFIER

If a CIS portfolio has holdings in illiquid, unlisted or otherwise complex instruments, consideration may be given to the use of an independent valuation expert or verifier, particularly if the position holdings are significant in size. This may be done in order to introduce independence and objectivity to the valuation process. Independent valuation experts or verifiers may be engaged by either the manager, the valuation committee (where relevant) or the trustee to provide advisory services when developing valuation techniques or to perform independent fair valuations.

Alternatively, depending on the nature of the CIS, an independent valuation expert or verifier may be engaged to perform verification work periodically to provide an additional check on the appropriateness of the instrument valuations performed in calculating portfolio NAV.

It is recommended that a robust due diligence process for selecting an independent valuation expert or verifier should be instituted (refer to section 2.12 of this chapter for further considerations in this regard).

2.3.5 AUDIT

In terms of section 73 of the CISCA, a manager is required to appoint an auditor for the purpose of auditing the whole of the business of the CIS administered by it, subject to the approval of the Authority.

Although the annual audit cannot be relied upon to provide evidence that the calculation of NAV and NAV pricing was appropriately performed throughout the year, it does introduce an additional layer of independent oversight. In conducting its procedures, the auditor will review the valuation process implemented by the manager to ensure all participatory interest transactions throughout the period under review were concluded at a fair NAV and may, in addition, perform substantive testing over the valuation of year end portfolio positions.

Auditor findings should be carefully scrutinised and investigated by the manager, with appropriate oversight by the trustee. Where required, corrective action should be implemented timeously. Consideration may be given to incorporating relevant requirements in the valuation policy for dealing with auditor findings.

CIS managers with an internal audit function should take into account the level of assurance and oversight afforded by the function's activities. The testing performed by the internal audit function should be integrated as part of the valuation function overall monitoring plan.

2.4 INDEPENDENCE OF THE VALUATION FUNCTION AND CONFLICTS OF INTEREST

Potential conflicts of interest in the valuation of CIS portfolio instruments can arise in a number of ways and should therefore be carefully contemplated and appropriate responses developed to minimise the risk of inappropriate valuation practices.

Examples of circumstances that may introduce potential conflicts of interest include portfolio investments or other transactions with entities related to the CIS (for example, the CIS manager holding company) or manager remuneration structures linked to portfolio performance. An appropriately high level of independence should be embedded into all aspects of the development, review and application of valuation policies and procedures, including with respect to the parties appointed to undertake valuation responsibilities.

A manager is responsible for the administration of the scheme, which encapsulates a number of functions pertinent to the management and control of a CIS. For the purposes of this Guideline, reference is made to two specific functions of a manager, both captured by the definition of the term 'administration' set out in section 1 of the CISCA:

- The valuation function, responsible for the NAV calculation, participatory interest pricing and other related activities; and

- The investment function, responsible for the investment of funds received from investors and other related activities.

This distinction in the functions of the manager, as specified above, is drawn to emphasise the importance of the implementation of adequate segregation of duties in the NAV determination process. A potential conflict of interest between the investment function and the valuation function exists. For example, the investment function may be incentivised to overvalue the CIS portfolio instruments in an attempt to attract more investors by showing an inflated performance record, thereby earning greater management fees. In general, it is considered best practice to ensure that the valuation function is independent of the investment function and not compensated on the basis of portfolio performance.

Despite the potential conflict of interest that may arise, it is important to consider that in some cases the investment function may possess a unique perspective on how to most appropriately value certain instruments due to complexity, illiquidity or some other factor. This may present a degree of tension between the need to maintain independence while ensuring the application of appropriate expertise to the valuation of portfolio instruments. In such cases, it is suggested that a robust governance process which includes meaningful controls to ensure transparency and independence in the valuation process should be established. Control mechanisms that may be considered include:

- The introduction of a robust valuation policy setting out the procedures and processes to be followed in governing the valuation of instruments, detailing appropriate methodologies and sources (refer to section 2.15 of this chapter for details regarding the requirements of a valuation policy);

- Review procedures over the calculation of NAV and NAV pricing, specifically for instruments where no market mechanism exists to facilitate the valuation process. For certain portfolio instruments, it may considered that the investment function possesses the relevant expertise to review the valuation. In this case any challenges or queries raised by the investment function should be raised through the appropriate channels and subjected to adequate interrogation prior to the implementation of any changes to the valuation of the instrument;

- The automation of the valuation process, to the extent possible, may reduce the possibility of human error and improper influence on valuation outcomes;

- Establishment of independent reporting lines within the manager to ensure appropriate segregation between the investment function and the valuation function, including the development of clear reporting lines;

- The use of a suitably constituted valuation committee (as described in section 2.3.3 of this chapter), may assist in introducing a degree of independent review over the development or application of valuation policies; and

- Use of a suitably skilled third party valuation service provider may assist in mitigating conflicts of interest in the valuation process. The involvement of the third party may vary from detailed valuation execution to review responsibilities (refer to section 2.12 of this chapter for relevant considerations in the delegation of the valuation function);

In addressing the need for independence in the valuation process, the control mechanisms implemented will be driven by the surrounding facts and circumstances pertinent to the CIS, including the nature of the relationship between the valuation function and other CIS functions, the nature of the instruments included in the portfolio and the complexity of the valuation methodologies employed. Clearly documented policies and allocation of responsibilities are critical elements to ensuring fair and efficient valuation practices.

2.5 CONSIDERATION OF SOURCES, MODELS AND METHODOLOGY

The approach followed in calculating the fair value of a portfolio instrument will be driven by the nature of the instrument and the market in which the instrument trades.

Some instruments may be valued directly by reference to an observable price (for example, a stock exchange price or broker quote). The observable price can, however, only be used if it is considered representative of the 'fair value' of the instrument at the valuation point. In other words, the quoted price must be sourced from an active market and therefore should represent the amount that the CIS would receive if the instrument were to be sold (or in the case of a liability, transferred), in an arms-length transaction (i.e. exit the position), at the valuation point.

For instruments that lack a market mechanism to facilitate the valuation process or in instances where quoted prices are no longer available or no longer considered representative of 'fair value' (e.g. default of non-equity securities, imposition of trading restrictions, restructuring actions that directly impact the value of an instrument etc.), an alternative valuation technique must be developed and adopted. The selection of the methodology to value an instrument directly affects the valuation result. Therefore, in selecting the methodology to value an instrument, the sensitivity of varying methodologies and how specific strategies may determine the relative value of an instrument should be taken into account. The guiding principle should be that the valuation methodology that provides the fair value (or exit price) for the instrument at the valuation point should be used. A valuation methodology must be fair and cannot be either aggressive or conservative in its application.

It is generally considered best practice to give preference to valuation techniques that maximise the use of observable inputs. In some cases, the determination of inputs may require the application of specified operations and techniques to market data sourced (for example, in the construction of forecasting or discounting curves).

The valuation policy should clearly identify the valuation methodology, market data sources and model input calculation techniques to be used for each portfolio instrument, which may be presented in the form of a matrix. To the extent possible, preference should be given to the use of third party sources (and multiple third party sources, if available).

The use of models to measure the fair value of an instrument introduces a number of risks and complexities that need to be managed on an ongoing basis. For each model employed in the valuation process, clear model documentation is required describing the model methodology, assumptions, limitations as well as input data sources and calculation techniques. In addition, in a constantly changing market environment, it is recommended that a model governance framework is formulated setting out the procedures for the continuous evaluation of the suitability of each model for its intended purpose. The governance framework may consider:

- Roles and responsibilities;

- Model setup (e.g. model selection criteria, model change processes and approvals (including version controls), sources of model inputs and techniques to adapt input data for use in a model);

- Model documentation for each model, providing full details of the model methodology, assumptions, input data (including sources), nature and interpretation of model output and approval procedures;

- Model maintenance activities which are aimed at assessing the appropriateness of the valuation approaches employed and to inform any required changes for the improvement of the valuation models. Model maintenance activities include:
    - Model validation procedures (specifying the frequency and nature of ongoing review procedures over models as well as model assumptions and inputs);
    - Change control processes and requirements for the updating of model documentation;
    - Backtesting methods - comparing the instrument valuations used in the NAV price against actual trades that occur subsequently;
    - Stress testing – testing the effects of changes in key inputs on the valuation results, particularly inputs that are unobservable;
    - Ongoing monitoring and assessment of the appropriateness and / or liquidity of market data used in valuation models; and
- Documentation requirements and standards for each aspect of the governance framework.

A liquidity assessment framework is a critical aspect of the valuation process as it is a determining factor of the choice of valuation methodology applied to each instrument valuation. The objective of the liquidity assessment framework is to support the consistent monitoring of whether price quotes continue to be an appropriate reflection of the fair value of an instrument (i.e. identification of stale prices) or whether market quotes used as inputs into a valuation model continue to be appropriate. To this end, the valuation policy should outline a liquidity assessment framework, identifying suitable tools, metrics and guidelines as part to be used in assessing the liquidity of market data quotes, including the specification of relevant action plans and escalation channels based on conclusions reached.

Chapter 3 provides detailed guidance to support the development of suitable selection criteria for market data sources as well as valuation techniques, linked to relevant fair value measurement principles (including the development of a liquidity assessment framework).

The valuation methodology employed for each instrument requires frequent assessment to maintain its relevance in light of changing conditions.

To ensure the continued availability of a CIS portfolio NAV price at each valuation point, the establishment of contingency measures as part of the valuation policy is recommended. These measures should be aimed at minimising the disruption that may be caused due to unforeseen events such as the delisting, suspension in trading or reduced liquidity of an exchange-traded instrument. The nature of the measures introduced should be directed at securing alternative sources or techniques to be used to value an instrument. In addition, given the increased level of subjectivity introduced into the valuation process, appropriate escalation and review procedures should be established (incorporating the involvement of the valuation committee and / or the trustee, if relevant and considered necessary). All procedures in the valuation policy should be comprehensively described and appropriately customised for each instrument type the CIS portfolio may hold. Contingency planning requires regular review and updates to take into account any internal or external environmental changes.

2.6 USE OF MARKET DATA VENDORS

The valuation of all CIS instruments should be performed on the basis of the valuation policy, which ideally specifies the valuation technique and the source of the data to be used for each valuation. Market data should be sourced consistently (at the same point in time from the same source, unless circumstances require otherwise).

Market data vendors are third parties that may be engaged by the manager as a source of price information (e.g. price of an exchange traded equity instrument) and other market input data (e.g. volatility surface). Although the use of vendors is generally commonplace, adequate controls and review procedures are required to ensure that the information sourced is reliable and accurate. The valuation policy should provide practical procedures to be used to test the integrity of data provided by the vendor and ensure that both instrument valuations and model outputs are not skewed by inaccurate data.

It is important that the valuation function of the CIS understands how the market data obtained from a vendor is derived and whether any techniques applied to the data prior to publication by the vendor (e.g. quoted data for a specified tenor is derived via the application of an interpolation technique). To the extent possible and practical, the Conduct Standard recommends the validation of market data by comparing multiple sources. Where this is done and a variance between sources exceeds a pre-determined threshold (quantitative or qualitative), or where other anomalies are identified, a price challenge should be raised to the relevant vendor.

A price challenge is a request made to the vendor of price and other market data to confirm the accuracy of the information provided. Service agreements with vendors should detail how the price challenge process should be conducted, expected timelines for resolution and appropriate escalation channels. Following a price challenge, the market data may be confirmed, adjusted or withdrawn entirely. Appropriate review and interrogation should be conducted by the manager to determine the course of action that will be taken subsequently in concluding on the fair value of the instrument at the valuation point and potentially correcting an error in the published NAV price.

From a business continuity perspective, properly testing the information transmission as well as compatibility between the manager and the vendor systems will validate the effectiveness of the valuation process and identify any potential issues timeously.

Section 2.12 of this chapter provides a list of points for consideration when engaging the services of an external party with respect to the CIS valuation function. This includes the performance of suitable due diligence procedures.

Chapter 3 provides practical considerations to be employed in the assessment of the suitability of market data used to determine the fair value of an instrument – both price quotes and market data inputs used in valuation models.

2.7 VALUATION PROCESS

The outcome of the valuation process is the NAV price, determined on the basis that all portfolio instruments are measured at fair value (with the exception of constant NAV money market portfolios – refer to section 3.9 of Chapter 3). The frequency of the valuation of a CIS portfolio is consistent with the CISCA and the trust deed. A CIS portfolio should be valued on any day that participatory interests are purchased or redeemed.

To achieve the above outcome, the manager (supported by the valuation committee, where relevant), should ensure that, under the supervision of the trustee, appropriate processes and systems are in place to ensure that the NAV calculations are correct at each valuation point (i.e. all instruments, income and expenses have been included and valued appropriately).

A comprehensive and robust valuation policy, prepared by the manager (supported by the valuation committee, where relevant) and approved by the manager's board of directors, should be the focal point of the valuation process. Instrument valuations must be performed in accordance with the methodology specified in the valuation policy. The valuation policy should be applied consistently, over time and across all the portfolios under the control of the manager. A lack of consistency in the application of the valuation policy can lead to inaccurate and potentially misleading information being distributed and relied upon by investors and other third parties.

The CIS valuation function is responsible for the execution of all aspects of the valuation process at each valuation point (including fair value hierarchy classifications where relevant – refer to section 2.10 of this chapter). This includes the responsibility to source all price and input data. Appropriate review procedures within the valuation function are required to ensure that the production of NAV is appropriately executed in terms of the valuation policy, trust deed and the CISCA (refer to section 2.8 of this chapter).

In certain instances, the involvement of an independent valuation expert or verifier may be required in the establishment of the fair value of an instrument at the valuation point. Sound practice has progressed to require the valuation function to understand how an independent price is derived, any models and inputs used, and to ensure it is corroborated by secondary sources and other market data at each valuation point. Similarly, the price quotes, market data or other input information obtained from vendors or other sources should be subjected to careful analysis and review to ensure the data is both reliable and credible for its intended purpose.

When a manager contemplates investing in an instrument type which has not been included in the CIS portfolio previously (subject to the portfolio's investment policy), appropriate engagements are required to introduce relevant amendments to the valuation policy (to be approved by the manager's board of directors). Best practice suggests that the relevant updates to the valuation policy should be effected prior to investing in the new instrument type. In instances where this is not possible, appropriate escalation and review procedures should be introduced to ensure that the valuation of the instrument for NAV calculation purposes is accurate and reflective of fair value measurement principles. This may be achieved through the introduction of additional review processes by senior personnel within the valuation function, the valuation committee (where applicable) or the trustee. The escalation and review procedures should remain effective until the valuation policy is updated and a formalised process for the valuation (including relevant system implementations and model documentation development) of the instrument is adopted.

The maintenance of complete, accurate records promotes transparency and forms an integral part of the valuation process. It is recommended that documentation pertinent to the execution of the valuation function should be sufficient for an appropriately experienced valuation professional, with no prior involvement with the valuation, to understand the approach, method, inputs, assumptions and conclusions reached, including any overrides or departures from the valuation policy.

2.8 REVIEW OF NAV CALCULATION

Published NAV prices are relied upon by a wide range of stakeholders for decision-making purposes. It is critical that control processes are established to reduce the risk of valuation or pricing errors through the implementation of suitable detective review procedures prior to the publication of NAV.

The nature, timing and extent of review procedures is determined by the manager and driven by a number of factors such as the extent of automation in the valuation process and the nature of the instruments in the CIS portfolio. Certain instrument valuations introduce an additional level of risk due to their complexity or need for subjective assumptions, requiring additional review focus. Examples of such instruments include:

- Illiquid, unlisted or complex instrument valuations;
- Portfolio instruments valued by reference to a single, non-public source (e.g. a single, non-executable broker quote);
- Valuations that are subject to a significant degree of input and influence by the CIS investment function or other parties related to the manager (such as the manager holding company); or
- Instrument valuation technique deviations from the valuation policy or the application of price overrides.

The role of the review process is to bring objectivity to the pricing function, to promote greater transparency of price and market data sources, arbitrate and resolve valuation disputes and to balance any undue influence that may exist over valuation outcomes.

The design of review procedures should ideally be aimed at introducing an appropriate degree of interrogation to the valuation results, in conjunction with the establishment of clear reporting lines within the valuation function. Examples of control procedures may include:

- Investigation of prices or valuation inputs that have not changed between valuation points (i.e. testing for stale quotes);
- Review of liquidity assessment results for price and other market data quotes;
- Enquiries into the use of sources or valuation methodologies other than those specified in the valuation policy;
- Interrogation of unusual differences or large variances in instrument values between valuation points (or other interval considered appropriate), exceeding a specified threshold;

- Comparison of instrument valuations to other sources of information (for example, a counterparty valuation in the case of a derivative instrument); or

- Engagement with an independent valuation expert or verifier.

In certain exceptional circumstances, the value of an instrument determined in accordance with the valuation policy may not be considered appropriate (for example, suspension in the trading of an exchange-traded instrument). The manager may determine that there is a need to deviate from the methodology set out in the valuation policy and to determine the value of an instrument by applying an alternative methodology (e.g. adjusting the last quoted price). A price override (or deviation) is the rejection of a value for an instrument that was determined according to the valuation policy.

The valuation policy should describe the process for handling and documenting price overrides, including the establishment of appropriate escalation and review procedures. Strict controls are required to ensure that price overrides are not used as an input into the calculation of the formal NAV until the relevant review procedures have been concluded (which may incorporate review by the valuation committee, where relevant). Where overrides have occurred, any other instruments in the fund that are related to the overridden instrument should be reviewed to assess whether any additional adjustments are required. Where repeated use of overrides occurs for a particular instrument, it is recommended that a review of the valuation policy is triggered.

It is suggested that relevant policies and procedures to guide the review process, including the assignment of responsibilities and documentation requirements for the procedures performed should be covered as part of the scope of the valuation policy. Continuous monitoring of the valuation methodologies applied and whether they remain relevant in light of changing market dynamics is also a critical role of the review process.

2.9 REPORTING TO INVESTORS

Clear and complete disclosures afford protection to investors and represent an important element of the core principle of transparency (paragraph 4(3) of the Conduct Standard). It is generally considered best practice to ensure sufficient disclosure is provided to CIS investors around the nature and characteristics of participatory interests, including disclosure around the valuation policies and procedures underpinning the publication of the NAV price.

Information disclosed may comprise of any information considered to be important to an investor’s understanding of the characteristics and risks inherent in the holding of a participatory interest, including risks arising from the fair value estimation process (e.g. in the case of instruments subject to significant valuation uncertainty). For example, as part of performance reporting to investors, disclosure may be provided around fair value measurement practices applied, significant judgements made in determining fair value, distribution of portfolio instruments across the fair value hierarchy levels (refer to section 2.10 of this chapter), audit findings, the identification and steps taken in the management of conflicts of interest.

The specific nature of the information disclosed will be dependent on the nature of the CIS and the portfolio instruments held. In general, the greater the degree of complexity and subjectivity required to determine the fair value of portfolio instruments, the greater the degree of transparency and disclosure required.

Disclosures to investors should be made both at the time of initial investment (as part of the prospectus) and on an ongoing basis.

2.10 FAIR VALUE HIERARCHY

The allocation of instruments in accordance with a fair value hierarchy may be used by the manager as a tool to ensure that the nature of the control and review procedures over the valuation process are appropriately responsive based on the complexity and / or subjectivity inherent in certain portfolio instrument valuations. For example, instruments valued directly by reference to a quoted price would generally not require the same level of scrutiny, assessment and interrogation as an instrument valued by reference to the output of a valuation technique, sensitive to unobservable inputs.

The use of a fair value hierarchy may also assist in facilitating transparency in reporting to investors (including financial reporting) by allocating instrument valuations according to nature, risk and complexity.

The consistent categorisation of instrument valuations assists in increasing the consistency and comparability of fair value measurements across CIS portfolios.

The classification basis of portfolio instruments according to the hierarchy may form part of the valuation policy and should be applied consistently (over time and to each portfolio under the manager's control).

The accounting standards, for instance, establish a fair value hierarchy used to categorise instrument valuations and that may be considered for these purposes.

2.11 SYSTEMS AND DATA SECURITY

The use of information technology systems to facilitate the calculation of the NAV and NAV pricing introduces a number of benefits to the valuation process, including efficiency and reduction in the risk of valuation or pricing errors. However, the risks posed by information technology systems require due consideration as well as the design and implementation of adequate controls to ensure the integrity of the data and processes that the systems support.

The manager is required to ensure that sufficient, appropriate system controls pertinent to the valuation function are introduced, using the categories listed below as a guideline:

- **Access controls**
  Segregation of duties between the valuation function and the investment function should be reinforced by system access controls. In addition, review controls over the calculation of the NAV may be supported by automated sign-off triggers.

- **Computer operation controls**
  These controls relate to the facilitation of the day-to-day execution of the valuation function, including the sourcing of market data, generation of various reports to support review responsibilities and the retention of records (i.e. audit trail).

  To the extent possible, systems should be set up to facilitate compliance with the valuation policy – for example:

  - Establishment of a direct link for sourcing market data from vendors;
  - Comparison of market data quotes between sources and highlighting differences for further investigation;
  - Automated reconciliations to ensure consistency of data over time, across systems and with other corroborating evidence);
  - Comparison of instrument valuations over time and identifying large movements for further interrogation.

  In addition, the integration of automated controls into the systems used as part of the valuation process will assist in ensuring that data capture, processing and output is valid, accurate and complete (e.g. validation checks to ensure trade data captured is reasonable, automated calculation processes etc.).

- **Change management controls**
  Any deviations from the methodologies specified in the valuation policy or other changes to the system should be subjected to appropriate controls including review, testing and authorisation prior to implementation.

- **Backup and recovery controls**
  Data storage security procedures are critical to ensuring demonstration of the manager's compliance with its legislative and regulatory duties (i.e. suitable record keeping and audit trails). In addition, consideration should be afforded to the development and testing of suitable continuity plans and procedures to ensure pricing is available during an emergency, including measures to detect, respond to and recover from a cybersecurity attack.

2.12 DELEGATION OF ADMINISTRATION FUNCTIONS BY THE CIS MANAGER

Section 4(5) of the CISCA permits a manager, subject to approval by the Authority, to delegate any of its administration functions (as defined in section 1 of the CISCA) to any person, which may include the NAV calculation and pricing function for a CIS portfolio (the relevant function for the purposes of this Guideline).

The scope of possible delegation arrangements is broad and may include the engagement of an independent valuation expert or verifier, the use of price and market data vendors or the outsourcing of the entire valuation function to a valuation service provider or fund administrator.

It is important that the manager exercises due care, skill, and diligence in the establishment of a delegation arrangement, so that the manager can be satisfied that the delegated person has the ability and capacity to undertake the provision of the service effectively and consistently.

The delegated person is placed within the regulatory ambit of the CISCA. However, the delegation of any function does not relieve the manager from the duties set out in the CISCA and the trust deed. The manager should, therefore, ensure a comprehensive understanding is gained and maintained of the delegated person's valuation methodologies, source data and input assumptions used. In order to comply with its duties, the manager is required to have sufficient expertise available in order to be able to oversee, monitor and manage the delegated person.

Some aspects specific to the delegation of the NAV calculation function that may be considered are listed below:

- A due diligence of the proposed delegated person should be performed for the purposes of gathering information about the ability to perform the requested functions and identify any potential risks from the delegation arrangement. The due diligence process, which may include on-site visits, should be conducted in accordance with the manager's delegation policy.

  The results and conclusions from the due diligence investigation should be appropriately documented. Mitigating controls should be identified for any risks identified during the due diligence and continuously managed throughout the subsistence of the delegation arrangement.

  As part of the due diligence it may be considered appropriate to perform testing of the service to be rendered by the delegated person. An example of such test procedures may include providing the delegated person with specified instruments of the CIS portfolio (preferably unlisted or otherwise complex instruments) to value at historic valuation points. The results produced by the delegated person would then be assessed for reasonability and accuracy by comparison to other independent valuations or actual transaction data for the instrument.

  Where the delegated person is located in a foreign jurisdiction, additional considerations should be afforded as part of the due diligence with particular emphasis on aspects such as compliance risks (and choice of contracting law), confidentiality of data transmission mechanisms, payment arrangements and exit strategies.

- The nature of the remuneration structure negotiated with the delegated person should not be linked to the performance of the CIS portfolio in order to avoid any conflicts of interest;

- A formal, written agreement should be concluded between the delegated person and the manager. Appropriate contractual provisions can reduce the risks of non-performance or disagreements regarding the scope, nature, and quality of the service to be provided. A written contract may also facilitate the monitoring of the service levels rendered. To ensure that the services performed by the delegated person are adequate and aligned to the needs of the CIS, the valuation policy may be included as part of the agreement.

- Once the due diligence is finalised and the agreement concluded, the manager should ensure that adequate resources, project plans and timelines are in place to formally and seamlessly integrate the delegated person into the valuation function;

- The trustee and the auditors of the CIS and CIS manager should be afforded access to the delegated person in order to facilitate the fulfilment of their duties;

- Clear roles and responsibilities should be assigned within the manager for the ongoing monitoring of the performance of the delegated person, including processes and procedures enshrined in the valuation policy that:
    - Clearly define metrics that will measure the quality of the service level, including the nature of the review procedures over the delegated person;
    - Establish measures to identify, report and resolve instances of non-compliance or poor performance by the delegated person;
    - Prescribe the techniques for identifying and undertaking a price challenge of the results provided by the delegated person and the steps for resolution; and
    - Assist in monitoring the delegated person's compliance with relevant legislation and regulation;
- Periodic reviews to refresh the due diligence (per the points for consideration summarised above) of the delegated person are recommended in order to obtain assurance of the continued ability of the delegated person to perform the required services to the required standards;
- The adoption of a contingency plan by the manager is recommended. The contingency plan is intended to identify the processes to be followed in order to ensure the continued execution of the valuation function and availability of the NAV price in the event that the delegation arrangement is terminated.

2.13 SIDE POCKETING / SUSPENSION MECHANISMS

Side-pocket arrangements segregate specified instruments (generally illiquid instruments or instruments that are otherwise difficult to value) from the main pool of instruments in a portfolio until they are realised or are no longer considered difficult to value. The side-pocket serves to equitably attribute these instruments to investors existing at the time the side-pocket is created.

The formation of a side-pocket should be subject to strict oversight and control in order to avoid the use of the mechanism as a means of excluding underperforming instruments from a portfolio to improve reported results. Transparent disclosure to CIS investors is recommended.

Due to the nature of the instruments typically included in a side-pocket, the manager should ensure that the CIS valuation function possesses the necessary competence and experience to value the instruments. In addition, the implementation of detailed review procedures over the valuation results of side-pockets is recommended. Advice from an independent valuation expert or verifier may be required.

2.14 NAV PRICING ERRORS

The implementation of comprehensive and responsive review procedures is a critical component of the CIS valuation process in supporting the production of an accurate NAV price at each valuation point. Section 2.8 of this chapter highlighted various procedures that may be considered and implemented for the purposes of detecting and correcting valuation errors prior to the publication of the NAV price.

However, in some instances, despite the existence and exercise of review procedures by the CIS, pricing errors may occur. A pricing error occurs when a CIS's price per unit is incorrect and can result in an investor purchasing or redeeming participatory interests at the incorrect price.

The Conduct Standard requires the establishment of policies and procedures to detect, prevent and correct material valuation or pricing errors, which may incorporate elements such as escalation procedures, documentation requirements, materiality considerations and remediation efforts.

2.15 VALUATION POLICY

The valuation policy is intended to establish comprehensive, documented policies and procedures to govern the valuation of all instruments that may be held in a CIS portfolio. The valuation policy should be fully compliant with all relevant legislation and regulation, particularly the CISCA and the Conduct Standard.

The Conduct Standard requires a manager to develop and adopt a valuation policy, approved by the manager's board of directors. Where relevant, the valuation committee may support the manager in the establishment of the valuation policy.

Independent oversight by the trustee over the valuation policy may be required, consistent with the trustee's duties in terms of section 70(1)(b) of the CISCA, which requires the trustee to ensure that the selling or repurchase price of participatory interests is calculated in accordance with the CISCA and the trust deed.

The valuation policy is aimed at ensuring that all instruments in a CIS portfolio are measured at fair value (with the exception of certain constant NAV money market portfolios), in a consistent manner:

- Across all portfolio instruments that are similar in nature;
- Across all portfolios administered by the manager; and
- At each valuation point;

The content of the valuation policy is not fully prescribed by the Conduct Standard and is subject to the discretion of the manager. Appendix 1 to this Guideline provides an overview of considerations that may be taken into account in the development of a valuation policy document that is both robust and successfully contributes to a sound CIS governance structure. The recommendations are, however, not binding.

2.16 ADDITIONAL SUPPORTING GUIDANCE

Reference may be made to the guidance issued by the following bodies, as required:

- International Organization of Securities Commissions
- Alternative Investment Management Association
- International Valuation Standards

CHAPTER 3:
VALUATION PRINCIPLES OVERVIEW

3.1 INTRODUCTION

The Conduct Standard requires all instruments (other than in the case of a constant NAV money market portfolio), to be measured at fair market value at each valuation point, despite any accounting classification options that might suggest an alternative measurement basis.

The process of valuation requires the manager to make impartial judgements, in a transparent manner, as to the reliability of inputs, assumptions and valuation techniques.

The objective of this chapter is to provide an overview of key guiding principles to be applied in the process of measuring the fair value of portfolio instruments at each valuation point. Please note that for the purposes of this Guideline, references to 'fair value' may be construed to mean 'fair market price'.

3.2 SUMMARY OF FAIR VALUE MEASUREMENT PRINCIPLES IN ACCORDANCE WITH THE ACCOUNTING STANDARDS

The accounting standards provide a single framework for measuring fair value. A brief overview of the relevant fair value measurement principles is provided below but it is recommended that users refer to the full text of relevant accounting standard for the detailed requirements.

Under IFRS, 'fair value' is defined as "the price that would be received to sell an asset or paid to transfer a liability (exit price) in an orderly transaction between market participants at the measurement date".

This basis for measuring fair value is an exit price approach because it reflects the price at which a market participant that holds the asset or owes the liability could exit that position by selling the asset or transferring the liability to a third party. The definition assumes a hypothetical and orderly exchange transaction (i.e. it is not an actual sale or a forced transaction).

Fair value is a market-based measurement (not an entity-specific value). It is therefore measured using the assumptions that market participants would use when pricing the asset or liability, including assumptions about risk. As a result, any specific intention of a CIS with respect to an asset is not relevant when measuring fair value.

The definition of fair value clarifies that it should be reflective of current market conditions at the valuation point (i.e. reflect current expectations about future market conditions) and not those at any other point.

The extent to which market information is available can vary between different types of assets or liabilities. Regardless of this fact, the objective of fair value measurement remains the same – to estimate the price at which an orderly transaction to sell the asset or to transfer the liability would take place between market participants at the valuation point, under current market conditions. When a price for an identical asset or liability is not observable, an entity measures fair value using another valuation technique that maximises the use of relevant observable inputs.

To facilitate the valuation process, the accounting standards present a fair value measurement framework, described in the remainder of this section.

IDENTIFICATION OF THE PARTICULAR ASSET THAT IS THE SUBJECT OF THE VALUATION

When measuring fair value, the characteristics of an asset or a liability that should be taken into account are those that market participants would consider when pricing that asset or liability at the valuation point. Such characteristics may include, condition, location or any restrictions (on sale or use). For example, unlisted equity holdings are often subject to restrictions, rights of pre-emption and other barriers which would need to be taken into account in estimating the amount a willing buyer would pay to take ownership of the equity instruments, subject to the restrictions.

The accounting standards generally prohibit the application of premiums or discounts related to the size of the holding in an instrument. The level at which fair value should be measured depends on the level at which the asset or liability is aggregated or disaggregated (often referred to as the 'unit of account' and determined by the relevant accounting standard applicable to the asset or liability being measured). For the purposes of a CIS, the fair value of each instrument is likely to be measured on a stand-alone basis.

IDENTIFICATION OF THE MARKET IN WHICH TO PRICE THE ASSET

For the purposes of measuring fair value, the transaction to sell the asset or transfer the liability is assumed to take place in the 'principal market' for the asset or liability. In the absence of a principal market, the 'most advantageous market' is assumed.

The principal market is the market with the greatest volume and level of activity for the asset or liability. The most advantageous market is the market that maximises the amount that would be received to sell the asset or minimises the amount that would be paid to transfer the liability after taking into account transaction costs. The consideration of transaction costs is only relevant for the identification of an advantageous market and are generally not relevant when measuring fair value (as transaction costs are entity-specific).

The principal or most advantageous market is identified using the assumptions that market participants would use and should be accessible by the entity at the valuation point. The entity does not, however, need to be able to sell the particular asset or transfer the particular liability at the valuation point to be able to measure fair value on the basis of the price in that market.

An exhaustive search of all possible markets for each asset valuation is not required but an entity is required to take into account all information that is reasonably available. In the absence of evidence to the contrary, the market in which an entity would normally enter into a transaction to sell the asset or to transfer the liability is presumed to be the principal (or most advantageous) market.

If there is a principal market for the asset or liability, the fair value measurement should reflect the price in that market (whether that price is directly observable or estimated using another valuation technique). This applies even if the price in a different market is potentially more advantageous at the valuation point (for example, where a CIS holds an instrument that may be sold in the local market or the international market).

When an observable market for an asset or a liability does not exist, an entity must assume a hypothetical transaction at the valuation point, developing assumptions from the perspective of a market participant that holds the asset or owes the liability.

IDENTIFICATION OF THE MARKET PARTICIPANTS AND RELATED ASSUMPTIONS

Fair value measurement is a market-based measurement and should therefore be based on the assumptions of market participants, acting in their economic best interest. The relevant assumptions are those that market participants would make in a transaction that maximises the amount received to sell an asset or minimises the amount paid to transfer a liability.

Market participants are defined as buyers and sellers in the principal (or most advantageous) market for the asset or liability that have all of the following characteristics:

- They are independent of each other;
- They are knowledgeable about the asset or liability; and
- They are able and willing to enter into the transaction (i.e. excludes a forced or distressed sale).

An entity is not required to identify specific market participants, but is expected to identify characteristics that distinguish market participants generally. The specification should consider factors specific to the asset or liability, the principal (or most advantageous) market for the asset or liability and the market participants with whom the entity would enter into a transaction in that market.

In the absence of an observable market to provide pricing information, a fair value measurement should assume that a transaction takes place at the valuation point, considered from the perspective of a market participant that holds the asset or owes the liability. That assumed transaction establishes a basis for estimating the price to sell the asset or to transfer the liability, generally determined through the application of a valuation model.

DEFINITION OF THE CHARACTERISTICS OF A FAIR VALUE MEASUREMENT

Fair value measurement assumes that the asset or liability is exchanged in an orderly transaction between market participants under current market conditions at the valuation point. As a result, the measurement of fair value is only based on information available at the valuation point.

An orderly transaction assumes exposure to the market for a period before the valuation point to allow for marketing activities that are usual and customary for transactions involving such assets or liabilities. The transaction is not a forced transaction (e.g. a forced liquidation or distress sale). As a result of this assumption, it is not appropriate to quantify a marketability discount (where marketability is the time required to complete a transaction) when measuring fair value.

The price may be directly observable or estimated using another valuation technique. The price should not be adjusted for transaction costs because such costs are specific to a transaction (e.g. costs to sell). However, the price may be adjusted for transport costs if location is a characteristic of the asset.

CONSIDERATIONS SPECIFIC TO THE VALUATION OF LIABILITIES

The fair value of a liability (e.g. an interest rate swap held in a portfolio that is in a liability position to the CIS) is based on a transfer amount (the amount the entity would need to pay a third party to take on the obligation) and the assumption that the obligation remains outstanding and contractually unaltered both before and after the transfer. Fair value is therefore not based on the premise of settling the liability with the counterparty at the valuation point.

A fair value measure should be based on an assumed transfer to a market participant even if an entity does not intend to transfer its liability to a third party or is unable to do so (e.g. because the counterparty would not permit the liability to be transferred to another party).

In the absence of an observable market to provide pricing information for the transfer of an identical or similar liability, following fair value measurement approaches can be identified:

- Where the identical item is held by another party as an asset, the valuation of the liability is performed from the perspective of a market participant that holds the identical item as an asset at the valuation point. Adjustments to the price of a liability held by another party as an asset should only be applied if there are factors specific to the asset that are not applicable to the fair value measurement of the liability (e.g. restriction on the sale of the asset or differences in the unit of account);

- Where the identical item is not held by another party as an asset, the fair value of the liability is required to be measured using a valuation technique from the perspective of a market participant to whom the liability would be transferred.

The fair value of a liability should reflect the effect of non-performance risk, consistent with the unit of account of the liability. Non-performance risk is the risk that an entity will not fulfil an obligation and includes, but is not limited to, the entity's own credit risk. Non-performance risk is assumed to be the same before and after the transfer of the liability.

ASSESSMENT AND QUANTIFICATION OF CREDIT RISK

A fundamental characteristic of 'fair value' is that it is defined on the basis of an 'exit price' notion, as opposed to an entry price or settlement price. This means that the fair value of the asset or liability is determined on the basis of the price paid or received to transfer the asset or liability at the valuation point (in a hypothetical transaction), rather than to settle the asset or liability at the valuation point. Non-performance risk is assumed to be the same before and after the transfer of the liability.

The consequence is that the measurement of fair value should assume that the asset or liability continues to exist after the valuation point. The same assumptions a market participant would use when pricing the asset or liability, including assumptions about risk, should be considered. Credit risk, in particular, is an aspect that would be considered by a market participant when assessing the fair value of an asset or a liability. This is because it is assumed that the credit risk inherent in the asset or liability will continue to exist after the valuation point. For example, in estimating the fair value of a debt instrument, a market participant would take into account the risk that the obligor is unable to fulfil its obligations to make the contractual future payments under the loan. There are several methods in which the adjustment for credit risk may be taken into account, including for example:

- Adjustment to the contractual cash flows in order to determine an estimate of the lower expected cash flows, reflecting the risk that the obligor may default on its obligations;
- An increase in the discount rate reflecting the higher return required by a market participant due to the uncertainty of collecting the contractual cash flows in full (i.e. to take on the risk of default of the obligor);
- The quantification and application of an explicit credit risk adjustment reducing the fair value of the loan.

There are a variety of methods that can be used to incorporate market participant assumptions in the measurement of fair value. As a result, specific attention should be afforded to ensuring that risks are not double counted in the valuation process.

Refer to section 3.3 of this chapter for further details with respect to valuation adjustments.

SELECTION OF VALUATION TECHNIQUE(S) AND RELATED INPUTS

The measurement of fair value requires the selection of a suitable valuation technique that is both consistent with the objectives of the fair value measurement principles and with the characteristics of the asset or liability. Choosing a valuation technique requires the exercise of judgement and will be driven by a number of factors, including the availability of data.

The reliability of a fair value measurement derived from a valuation technique is dependent on the reliability of both the valuation technique and the inputs used. As a result, the valuation technique selected should be a technique for which sufficient data is available, maximising the use of relevant observable inputs and minimising the use of unobservable inputs.

In the context of fair value measurement, 'valuation technique' is a generic term and its application is not limited to complex valuation models. For example, valuing an asset or a liability using quoted prices in an active market for identical assets and liabilities is a valuation technique. In other cases, when prices cannot be observed directly and more judgement is required, it will be appropriate to use more complex valuation techniques.

A hierarchy of valuation techniques is not specified. This is because particular valuation techniques may be more appropriate in some circumstances than in others. Each valuation technique should be assessed on its own merits. In practice, different valuation techniques can give rise to different estimates of fair value and, therefore, it is important to select the most appropriate methodology for the particular circumstances.

Any valuation technique used to measure fair value should be consistent with one or more of the below approaches:

- **Market approach**
  The market approach is a valuation technique based on the principles of price equilibrium. This approach uses price and other relevant information derived from publicly available data about market transactions involving identical or similar assets or liabilities (or groups of assets and / or liabilities).

  An example of a valuation technique consistent with the market approach, used for the valuation of an equity instrument, involves the use of market multiples derived from a set of comparable assets or liabilities. A range of multiples may be derived, with a different multiple for each comparable asset or liability. The selection of the appropriate multiple within the range requires the exercise of judgement, with appropriate consideration of the relevant qualitative and quantitative factors. Refer to Appendix 5 for further details.

- **Income approach**
  The income approach uses a model of forecast cash flows, discounted to a single present value amount. The approach is based on the use of current market expectations about future cash flows.

  Examples of the income approach include present value techniques, multi-period excess earnings methods and option pricing models (which incorporate present value techniques, time value and an option's intrinsic value).

  The present value technique is a tool used to link future amounts (e.g. cash flows) to a present amount using an appropriate discount rate. The following elements should be captured in a present value technique when measuring the fair value of an asset or liability, from the perspective of a market participant, at the valuation point:

  - An estimate of future cash flows for the asset or liability being measured;
  - Expectations about possible variations in the amount and timing of cash flows;
  - Time value of money, based on a risk-free rate with a term structure coinciding with the timing of the cash flows;
  - Risk premium due to the uncertainty inherent in the cash flows;
  - Other factors market participants would take into account; and
  - Non-performance risk.

  Any technique used should be fully aligned to the principles of fair value measurement. This requires assumptions about cash flows and discount rates to be both reflective of the assumptions that would be used by market participants and specific to the characteristics attributable to the asset or liability being measured. In addition, the discount rate used should reflect assumptions that are consistent with those inherent in the cash flows (for example, a discount rate that has been adjusted to reflect the uncertainty in expectations about future defaults may be used to discount contractual cash flows, but not if the cash flows have been probability-weighted). The integrity of the technique used should also be considered by ensuring that the assumptions about cash flows and discount rates are internally consistent (for example, nominal vs. real cash flows and discount rates). Finally, discount rates should be consistent with the underlying economic factors of the currency in which the cash flows are denominated.

  A fair value measurement using present value techniques is made under conditions of uncertainty because the cash flows used are estimates rather than known amounts. Market participants generally seek compensation for bearing the uncertainty inherent in the cash flows of an asset or a liability and therefore a risk premium must be taken into account in measuring fair value.

  Present value techniques differ in how they adjust for risk and in the type of cash flows they use.
  Two main types of present value technique can be identfied:

  - **The discount rate adjustment technique**
    This technique uses contractual, promised or most likely cash flows and a risk-adjusted discount rate. The discount rate used is derived from observed rates of return for comparable assets or liabilities that are traded in the market. The assessment of comparability is based on the nature of the cash flows as well as other factors (e.g. credit standing, collateral, duration, restrictive covenants and liquidity).

    If a single comparable asset or liability does not fairly reflect the risk inherent in the cash flows of the asset or liability being measured, it may be possible to derive a discount rate using data for several comparable assets or liabilities in conjunction with the risk-free yield curve (i.e. using a 'build-up' approach).
  - **The expected cash flow (expected present value technique)**
    This technique uses as a starting point a set of cash flows that represents the probability-weighted average of all possible future cash flows (i.e. the expected cash flows). The expected present value technique may be applied in one of two ways. The calculation either uses risk-adjusted expected cash flows and a risk-free discount rate or expected cash flows that are not risk-adjusted and a discount rate adjusted to include the risk premium that market participants require (i.e. the expected rate of return which may be estimated through the application of the capital asset pricing model, for example).

There is no requirement to specifically use one of the present value techniques set out above. The most appropriate present value technique for the measurement of fair value will depend on the facts and circumstances specific to the asset or liability being measured, the availability of sufficient data and market practice.

- **Cost approach (sometimes referred to as 'replacement cost')**
  This valuation technique seeks to determine the amount required to replace the service capacity of an asset. When the cost approach is applied, the fair value of the asset is based on what it would cost a market participant buyer to acquire or construct a substitute asset of comparable utility, adjusted for obsolescence. This method is most commonly applies to the valuation of tangible assets where the use of the market or the income approach is not considered feasible, or to corroborate another approach.

In some cases, it is appropriate to use a single valuation technique (e.g. when valuing an asset or a liability using quoted market prices in an active market). However, in other circumstances, it may be considered necessary to use multiple valuation techniques, particularly when there are insufficient observable inputs for a single method to produce a reliable conclusion. In determining whether it is more appropriate to use a single technique or multiple techniques, an entity should consider the appropriateness of each method and the observability of the available inputs that are considered significant to the valuation. When multiple valuation techniques are used to measure fair value, the reasonableness of the range of values obtained must be evaluated. A fair value measurement is the point within that range that is most representative of the fair value in the circumstances.

Although there is no single valuation technique that is applicable in all circumstances, quoted prices in an active market, for an identical asset or liability, are considered to be the strongest evidence of fair value. The application of subjective adjustments to such price information is prohibited.

Valuation techniques should be applied consistently, to all similar assets or liabilities and over time, unless there is a change in market conditions or instrument-specific factors which would modify how a market participant would determine fair value.

This Guideline does not provide a comprehensive list of all possible valuation methods or techniques within the approaches identified above. The remaining chapters of this Guideline discuss certain methods or techniques that may be appropriate for specified instrument types.

FAIR VALUE HIERARCHY CLASSIFICATION

To increase consistency and comparability in fair value measurements and related disclosures, the accounting standards introduce a fair value hierarchy classification approach. The fair value hierarchy categorises into three levels the inputs to valuation techniques used to measure fair value.

The categorisation of a fair value measurement within the fair value hierarchy is a two-step process. First, each of the inputs used is categorised within the fair value hierarchy. Second, the appropriate categorisation of the fair value measurement of the asset or liability is based on the lowest level input that is significant to the entire measurement (considered individually and in aggregate, by level). The term 'significant' is not defined and the assessment requires the exercise of judgement, considering factors specific to the asset or liability. A methodology for determining the significance of inputs to a fair value measurement should be established (in the valuation policy) and applied consistently.

The fair value hierarchy outlined in IFRS is as follows:

- **Level 1**
  Level 1 inputs comprise of unadjusted quoted prices in active markets for identical assets or liabilities that the entity can access at the valuation point.

  A quoted price for an identical asset or liability in an active market provides the most reliable evidence of fair value. When a quoted price exists for an identical asset or liability, it should be used without adjustment.

- **Level 2**
  Level 2 comprises of inputs other than quoted prices included in Level 1 that are observable for the asset or liability, either directly or indirectly. Level 2 inputs include:
  - Quoted prices for similar assets or liabilities in active markets;
  - Quoted prices for identical or similar assets or liabilities in markets that are not active;
  - Inputs other than quoted prices that are observable for the asset or liability (e.g. interest rates and yield curves, implied volatilities, credit spreads);
  - Inputs that are derived principally from, or corroborated by, observable market data.

  The identification of a similar asset or liability involves the exercise of judgement and should be considered and documented as part of the CIS valuation policy.

- **Level 3**
  Level 3 comprises of unobservable inputs for the asset or liability. Level 3 inputs should only be used when observable inputs are not available.

  Unobservable inputs should reflect the assumptions that market participants would use when pricing the asset or liability, including assumptions about risk.

The fair value hierarchy gives the highest priority to Level 1 inputs and the lowest priority to Level 3 inputs.

The fair valuation hierarchy focuses on the significance of the inputs used in arriving at fair value rather than the valuation method.

3.3 FAIR VALUE ADJUSTMENT CONSIDERATIONS

In measuring the fair value of an instrument an entity must use the assumptions that market participants would use in pricing the asset or liability, including assumptions about risk.

The assumptions about risk are generally encapsulated in the concept of a fair value adjustment. Fair value adjustments may result in either a direct adjustment to prices or an indirect adjustment to inputs or valuation techniques.

Valuation adjustments may be considered appropriate if those adjustments are consistent with the objective of a fair value measurement, with a view to avoiding an understatement or overstatement of fair value. The adjustment should be reflective of an orderly transaction between market participants at the valuation point, under current market conditions.

There are two caveats to consider in relation to valuation adjustments:

- Adjustments are only permissible if they are consistent with the unit of account for the asset or liability being measured; and

- Adjustments are permitted only where they reflect a characteristic of an asset or liability. Adjustments are not permitted for premiums or discounts that reflect size as a characteristic of the entity’s holding.

A brief description of examples of valuation adjustments that may be considered when measuring fair value, consistent with the assumptions a market participants would make when pricing the asset or liability at the valuation point, are listed below (the list is not exhaustive).

- In certain instances, it may be concluded that the quoted price in an active market for an identical asset or liability (Level 1 input) is not considered to be representative of fair value at the valuation point (for example, where significant events take place after market close but before the valuation point or brokered trades). In such instances, the quantification of a valuation adjustment in order to conclude on the measure of fair value may be required. The establishment and consistent application of a policy for identifying and incorporating events that might affect the measurement of fair value is recommended;

- Where the measurement of the fair value of an asset or liability is performed on the basis of a quoted price for a similar asset or liability (Level 2 input), a comparative analysis of the qualitative and quantitative similarities and differences is required. In many cases, an adjustment to the quoted price will be required on the basis of the comparative analysis performed, in order to arrive at a suitable measure of the fair value of the asset or liability at the valuation point;

- Where recent transaction information for an asset or liability is not reliable (e.g. distressed sale or a transaction that was not executed on an arms-length basis), appropriate adjustments will be required to arrive at a measure of fair value for the asset or liability consistent with the principles of fair value measurement;

- If there has been a significant decrease in the volume or level of activity for an asset or liability in relation to normal market activity for the asset or liability (e.g. suspension of an exchange-traded instrument), further analysis of the transactions or quoted prices is required. Where it is concluded that a transaction or quoted price does not represent fair value, an adjustment to the transaction or quoted prices may be necessary if those prices are to be used as a basis for measuring fair value (i.e. the prices would effectively be used as inputs in the application of a selected valuation technique);

- When measuring the fair value of a liability using the price of an identical item held by another party as an asset, an adjustment to the price may be required to take into account factors specific to the liability (e.g. the existence of a credit enhancement arrangement). However, the inclusion of adjustments to reflect the existence of a restriction that prevents the transfer of the liability are generally not permitted (in accordance with the principles of fair value measurement);

- The inputs (both observable and unobservable) used in valuation techniques may be subject to adjustments in order to ensure valuation outputs are appropriate and meet the principles of a fair value measurement. For example, unobservable inputs developed by the entity may require amendment to ensure alignment with market participant assumptions (such as the exclusion of any information about the instrument that is only internally available to the entity). Another example includes adjustments to observable inputs in order to take into account the volume and level of activity in the markets within which the inputs are observed;

- Where price or other input information is not available at the valuation point,

- An adjustment to a valuation technique or inputs to take into account a characteristic of an asset or a liability. Examples include a restriction on the transfer of an asset or a liquidity discount that would be taken into account by a market participant to compensate for the difficulty in selling the asset under current market conditions;

- Valuation adjustments may be required to take into account measurement uncertainty inherent in a particular valuation technique or in the inputs to the valuation technique. For example, a risk premium may be incorporated to take into account the compensation required by market participants for bearing the uncertainty inherent in the cash flows of an asset or a liability;

- Calibration adjustments to inputs or valuation techniques to align outcomes to observable market data;

- Adjustments determined with the objective of applying the point within the bid-ask spread that is most representative of fair value in the circumstances;

- The characteristics of an asset or liability may result in the application of an adjustment to a price or model output, such as a premium or discount (e.g. a control premium or non-controlling interest discount). The incorporation of a premium or discount must be consistent with the unit of account for the asset or liability being measured. An adjustment that reflects size as a characteristic of the entity’s holding, rather than a characteristic of the asset or liability, is not permitted (e.g. a blockage factor that adjusts the quoted price for an asset or liability because the market’s normal daily trading volume is not sufficient to absorb the quantity held by the entity).

  In all cases, where a quoted price in an active market (i.e. a Level 1 input) exists for an asset or a liability, an entity uses that price without adjustment when measuring fair value;
  Adjustments may also be necessary in other circumstances (e.g. when a price for a similar / comparable instrument requires adjustment to make it comparable to the instrument being measured);

- Adjustments to take into account non-performance risk.

  In particular, the principles of fair value measurement generally require the mandatory assessment of credit risk when measuring fair value (refer to section 3.2 of this chapter). Credit risk is the risk of default or non-performance by a party to an asset or liability.

  The requirement to assess credit risk stems from the 'exit price' concept of fair value measurement. In accordance with this concept, the measurement of fair value should reference the price paid or received to transfer the asset or liability at the valuation point, rather than to settle the asset or liability. Non-performance risk is assumed to be the same before and after the transfer of the asset or liability.

  The assessment of credit risk will be dependent on the obligations imposed on the parties to an asset or liability. For some instruments, the credit risk exposure may arise from only one party to the instrument. For example, the holder of a debt instrument is exposed to the non-performance risk of the issuer.

  However, the definition of non-performance risk clarifies that it encompasses an entity's own credit risk (credit standing) and any other factors that might influence the likelihood that the obligation will be fulfilled. Therefore, non-performance risk may include the risk associated with the entity's ability to perform its obligations under an instrument. For example, because a derivative instrument is bilateral in nature (i.e. can move from an asset to a liability position to either counterparty over the life of the instrument), the exposure may be positive or negative to the entity at various points throughout the life of the instrument.

  In simple terms, the measurement of fair value must take into account the creditworthiness of both counterparts to an asset or liability, at each valuation point.

  The adjustment arising from the assessment of credit risk inherent in a derivative instrument (which is bilateral in nature) is commonly referred to as:

  - Credit Valuation Adjustment ("CVA") - quantifying the price of the counterparty credit risk for a given asset or liability; and
  - Debit Valuation Adjustment ("DVA") - quantifying the price of an entity's own credit risk for a given asset or liability.

  To assess non-performance risk, it is necessary to consider the specific terms of the instrument rather than simply looking at the overall credit rating or quality of the entity in its entirety. Looking at the latter will generally obscure the particular credit characteristics of the instrument itself, like credit enhancements, or fail to reflect the relative seniority or subordination of the liability relative to the liabilities of the entity.

  Collateral is a form of credit enhancement that is contractually linked to an asset or liability. The fact that an entity has provided collateral typically means that the stated terms of the asset or liability (e.g. the interest rate charged) differ from the terms of an identical asset or liability that is not supported by collateral. The collateral is a characteristic of the asset or liability and, consequently, it should be reflected in the fair value measurement.

  Changes in the fair value of collateral or an entity's credit standing should be taken into account in measuring the fair value of an asset or liability on an ongoing basis. This is to ensure that the fair value measurement reflects market participant assumptions at the measurement date.

3.4 ESTABLISHMENT OF A LIQUIDITY ASSESSMENT FRAMEWORK

The concept of an 'active market' in relation to quoted prices was introduced in the section 3.3. of this chapter. Quoted prices may either be used as a direct measure of fair value, or used as an input into another valuation technique. In particular, a Level 1 input is generally considered to be the most reliable evidence of fair value and should therefore be used, without adjustment, whenever available.

Additionally, certain valuation techniques rely on the use of inputs other than quoted prices that are observable for the asset or liability (e.g. interest rates and yield curves, implied volatilities, credit spreads). These inputs should be both reflective of market conditions at the valuation point and consistent with market participant assumptions and the exit price notion of fair value measurement. Observable inputs, should therefore represent liquid quotes that are executable at the valuation point.

In order to assess the suitability of price or other input data, for the purposes described above, the implementation of a liquidity assessment framework is a key element of the valuation process.

The objective of a liquidity assessment framework, in the valuation context, is to continuously monitor the liquidity and trading levels of the price and input data required. This facilitates the analysis of the continued relevance and appropriateness of the valuation techniques and related inputs applied to each instrument.

For example, a corporate bond listed on the JSE debt market, which has not traded in several months, would still have a quoted price available on any given date. Despite this, the quoted price may not necessarily be reflective of the fair value of the bond because it was not derived from actual transaction data but rather determined by the exchange, applying a valuation technique using the last traded price and the current bond curve. Additional analysis and testing would be required to conclude on whether the quoted price is equal to the price at which a market participant would be able to exit the position at the valuation point.

The continuous monitoring and assessment of the liquidity of price and other market data quotes assists in:

- Evaluating the suitability of the valuation technique used for each instrument at each valuation point;

- Concluding on whether price quotes are being sourced from a market that is sufficiently active and the consequential impact on the measurement of fair value;

- Timeously identifying instances of a reduction in the volume or level of activity that may be indicative of the need to consider whether price quotes continue to be representative of the fair value of an instrument. Where necessary, suitable contingency plans for the establishment of alternative valuation techniques are required;

- The assessment of observable input data, specifically considering whether the data reflects market conditions at the valuation point (e.g. interest rates sourced must be indicative of actual market rates and implied volatilities should be derived from liquidly traded instruments). In the absence of suitable observable input data, an adjustment to the inputs may be required or the implementation of alternative sources, inputs or valuation techniques may need to be considered;

Ultimately, regardless of the valuation technique used, the objective of a fair value measurement is to establish an exit price for the instrument, from the perspective of a market participant, at the valuation point.

The accounting standards do not provide specific requirements for the assessment of liquidity. It is therefore necessary to formulate and implement a liquidity assessment framework, which should consider both quantitative and qualitative factors, supported by a suitable governance structure.

Common market practice is to implement a ‘liquidity scoring framework’, where:

- Metrics that characterise a liquidly traded instrument are identified;

- The benchmark level for each metric is set with reference to a proxy liquidly traded instrument(s) or based on the entity’s judgment;

- The actual level is determined for each metric, per instrument held by the entity and compared to the benchmark. Based on the results obtained, a ‘liquidity score’ is assigned to each instrument; and

- A decision is subsequently made as to whether the instrument is liquid or illiquid, based on a pre-defined interpretation of the score.

Possible metrics that may be considered as part of the liquidity assessment exercise include, but are not limited to:

- Whether a trade has occurred during a predefined historic period considered from the valuation point;
- Percentage of issued principal that traded over a predetermined period;
- Inclusion in an index; or
- Whether the issuer has an updated national scale rating.

For illustrative purposes, when considering the valuation of an illiquid bond, government bonds are typically used as the proxy, liquidly traded instruments used to infer the liquidity benchmark. As an example of the application of a liquidity assessment metric, the principal amount traded as a percentage of the principal amount issued for the illiquid bond over a three month period (annualised) may be determined and compared to a liquidity threshold inferred by utilising government bonds as the benchmark.

It is important to note that even when an instrument is determined to be illiquid, recent trade data, if deemed to be from an 'orderly transaction', may be used to test or calibrate a valuation model.

Ultimately, liquidity considerations of input data and price quotes should form an integral part of the valuation process. Suitable contingency measures are also required to ensure the continued availability of NAV prices, in both normal and stressed conditions, through the adoption of alternative valuation techniques, as required (refer to Chapter 2 for further guidance in this regard).

3.5 SOURCES OF PRICE AND OTHER MARKET DATA

In general, in measuring fair value, preference is afforded to the use of valuation techniques that maximise the use of observable inputs and minimise the use of unobservable inputs.

Examples of markets from which observable inputs for some instruments may be sourced include:

- **Exchange markets**
  In an exchange market, price or market data is publicly available. Bid, ask and closing prices can typically be easily sourced from exchange markets.
- **Dealer markets**
  Dealers stand ready to trade, for their own account, creating liquidity for the instrument for which they make a market (by using own capital to hold inventory of the instrument). OTC markets for which prices are publicly reported (such as the foreign exchange market) are dealer markets. Dealer markets also exist for some other instruments (financial instruments, commodities and physical assets). Typically bid and ask prices are accessible in dealer markets.
- **Brokered markets**
  In a brokered market, brokers match buyers with sellers but do not stand ready to take positions for their own account in order to make a market for an instrument. In some cases, the prices concluded in completed transactions may be available.
- **Principal-to-principal markets**
  In principal-to-principal markets all transactions are negotiated independently without an intermediary. Generally, limited price information is publicly accessible for this market.

The process of sourcing, assessing and selecting the most appropriate price or market data, for each valuation technique adopted, forms a critical component of ensuring the integrity of the valuation process. As a result, Chapter 2 of this Guideline suggests the inclusion of a matrix in the valuation policy. The matrix should incorporate the identification of the primary and one, or more, secondary market data sources to be used in conjunction with the identified valuation technique for each portfolio instrument. Consideration should also be afforded to the inclusion of procedures for changing market data sources and the frequency of the review of the matrix should be established.

In accordance with principles of fair value measurement, the selection of inputs (price or market data) should be consistent with the characteristics of the instrument that market participants would take into account in a transaction for the instrument. In some cases those characteristics result in the application of an adjustment, such as a premium or discount (refer to section 3.3 of this chapter). For example, discounts may be applied to prices quoted in an active market if there is some contractual, governmental or other legally enforceable restriction attributable to the instrument (not the holder), resulting in diminished liquidity that would impact the price a market participant would pay at the valuation point. However, blockage factors that reflect size as a characteristic of the CIS holding (specifically, a factor that adjusts the quoted price of an instrument because the market's normal daily trading volume is not sufficient to absorb the quantity held by the CIS), should not be applied.

The valuation policy procedures should focus on independence and consistency of application. The sourcing of any price or market data should be performed consistently at each valuation point, as documented in the valuation policy:

- At a specified time of day; and
- Using the specified price quote (e.g. bid, ask, mid etc.).

It is considered best practice to ensure that an appropriate audit trail of price and market data is extracted and retained.

To the extent possible, price and other market data should be validated by comparing multiple sources (paragraph 5 of the Conduct Standard). It is recommended that the valuation policy should establish suitable tolerance levels for variances between sources, along with a process for the resolution of tolerance breaches. Threshold levels are generally determined both on an individual instrument basis and in aggregate, across the portfolio. Examples of thresholds include percentage difference between sources or the monetary impact on NAV arising from the difference between sources.

In accordance with the fair value measurement framework and as a general principle, the best indication of fair value is the quoted price for an identical instrument to the one held by the CIS, in an active market. Therefore, for most liquid, exchange-traded instruments, fair value will be measured by reference to the quoted exchange price.

For instruments that do not necessarily trade on an organised exchange but do have quoted prices, price data may be obtained from various sources such as market data feeds, consensus pricing services or broker quotes. The availability of pricing information can be a determinant of the depth of the market and may differ between markets. The use of quoted prices provided by third parties is not preculuded, if it is determined that the quoted prices provided by those parties were developed in accordance with the principles of fair value measurement. The valuation policy should, therefore, clarify the standard practice for the valuation of both liquid, quoted instruments as well as illiquid instruments (including the identification of the principal (or most advantageous) market).

The application of alternative valuation techniques is required for certain instruments because of the absence of a mechanism to provide accurate pricing information at the valuation point (e.g. an OTC derivative, whether bilaterally traded or centrally cleared). These techniques will normally involve one, or a combination of valuation models, counterparty valuations and engagement with independent valuation experts. To the extent possible and in these instances, it is generally considered best practice to use a combination of valuation techniques in order to corroborate the fair value determined for the instrument. Differences in valuation results may be an indication of inappropriate assumptions or errors to be investigated further.

Considerations specific to the selection criteria for market data sources are summarised below. The data provided from these sources could be any level in the fair value hierarchy, depending on the source of the information. The assessment of the liquidity of market data quotes is a key consideration in evaluating various available sources (refer to section 3.4 of this chapter).

MARKET DATA VENDORS

Depending on the specific market environment, market data vendors (e.g. Bloomberg, Reuters) may generally be used as a source of:

- **Price data**
  Prices of exchange-traded instruments and other instruments which do not necessarily trade on an exchange but do have quoted prices.

  The key aspect introduced by the accounting standards in relation to the use of quoted prices to measure fair value is that prices must be derived from an 'active' market – that is, a market where arms-length transactions are concluded with sufficient volume and frequency to determine an exit price for the instrument (i.e. to ensure that the levels quoted could be executed upon at the valuation point). The assessment of the liquidity of price quotes through the application of a liquidity assessment framework (refer to section 3.4 of this chapter) is crucial as the manner in which instruments are priced may depend on the market and its current state. The conclusion as to whether a market has the necessary level of trading to be considered 'active' is a matter of judgment.

  Regardless of the source used, instrument prices should be derived from actual transaction data and if not, the instrument price should be determined by assessing available transaction data in conjunction with other observable market data or valuation techniques.

- **Other market data**
  Market data used as inputs into valuation techniques. This may include price quotes in active markets for instruments that are similar, but not identical to the instrument being valued or other observable inputs (for example bond yields, credit spreads). Consistent with the principles of fair value measurement, the data must be reflective of market conditions at the valuation point. This is critical in ensuring that the output from the valuation technique employed reflects the exit price of the instrument at the valuation point. Therefore, input data should be sourced from an active market (similar to the sourcing of price data as described above), necessitating the implementation of a suitable liquidity assessment framework.

Price and other market data quoted in an active market should be sourced at the point within the bid/ask spread that is most representative of fair value or will result in an output that is most representative of fair value at the valuation point. The point estimate selected in the bid/ask spread should be consistently used.

If the required price (or other market data) is available on more than one exchange, the exchange data which is considered most representative of fair value or will result in an output that is most representative of fair value should be used.

As indicated above, even for instruments that are valued directly by reference to a quoted price, it is advisable to validate the reasonability and accuracy of price data sourced against a secondary source (provided each source is derived independently from an active market). Direct feeds are often established with one or more vendors, making validation of prices or other market data by comparing multiple sources relatively straight forward.

Price and market data should be sourced from vendors that have been subjected to appropriate due diligence procedures and approved by the CIS manager, with oversight by the trustee, as deemed appropriate (refer to section 2.12 of Chapter 2).

Before using the information provided by a vendor, it is vital to ensure that a clear understanding is gained of how the information was sourced or derived in order to conclude on whether it is suitable for fair value measurement purposes. Particular attention should be given to information that has been subjected to mathematical operations by the market data vendor in order to ensure that the information continues to be suitable for the intended valuation purposes. Examples include varying methodologies that may be used by market vendors to determine volatility measures or constructing interest rate curves.

Other than the use of vendors, in some cases price and other market data can be extracted from alternative sources (for example, government websites). This may be appropriate provided adequate investigations into the adequacy of the data has been performed. Measures should be established to ensure the consistent sourcing of the data and the appropriate maintenance of an adequate audit trail.

Price and market data vendors may also provide broker or other consensus data (as described below).

PRICE AND MARKET DATA QUOTES PROVIDED BY THIRD PARTIES

The use of price or other market data quotes provided by third parties, such as consensus pricing services or brokers, is permissible provided the principles of fair value are consistently applied in assessing the reasonability of the information for fair value measurement purposes. Consideration should be given to whether the source and the basis of the quotes are appropriate, taking into account the frequency with which quotes are received and reviewed. From a governance perspective, assessing the existence of any conflicts of interests between the third party price source and the CIS assists in validating the relevance of quotes obtained for fair value measurement purposes.

- **Broker (or dealer) quotes**
  For some instruments (including thinly-traded instruments or where trading in the instrument has been temporarily suspended), quotes from brokers (or other market makers) may be used as a measure of the fair value of an instrument. In order to meet the definition of fair value, a broker quote should be reflective of the price at which the instrument may be realistically traded at the valuation point.

  In assessing whether fair value measurement based on a broker quote is reliable, aspects that should be considered include:

  - Whether the quote is appropriately reflective of market conditions at the valuation point and represents the price at which a transaction for the instrument may be executed;
  - Whether any conflicts of interest arise due to a pre-existing relationship between the CIS and the broker;
  - Whether the broker specialises in the specific instrument held by the CIS and for which a quote is required; and
  - The existence of any restrictions or limitations on the broker quote which may compromise its suitability as a measure of fair value.

  Broker quotes are generally most reliable when they are sourced at the valuation point from independent market makers for the instrument in question and the quote is both binding and free of any restrictions, disclaimers or limitations. However, this is generally not the case and broker quotes are often based on limited, or in some cases no actual transactions. Therefore, in most cases a broker quote will need to be supported by other data such as the results of valuation techniques or transaction data of actual instrument trades close to the valuation point.

  If broker quotes are sourced and used, it is essential to ensure that the process is independent of the CIS investment function in order to gain comfort of the reasonability of information received. It is therefore suggested that to the extent possible, multiple broker quotes should be sourced independently by the CIS valuation function (without the intervention of the CIS investment function). To ensure consistency in the valuation of a portfolio instrument, as far as possible, the same broker quotes should be used at each valuation point. If necessary, any broker substitutions should be subject to appropriate escalation and review procedures (formalised in the valuation policy), to ensure that the fair value measurement objectives continue to be met.

  The minimum number of quotes required and the method of calculating fair value will be driven by the nature of the instrument. The valuation policy should dictate:

  - The procedures to be followed in assessing the quotes received (for example, identification of outliers to be discarded, comparison of broker quotes over time or to price movements in comparable instruments or indices); and
  - How the fair value of the instrument should be calculated at the valuation point (for example, average or median of broker quotes sourced).

- **Consensus pricing services**
  In the absence of liquid price or market data quotes, consensus pricing services poll a group of market participants periodically with the objective of obtaining a view of price or other market data estimates at a point in time. Subscribers to the service agree to send their best estimates of price or other market data for a range of instruments confidentially to the service provider, which then uses the data to calculate a consensus estimate, which is passed back to the subscribers. Examples may include consensus estimates of the prices for specific instruments or consensus estimates of the credit spreads applied to specific groups of market participants (e.g. sectors), by credit rating.

The price or market data is generally presented impartially, allowing for an unbiased view of the information.

Prior to the use of consensus pricing services for the valuation of portfolio instruments, careful consideration should be afforded to whether the price or market data is appropriate for the purposes of fair value measurement. Some specific aspects to consider include:

- Whether the contributors represent independent and knowledgeable market participants, in the principal (or most advantageous) market;
- The soundness of the methodology employed by the service provider in collecting, aggregating and presenting the price or market data;
- The frequency with which updated consensus price or market data is published and whether information is sufficiently current to facilitate the valuation of portfolio instruments at each valuation point; and
- Whether consensus price or market data can be corroborated by other observable market data.

Consensus pricing service providers should be subjected to appropriate due diligence procedures and approved by the CIS manager, with oversight by the trustee, as deemed appropriate (refer to section 2.12 of Chapter 2).

OTHER SOURCES

- **Valuation models**

  The use of a valuation model to measure fair value may be required in the absence of accurate pricing information for an instrument at the valuation point (for example, in the case of illiquid, OTC or otherwise structured instruments).

  A valuation model makes assumptions about the fundamental value drivers of an instrument and, in conjunction with relevant inputs (observable and / or unobservable), is used to measure the fair value of an instrument at the valuation point.

  The use of a valuation model to measure fair value introduces both:

  - Model uncertainty - whether the model and assumptions inherent in the model are reasonable and appropriate, given the characteristics of the instrument; and
  - Input uncertainty – whether the available inputs to be used in the model are appropriate and consistent with the model assumptions and whether the inputs themselves are accurate and reflective of market conditions at the valuation point.

  For standardised instruments (e.g. an OTC interest rate swap), there are standard valuation models that are widely used by market participants to measure fair value. However, the valuation models for complex instruments involve a significant degree of subjective judgement in developing model assumptions and selecting inputs. Prior to employing a valuation model to measure fair value, the exercise of judgement is required with respect to:

  - The choice of the model and the assumptions embedded in the model (the level of model risk increases with the complexity of the instrument);
  - The sources of inputs into the model and the techniques (e.g. interpolation or extrapolation techniques) used to adapt inputs into the form required by the model.

  The use of a valuation model should be approved as part of the valuation policy and incorporated in the price matrix (refer to section 2.5 and section 2.15 of Chapter 2). The price matrix should also specify the source and nature of the inputs required for the valuation model, including procedures for interrogating the appropriateness of the inputs. Observable inputs, for example, may in many instances be sourced via the market data feeds described above.

Given the additional level of subjectivity introduced by the use of a valuation model, model outputs should be subjected to thorough analysis and interrogation for reasonability, performing comparisons to other available information (such as broker quotes, counterparty valuations, the opinion of an independent valuation expert).

Valuation models introduce a number of risks and complexities that need to be managed on an ongoing basis. In a constantly changing market environment, the assessment of the continued validity of model assumptions and input parameters should be incorporated as part of a properly documented model governance framework (as described in section 2.5 of Chapter 2):

- **Counterparty valuations**
  Valuations sourced from a counterparty (including a central counterparty) are generally readily available and therefore commonly used in practice. However, it is important to bear in mind the inherent limitations of counterparty valuations prior to application in the valuation process:
  - Counterparty valuations may not have been determined according the principles of fair value measurement, particularly in relation to the requirement to assess and quantify credit risk;
  - Counterparty valuations rarely disclose the basis, methodology or input data used in the valuation posing challenges to interrogating the appropriateness of the process followed;
  - The valuation point of the counterparty valuation may not coincide with that of the CIS portfolio;
  - Counterparties are not independent to the transaction which may introduce bias in the valuation determination (e.g. aspects specific to the counterparty that are not necessarily relevant to a market participant may be taken into account, contrary to the principles of fair value measurement);
  - Identical instrument types may be valued differently depending on the counterparty;

  If counterparty valuations are used, it is important that appropriate processes are established to mitigate the limitations identified above in order to ensure that the instrument valuation included in the NAV is representative of fair value. All relevant policies and procedures in this regard should be integrated as part of the valuation policy.

- **Independent valuation expert**
  Particularly in the case unlisted (and illiquid) or otherwise complex instruments, challenges arise both in the selection and development of suitable valuation models as well as in the sourcing of valuation inputs, which in most cases are unobservable and subject to significant judgment and estimation uncertainty. The manager or trustee may consider the involvement of an independent valuation expert in these instances.

  A number of service providers offer independent valuation services, covering a diverse range of instruments, which may be used by the CIS as a primary or secondary source of instrument valuations.

  The delegation of the valuation of an instrument to an independent valuation expert does not divest the manager from its responsibilities. An assessment of the work performed by the independent valuation expert is required in order to determine whether the principles of fair value measurement were appropriately applied. Some key considerations may include:
  - Whether the scope of the expert's work and the valuation basis employed is suitable for the purpose of the valuation;
  - Whether the valuation date and valuation currency (in the case of instruments that generate foreign-denominated cash flows) are appropriate;
  - The nature and source of inputs and assumptions used, including the results of procedures performed by the manager to assess the appropriateness and accuracy of the inputs and assumptions for the valuation purpose;
  - The model and model assumptions employed by the expert and whether these are consistent with the characteristics of the instrument and aligned to the view of a market participant;
  - Whether the valuation result can be corroborated by other observable market data or valuation techniques;
  - The nature and extent of the expert's work, including any restrictions or limitations that may compromise the use of the valuation results to measure fair value at the valuation point; and

- Conflicts of interest that may limit the expert’s ability to provide an unbiased and objective valuation (e.g. a pre-existing relationship with one of the parties to the subject instrument of the valuation);

In order to perform an adequate assessment of the work of an expert, the manager is required to possess the relevant skills and experience to assess and interpret the valuation results provided by an expert. In some instances, the CIS investment function may be involved in the review process of the work performed by an expert, given their direct understanding of the instrument. Appropriate review procedures and price challenge processes

There are several factors to weigh up when considering the use of an independent valuation expert, including competence, level of experience, methodologies and control environment. The use of independent valuation experts should be subjected to appropriate due diligence procedures and approved by the CIS manager, with oversight by the trustee, as deemed appropriate (refer to section 2.12 of Chapter 2).

POSITIONS IN OTHER CIS

The instruments of a CIS may comprise of investments in other CIS, fund of funds or feeder funds. The use of the NAV reported by the investee manager as a basis to measure the fair value of the investment held by the CIS should be carefully assessed to ensure it is representative of fair value (i.e. represents an ‘exit price’ for the investment).

It is the responsibility of the CIS manager to ensure that the investee fund has established appropriate controls and processes in order to ensure the determination of NAV is accurate and aligned to the relevant fair value measurement principles. The evaluation process performed by the CIS manager requires the exercise of professional judgment.

If the use of the NAV price provided by the investee manager is not deemed to be representative of fair value, an alternative approach (such as an income approach or market approach) may be required.

Alternatively, if the NAV reported by the investee manager is not provided at the valuation point of the CIS, considerations should be given to the need for an adjustment to the reported NAV.

In the case of exchange-traded funds, prices may be available from the relevant exchange, in addition to the NAV determined by the investee manager. In this instance, due consideration to the fair value measurement principles outlined in section 3.2 of this chapter. The measure of fair value selected by the CIS manager should reflect the exit price in the relevant principal market for the CIS.

3.6 EXCHANGE TRADING – KEY CONCEPTS

Market participants can trade instruments bilaterally or through exchanges. An exchange is a central market where standardised contracts can be traded at a specified price. An exchange promotes market efficiency and liquidity by centralising trading.

KEY FUNCTIONS OF AN EXCHANGE

Exchange functions fall into three primary categories:

- **Product standardisation**
  Exchanges set the terms of traded, standardised products. Terms may include, depending on the nature of the instrument, contract size, maturity dates, delivery grades, locations.

- **Trading venue**
  Exchanges may be physical locations or electronic platforms that provide a central location for trading, which then facilities price discovery. Entities trading on an exchange must accept the exchange's rules and conditions.

- **Reporting services**
  Exchanges report transaction prices to various entities, including trading participants, vendors, and subscribers.

LIST OF EXCHANGE-TRADED PRODUCTS

Exchange-traded products are standardised and are traded in a secondary market. OTC products are privately negotiated, customised and traded directly between two parties without an exchange or intermediary involved.

The list of products offered by exchanges is continuously being expanded to meet market requirements. A list of common exchange-traded products is provided below:

- Equity instruments (ordinary shares, preference shares, depository receipts, ETFs, warrants, rights stemming from a rights issue, Real Exchange Investment Trust ("REIT"))

- Debt instruments (money market instruments, bonds, debentures)

- Derivatives, by instrument class:
  - Futures;
  - Options; and
  - Swaps (including forward rate agreements, interest rate swaps, cross-currency swaps etc.).

DERIVATIVES TRADING ON AN EXCHANGE - MARGINING AND NETTING

Although OTC trading permits a greater degree of flexibility with respect to contract terms, it involves a greater degree of credit risk. In addition to the functions described above, exchanges have assisted in the mitigation of counterparty risk in derivatives trading by the introduction of the following concepts:

- **Margining**
  Margining involves posting both initial and variation margin. The amount required to open a position is called the initial margin. Subsequently, a daily procedure of marking-to-market is undertaken to adjust the margin account balance for daily movements in the position price.

  The maintenance margin is the minimum margin account balance required to retain the position. When the margin account balance falls below the maintenance margin, the investor receives a margin call and must bring the margin account back to the initial margin amount. The amount necessary to do this is called the variation margin.

  Margin is generally cash or highly liquid instruments placed in an account to ensure that any trading losses suffered by an investor are covered.

- **Netting**
  Netting refers to consolidating multiple offsetting positions between counterparties into a single payment. This assists in reducing the risk to a counterparty and the costs (i.e. margin requirements) of maintaining an open position.

- **Clearing**
  Exchanges have assisted in the establishment of methods for the clearing of trades. Clearing is the process of reconciling and matching contracts between trading parties from the time the commitments are made until settlement. Each exchange has a clearinghouse. The clearinghouse guarantees that traders in the derivatives market will honour their obligations. The clearinghouse does this by splitting each trade once and acting as the opposite side of each position. The clearinghouse acts as the buyer to every seller and the seller to every buyer. By doing this, the clearinghouse allows either side of the trade to reverse positions at a future date without having to contact the other side of the initial trade. The risk of counterparty default is also reduced as the counterparty is the clearinghouse in all cases. The clearinghouse has members that collateralize it, ensuring that no defaults take place.

CORPORATE ACTIONS AFFECTING EQUITY INSTRUMENTS LISTED ON AN EXCHANGE

A corporate action is any event that has a material impact on the stakeholders of an entity, including shareholders (ordinary and preference) and bondholders. These events are generally approve by the entity's board of directors.

Examples of corporate action events that directly impact the return on an instrument are dividends on an equity instrument (e.g. an ordinary share or preference share) and periodic interest payments or capital redemptions on a debt instrument (e.g. a corporate bond). These events may impact the price at which an instrument is traded depending on the point in the corporate action event timeline. As an example, all registered holders of an equity instrument (e.g. an ordinary share) on the record date will be entitled to receive the dividend payment on the corporate action event payment date. The record date is generally approximately one business day before the payment date. This means that the trading price of the equity instrument between the declaration date of the corporate action event and the record date will be cum-dividend. After the record date, the equity instrument will trade ex-dividend.

Each exchange will have different reporting, communication and processing requirements for each type of corporate event.

3.7 OTC MARKETS

An OTC market is a customised trading market and incorporates trading in all instruments not listed on a registered exchange. The terms of OTC instruments are not established by an exchange, providing for increased levels of flexibility in negotiating contract terms.

The bilateral nature of OTC contracts introduces the risk of default arising from each counterparty to the contract.

The OTC market includes the trading in all instruments not listed on one of the registered exchanges. This market is subject to credit risk since the party on the other side of an OTC trade could default on its obligations. A method that may be used to reduce this credit risk is by means of collateralisation. Collateralization is a marked-to-market feature for the OTC market where any loss is settled in cash at the end of a trading day. A cash payment is made to the party with a positive account balance. This is a similar system to trading on margin on an exchange (e.g. where a futures trader needs to restore funds when the value of the contract drops below the maintenance margin).

In some jurisdictions, legislation has been passed requiring the clearing of some OTC transactions through clearinghouses. OTC market clearinghouses operate in a similar fashion to clearinghouses on exchanges. After two parties negotiate an OTC contract, it is submitted to the clearinghouse for acceptance. Once accepted, the clearinghouse becomes the counterparty to both each party to the contract. Thus, the clearinghouse assumes the credit risk of both of the parties in the OTC contract. The clearinghouse manages the risk by requiring the parties to post initial margin and any variation margins on a daily basis.

3.8 DIGITAL ASSET CONSIDERATIONS

A digital asset is an instrument that only exists in digital form (i.e. digital records on a distributed ledger) and represents a resource that is expected to give rise to the inflow of future economic benefits (e.g. through the sale of the digital asset). The most common example of a digital asset that has grown in prominence is the cryptocurrency (e.g. Bitcoin).

The valuation of digital assets in a CIS portfolio requires careful consideration due to the unique characteristics of these instruments which may pose specific challenges, chief of which being the intangible and highly volatile nature of these instruments.

The reader is referred to the guidance published by the Alternative Investment Management Association Digital Asset Working Group for pertinent considerations.

3.9 AMORTISED COST MEASUREMENT BASIS

Constant NAV money market portfolios require an amortised cost measurement basis.

Refer to the accounting standards for guidance on the application of the amortised cost measurement basis and the associated effective interest rate method.

To the extent that there is uncertainty with respect the timing and amount of the receipt of contractual cash flows underlying an instrument measured at amortised cost (e.g. due to default), an impairment of the amortised cost amount must be considered.

It is important to note that the amortised cost measure cannot be considered as a proxy for fair value.

It is important to note that even in the case of a money market portfolio, the manager is required to perform a mark-to-market valuation of the portfolio and each participatory interest on the last day of each month to determine the variance of the mark-to-market value and the constant price (Board Notice 90 of 2014 to the CISCA).

APPENDIX 1:
VALUATION POLICY OUTLINE

It is suggested that the valuation policy should be clearly written and aimed at providing comprehensive fair value measurement principles, valuation requirements, procedures, processes and controls. A useful guideline is to ensure that the valuation policy is set out in such a manner that would allow for the practical implementation by a third party valuation service provider, if necessary. It is also generally considered best practice to ensure that the valuation policy is largely consistent with the accounting standards applicable to the CIS.

The valuation policy should be generally consistent across similar instrument types and cover the universe of instruments in which the CIS may invest, consistent with the trust deed.

To ensure its continued relevance, it is suggested that the valuation policy should be subject to periodic reviews, the frequency of which will depend on the CIS portfolio's complexity or investment activities (e.g. investing in new instrument types). Sound practice suggests that the valuation policy should be reviewed at least annually and upon a significant change in circumstances. The review process should be conducted by the manager and any changes are to be approved by the manager's board of directors. Input and review by the valuation committee (where relevant) or the trustee may be incorporated, as deemed appropriate and necessary.

The concepts and items listed below were introduced in Chapter 2 and have been summarised in order to provide an outline for a valuation policy document. The suggestions listed are not intended to be comprehensive and will not all be appropriate in each individual case.

The content of the valuation policy will differ across CIS and will be driven by the surrounding facts and circumstances, including the nature of the CIS business and its investment policy (i.e. type of portfolio instruments held). In addition the structure of the document may vary from a single consolidated policy document to a core policy document with various supporting appendices and other documentation (e.g. separate model documentation).

OBJECTIVE

The fundamental objective of the valuation policy in achieving fairness, consistency, transparency and accuracy in the NAV calculation and NAV pricing process.

- Valuation basis (instrument valuations to be determined in good faith and in accordance with relevant accounting standards);
- Specification of the types of instruments within the scope of the CIS;
- Identification of relevant governing regulation and legislation.

ROLES AND RESPONSIBILITIES

Specific identification of the roles in performing the NAV calculation and NAV pricing, including specification of responsibilities. Requirements should be specified in detail in order to facilitate the assignment of accountability and facilitate review processes.

- Identification of the various stakeholder roles and responsibilities in the valuation process, including the extent and form of the involvement of the trustee. Specific consideration should be afforded to ensuring that all personnel involved in the calculation of the NAV and the NAV pricing are competent;
- Policies aimed at ensuring the independence of the valuation function through appropriate segregation of duties;

- Where relevant, the role of the valuation committee, membership requirements, frequency of meetings (including requirements for a quorum) and protocol for minute-taking (e.g. by including a reference to the committee terms of reference).

CONFLICTS OF INTEREST

The existence of actual or perceived conflicts of interest may unduly influence NAV calculation and NAV pricing process and should be continuously monitored and appropriately managed.

- Clear, detailed policies focused on the management of any conflicts of interest that may exist or arise in the valuation process (including conflicts that may arise due to the existence of delegation arrangements).

VALUATION METHODOLOGY AND SOURCES

A critical component of the valuation policy is the identification, for each portfolio instrument, of the valuation methodology and sources of input data to be used. Where valuation models are used to measure fair value, the implementation of additional controls to manage model risk are an important consideration.

- Identification of the approach and sources to be used for the valuation of each instrument type in the CIS portfolio. This encapsulates both price and market data used either to value and instrument directly or as an input into a valuation technique. This may be presented in the form of a matrix specifying:
    - Valuation methodology to be applied;
    - Steps to be followed in the determination of the principal market from which to source market data;
    - Primary and alternative sources of data;
    - Specification of the quote to be used (i.e. bid, ask, last traded price, mid etc.);
    - Cut-off time for extracting quotes (should be largely consistent across instrument types);
    - Tolerable variance between sources, including specification of procedures to be followed where the tolerable variance is exceeded;
- For instrument valuations requiring the use of a model (due to a lack of a market mechanism to facilitate the valuation process), in addition to the information set out in the matrix, the valuation policy should specify:
    - Identification of the model to be employed (with references to documentation which provide detailed information regarding the nature of the valuation model, model assumptions and limitations);
    - Supporting documentation requirements for subjective assumptions and inputs updated at each valuation point;
    - Model input calculation techniques (e.g. curve construction methodologies using sourced market data);
    - Model calibration requirements (output valuations calibrated to market prices or data);
    - Governance framework for the use of models (including appropriate change and version controls) and model monitoring activities (procedures for the periodic evaluation of the continued accuracy of model setup as well as the appropriateness of the methodology, inputs and assumptions employed (refer to section 2.5 of Chapter 2);
    - Requirements for the corroboration of model outputs to other sources of information;
- For a CIS that may invest in other CIS, Fund of Funds, Feeder Funds or similar structures, practical considerations specific to the determination of the fair value of these instruments at each valuation point;

- Procedural steps and requirements governing the process of sourcing, assessing accuracy and selecting price and market data. Specific consideration should be afforded to techniques to be employed in assessing the adequacy of the use of broker quotes, counterparty valuations and other consensus pricing services for the purposes of determining the fair value of an instrument;

- Specification of a liquidity assessment framework, including relevant tools and techniques to be applied in determining the suitability of price or other market data quotes to be used for valuation purposes and actions required based on conclusions reached;

- The process for effecting a change to valuation methodology applied to an instrument valuation and in what circumstances this is appropriate (for example, upon delisting of an exchange-traded instrument, where an alternative model is deemed more appropriate or in stressed market conditions);

- Appropriate processes and review procedures for instruments traded by the CIS that have not yet been incorporated in the valuation policy (including the steps to be taken to ensure the timely update of the valuation policy);

- Establish and consistently apply a policy for identifying and incorporating events that might affect fair value measurements (e.g. announcements, brokered transactions etc.)

- Policy with respect to changes to pricing providers, pricing sources or sources of valuation information, including backtesting and stress testing of the impact of using an alternative pricing source and the required change approval process;

- For instruments valued by an independent valuation expert or verifier, the steps to be followed in reviewing the methodology employed and conclusions reached as well as corroborating the valuation results;

- Reporting requirements relating to valuation or operational matters, including valuation results and exception reports (content, nature, frequency and distribution of reporting).

FAIR VALUE HIERARCHY

The concept of a fair value hierarchy may be considered for inclusion in the valuation policy as a risk categorisation tool. This may assist the CIS manager in ensuring that the review and investigation procedures applied are appropriately tailored based on the subjectivity, risk or complexity of instrument valuations. Reference may be made to the fair value hierarchy defined in IFRS for guidance.

Based on the above, the valuation policy may outline the steps to be taken in consistently classifying each instrument valuation in accordance with the fair value hierarchy.

- Outline of the categorisation framework and basis for allocation. It is generally considered best practice to apply a categorisation framework consistent with the reporting basis used in the financial statements (refer to section 3.2 of Chapter 3). A key classification determinant is the significance of inputs used in the calculation of fair value – the valuation policy should therefore provide clear guidelines for identifying which inputs are significant to an instrument valuation;

- Policy in respect of any movements between levels or categories, including the parties responsible for approving such movements;

- If applicable, guidance on how frequently complex, illiquid instruments (e.g. Level 3 instruments and / or side-pocket) should be formally valued by an independent valuation expert, verifier or otherwise, framed in the context of the frequency of the NAV calculation;

- Protocol for level or category overrides (including relevant review and escalation procedures).

REVIEW PROCEDURES

This section sets out the policies and procedures to ensure the NAV calculation and NAV pricing is accurate and performed consistently in accordance with the valuation policy (i.e. prevention or detection of pricing or valuation errors prior to the publication of NAV). It is important that review procedures, commensurate with the nature and complexity of the instruments included in the CIS portfolio, are designed, documented and assigned to suitably skilled and independent senior individuals within the CIS manager. The involvement of a valuation committee, where relevant, can be used to support the review of particularly subjective instrument valuations.

- Timing, content and format of material or reports to be used by assigned reviewers in performing their review duties;

- Nature, frequency and responsibility for the performance of specified review activities aimed at assessing the accuracy and reasonability of CIS portfolio instrument valuations and NAV pricing calculations.

  It is suggested that the valuation policy should outline the required review processes to be performed over the fair value determined for each instrument, from the input data sourced to the application of the specified valuation technique (e.g. corroboration of price or market data between sources, assessment of valuation results for reasonability against observable market data, comparison of valuation outcomes from multiple valuation techniques, testing mathematical accuracy of valuation models and interrogation of daily price movements).

  The valuation policy may additionally dictate the relevant documentation, sign-off and escalation procedures in evidencing the performance of the specified review processes;

- Guidelines for the identification of material differences, appropriate escalation channels and reporting requirements. Special review considerations may be afforded to complex or otherwise subjective instrument valuations (e.g. involvement of an independent valuation expert or assignment to the valuation committee for review, where relevant);

- Specification of additional procedures and testing required when instrument valuations are the subject of large price movements between valuation points;

- Procedures for quantifying and assessing differences in price or market data between sources of input data (including accepted tolerance levels for any differences noted);

- Procedures for quantifying and assessing differences between sources of instrument valuations (these may be quoted price sources or outputs from valuation models), both at an individual position level and at an overall portfolio level);

- Procedures for backtesting;

- In instances of substantial involvement by the CIS investment function in the valuation of instruments, the establishment of suitable independent checks to assess the reasonability of the valuation result for NAV calculation purposes and to address any actual or perceived conflicts of interest;

- If relevant, activities of the valuation committee (refer to section 2.3.3 of Chapter 2) in the review process.

DEALING WITH EXCEPTIONS

This section focuses on the relevant responses required to ensure that any exceptions arising from the review procedures performed (described above) are appropriately escalated and addressed.

- Escalation and resolution procedure for exceptions identified. These may include breaches of tolerance levels, instrument values not validated in accordance with the valuation policy, use of stale prices and disagreements on valuation outcomes. The procedures should clearly define the requirements for implementing a price override (described below), as required;

- The controls implemented to identify inaccurate vendor-sourced prices and market data as well as the mechanisms and process by which price challenges are required to be made and resolved (including the individuals responsible for this function).

PRICE OVERRIDES (INCLUDING VALUATION ADJUSTMENTS)

Where the application of the valuation policy results in a valuation outcome for an instrument that is not considered representative of fair value, detailed interrogation of the difference noted and the development of suitable responses, subject to detailed review and approval, are required.

- Description of clear guidelines to be used in the identification of circumstances when an instrument value determined in accordance with the valuation policy is not considered to be representative of 'fair value' (for example, in the case of stale prices, low trading volumes and other liquidity constraints);

- In instances where an instrument value is not considered to be representative of 'fair value', the process to be followed and considerations required in determining the appropriate method of quantifying the fair value of the instrument at the valuation point, including relevant review, approval and documentation requirements;

- Review, approval and sign-off requirements for implementing a price override prior to inclusion of the fair value of an instrument in the portfolio NAV calculation (including the relevant supporting documentation requirements to be developed and retained). (Where relevant, the review and approval by the valuation committee of price overrides should be specifically detailed including meeting quorum requirements and protocols for minute-taking);

- Definition of materiality in the context of the CIS (for the purpose of assessing pricing errors – refer to section 2.14 of Chapter 2).

PRICING ERRORS

Where a valuation or pricing error is identified subsequent to the publication of the NAV, the CIS should have a clearly established process for addressing the error and ensuring that investors are not prejudiced.

- Definition of escalation channels including the individuals responsible for investigating the nature and source of the error, assessing the quantitative impact of the error and ensuring the timely communication with the Authority;

- Form, timing and nature of disclosure to investors;

- Method and review of the quantification of any required compensation to investors.

DELEGATION ARRANGEMENTS (INCLUDES ANY THIRD PARTY SERVICE PROVIDER)

Where the CIS engages a third party to perform any activity relevant to the valuation process (including reviews by an independent valuation expert or the performance of the NAV calculation by a valuation service provider), suitable controls and assessment mechanisms are required over the work performed by the third party ensuring its suitability for the required purpose.

- Determination of instrument valuations that may require consultation with an independent valuation expert or verifier, due to their complexity or subjectivity, including the frequency of review (for example, upon delisting of an instrument or due to the disappearance of a market for an instrument);

- Procedures to be followed in the monitoring of the performance of a delegated person, in particular interrogation and analysis of the appropriateness and accuracy of the data provided or work performed and conclusions reached;

- Controls over the transmission and protection of data, including testing system compatibility where required;

- Procedures for the periodic due diligence and monitoring of performance (unless included as part of the manager's delegation policy).

VALUATION POLICY UPDATES

In light of a constantly changing economic landscape and evolving valuation practices, the valuation policy should be subject to frequent review and update, approved by the manager's board of directors. In addition, where the CIS contemplates investing in a new instrument type, the valuation policy is required to be adequately updated to address all relevant aspects related to the fair valuation of the instrument at each valuation point.

- Frequency and process to be followed in the periodic review of the valuation policy to ensure its continued relevance given changing market dynamics and in order to minimise instances of deviations from the policy (including directions for the required approval by the manager's board of directors);

- Process for formulating policies in response to portfolio or other market changes (for example, when a portfolio starts to trade a new instrument type or due to a change in market practice). Changes to the valuation policy should be preceded by changes in the valuation and subject to approval by the manager's board of directors. Where this is not possible, the valuation policy should include suitable contingency measures to ensure the valuation of instruments in accordance with relevant fair value measurement principles (subject to appropriate senior review procedures), until such time as the valuation policy is updated.

SIDE-POCKETING

Where relevant to the CIS, the practice of side-pocketing may be addressed as part of the valuation policy and subjected to strict control and ongoing review in order to avoid inappropriate abuse of the mechanism. It is also critical that appropriate communication requirements with investors are considered, in order to promote transparency in the activities of the CIS.

- If applicable, clear description of the process and procedures around the valuation of side-pockets, consistent with the trust deed.

OTHER ITEMS

- Where the valuation policy requires the escalation of any matter (e.g. exception, error, challenge), consideration should be afforded to providing practical guidance regarding the protocol for resolution as part of the valuation policy (e.g. where issues are escalated to a valuation committee, what are the requirements for a quorum and support levels for a decision);

- For completeness, consideration may be given to the inclusion in the valuation policy (or a separate document) of processes and guidance relating to the following items dealt within the scope of the Conduct Standard (but beyond the scope of this Guideline):
    - The recording of income received or accrued to the portfolio (including the treatment of premiums or discounts);
    - The recording of expenses paid or accrued by the portfolio;
    - Monitoring the number of participatory interests held by investors;
    - The allocation of proportionate values to participatory interests;
    - Calculating and processing of distributions from the portfolio to investors;
    - Details of method of recording any breaches in the application of the valuation policy and / or the Conduct Standard;
    - Timetables and agreed method of NAV reporting;

- Responsibilities for the preparation of suitable disclosure to be provided to investors regarding the valuation process and methodologies underpinning the NAV calculation and NAV pricing. This disclosure may be provided as part of the preparation of financial statements, performance reports provided to investors or other marketing material (including material provided to an investor upon initial investment in a CIS);

In terms of paragraph 2 of the Conduct Standard, where the Conduct Standard is silent on a matter related to the valuation of instruments in a portfolio and determining the NAV price of a participatory interest, a manager must implement alternative solutions which are consistent with the principles of the CISCA and the Conduct Standard, as agreed with the trustee and documented in the valuation policy.

APPENDIX 2: VALUATION FUNDAMENTALS

2.1 INTRODUCTION

In the absence of a quoted price in an active market for an instrument, or in the case where the instrument is illiquid, the use of suitable, alternative valuation techniques requires consideration. This chapter introduces modelling concepts that are referred to throughout the Guideline, and summarises some of the key considerations in identifying and developing appropriate valuation model input information in the determination of the fair value of an instrument.

There is a vast body of established pricing theory and principles that are generally applied by the market. We will provide some of the fundamental principles and concepts in this section. We will also provide details of theoretical concepts in certain instances. These are not meant to be completely rigorous, and should not deter the reader from the broader ideas.

2.2 VALUATION FUNDAMENTALS

2.2.1 ARBITRAGE FREE PRICING

One of the cornerstones of derivative pricing is the law of one price, i.e. in the absence of transaction costs, financial instruments have a single price, irrespective of where the instrument is traded. This is based on the idea that if identical instruments have different prices an arbitrage opportunity exists, and that this opportunity will be exploited by market participants (to generate a riskless profit) causing the price to converge.

The fundamental theorem of instrument pricing gives conditions that must be satisfied for markets to be arbitrage free, most notably that markets have to be complete. A market is considered to be complete if all contingent claims can be replicated using existing instruments. A contingent claim is another term used to describe the pay-out of a derivative that is a function of uncertain future events.

Most pricing models assume the market is arbitrage free, and the bulk of financial mathematical literature is based on this assumption. We note that this is often not the case, for example due to transaction and funding costs. In certain instances a valuation adjustment is made to the risk-neutral price of derivatives in order to incorporate aspects like counterparty credit and funding risk.

The principle of no arbitrage implies the so-called law of one price, i.e. that an expected pay-out has a single price, or differently stated, if two investments have exactly the same future cash flows, then they have the same price.

Throughout this Guideline, we will assume arbitrage free markets and will use the risk-neutral pricing framework (as described in the next section) for the calculation of fair values, except where otherwise noted.

2.2.2 RISK-NEUTRAL FRAMEWORK

In the real world, the expected prices of instruments are a function of their level of risk. This poses a challenge when calculating the price of a contingent claim, for example a derivative on an instrument, as one needs to determine the distribution of prices, for each possible future value of the instrument and the probability of the price equalling that value.

Fortunately, under the fundamental theorem of instrument pricing, if a market is complete then a so-called risk-neutral measure exists which can be used for pricing, irrespective of the real-world expectation of instrument prices. In the risk-neutral framework the price of a derivative can be calculated by calculating the expected value of its future cash flows (under the risk-neutral measure) and discounting these to obtain a present value. In this framework all instruments have the same expected rate of return, the risk-free rate. The discount rate used in the valuation is exactly this risk-free rate.

In the no-arbitrage risk-neutral framework, the value of a contingent claim that pays $V(T)$, at time t_0 is given by:

$$V(t_0) = \beta(t_0)\mathbb{E}^{\mathbb{Q}}\left[\frac{V(T)}{\beta(T)}\middle|\mathcal{F}_t\right],$$

where $\beta(t)$ is the numeraire, $\mathbb{E}^{\mathbb{Q}}[\cdot]$ is the expectation of the pay-off under the risk-neutral measure $\mathbb{Q}$, and $\mathcal{F}_t$ is a filtration. Diving into the technical details of this formula is beyond the scope of this Guideline, but recognising that the present value is a function of a probability distribution is important. The reader is referred to Bjork [2009] for more information. In the sections that follow we are concerned with the case where the numeraire is the money-market account, and will re-write this equation as

$$V(t_0) = \mathrm{df}(t_0, T)\mathbb{E}[V(T)],$$

i.e. the price is given by the discounted expectation of the pay-off. The discount factor is $\mathrm{df}(t_0, T)$, and the expectation can be thought of as the average pay-off (assuming a certain distribution of instrument prices / returns).

We can use this formula to describe the valuation process:

1. Calculate the expected future cash flows;

2. Determine an appropriate discount curve; and

3. Compute the present value of the cash flows (as estimated in 1.) by discounting the cash flows using the discount curve.

We will consider the steps in the valuation process in the sections that follow, and will use these concepts throughout the guideline.

2.2.3 INTRODUCTION TO PRICING

For instruments with no optionality, e.g. forwards. futures and swaps, the valuations are performed in line with the aforementioned points. For example, for a fixed-for-floating interest rate swap:

1. To calculate the expected future cash flows for the floating leg we need to calculate the expected value of the reference rate, e.g. LIBOR or JIBAR, which corresponds to each cash flow. This is done by interpolating the values off a forecasting curve. Forecasting curves are discussed in section 2.4.2 of this appendix;

2. A risk-free discount curve is generally used for discounting each of the future cash flows, both fixed and floating. An alternative discount curve might be more relevant when taking collateralisation into account. For example, if the trade is uncollateralised an appropriate funding curve can be considered; doing this effectively incorporates a funding value adjustment (FVA) in the valuation. Alternatively, if the derivative is collateralised (under a Credit Support Annex), then the curve corresponding to the collateral currency (and collateral interest rate) is the relevant curve to use; and

3. The present value of each cash flow is computed by discounting the expected future cash flows using the discount curve. The present value of is calculated by adding the present value of each cash flow.

The valuation of forwards, futures, swaps and other derivatives will be expanded on in Appendix 4.

2.2.4 INTRODUCTION TO OPTION PRICING

An option is a function of an uncertain event in the future (e.g. for a vanilla European call option, whether the spot price is above the strike at expiry) and as such represents a contingent claim.

We will start off by introducing options and then go on to describe how options are valued using financial valuation models under the principle of no arbitrage. These models do not only offer a theoretical framework but are generally sufficiently accurate in practice.

As opposed to forward contracts or swaps, which have linear pay-offs in the underlying asset, options have non-linear pay-offs. For example, for a vanilla European put option with strike K, expiry T, the pay-off as a function of the terminal value of spot S_T is given by

$$(K - S_T)^+ = \begin{cases} K - S_T, & \text{if } S_T < K \\ 0, & \text{otherwise} \end{cases}$$

So the pay-off is non-linear at the point $S_T = K$. The pay-off is graphically depicted in Figure 1.

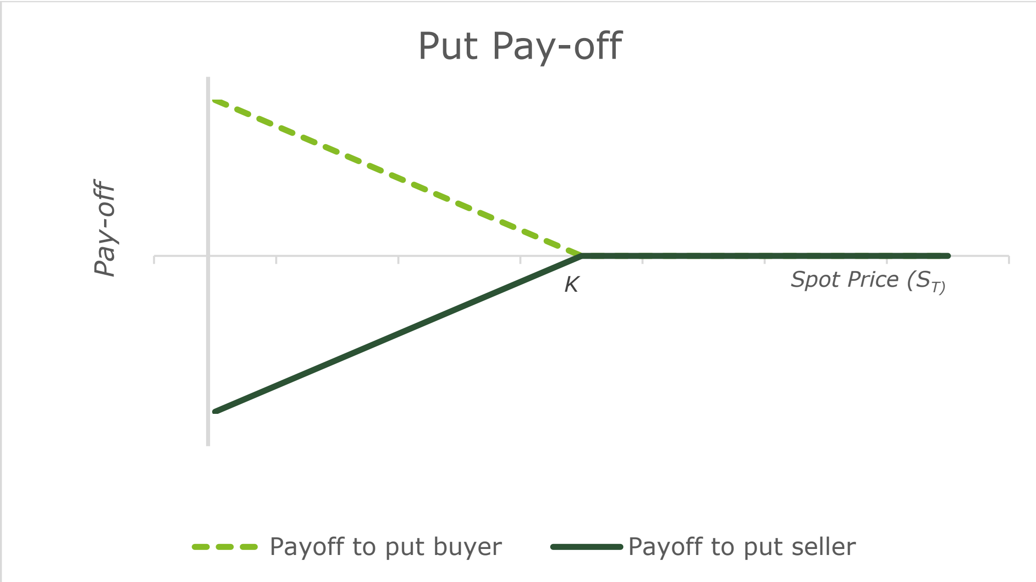


Figure 1 - European put option pay-off at expiry

From a pricing point of view we would like to calculate the discounted expectation of the pay-off, i.e. the price of the option at time t_0 is given by

$$V(t_0) = \mathrm{df}(t, T)\mathbb{E}[(K - S_T)^+],$$

here $\mathbb{E}[(K - S_T)^+]$ is the expected value of the option pay-off. As previously described, in order to calculate this expected value, we need to have a probability distribution for the underlying; this distribution is mainly characterised by the volatility of the underlying. The assumed distribution for the underlying (or returns of the underlying) is of key importance in option pricing. There is no single correct choice of distribution and different models imply different distributions.

Black and Scholes showed that under a certain set of assumptions it is possible to perfectly hedge a vanilla European option by holding positions in the stock and a money market account, thus rendering the portfolio (consisting of the option and hedges) insensitive to movements in the stock price, and so it is risk-neutral. In this special case a closed-form solution exists for calculating the price of the option. This model is known as the Black-Scholes model, and will be discussed in section 2.2.6 of this appendix.

For options with American or Bermudan exercise, or even for options that have European exercise but are path-dependent (i.e. where the pay-off is a function of market observables prior to the exercise date, for example an Asian Average Price Option), closed-form solutions like Black-Scholes do not exist. In such cases one has to resort to another approach, like Monte Carlo, in which an underlying (instrument price or interest rate) is simulated and the fair value is calculated as the expected (i.e. average) pay-off of the simulated scenarios, discounted back to the valuation date. The simulation requires a stochastic model to be specified for the underlying. We discuss stochastic models and Monte Carlo methods in sections 4.2.4 and 4.2.5, respectively.

Binomial option pricing models are also employed to value options with various nuances. They are often used as an introduction to financial modelling as they are based in a discrete time setting, and are easier to describe and to implement. Binomial models have their shortcomings and are generally used to a limited extent in practice. We defer the discussion of Binomial models to section 4.2.6.

2.2.5 STOCHASTIC MODELS

We can think of instrument prices as following a random walk, i.e. at any point in time we can think of the movement of the price (over some future time interval) to be random. The efficient market hypothesis supports this by asserting that all historic information that pertains to an instrument is reflected in the prevailing market price.

Technically a random walk describes the movement of the price of an instrument over equally spaced time periods as having the same probability distribution. When considering random walks in a continuous-time setting we can describe changes in the instrument price over an infinitesimally small period of time; this is useful as there is a significant body of mathematics that can then be employed for modelling purposes. We refer to such models as stochastic models (or processes). The reader is referred to Shreve [2010] for more information on stochastic calculus, the field that encompasses stochastic modelling.

There are a wide array of stochastic models that can be used to describe the dynamics of different instruments. The choice of these models is informed by the instrument class of the underlying, the type of behaviour that is associated with the change of instrument prices, and the complexity of the derivative to be priced. These processes are described using a stochastic differential equation (SDE). We provide a concrete example which is commonly employed without attempting to explain all the technical detail; for the lognormal assumption used in Black-Scholes, the process is called a Geometric Brownian Motion (GBM), and its SDE is given by:

$$dS_t = rS_t dt + \sigma S_t dW_t.$$

This equation describes the change in the underlying over an infinitesimally small change in time, and has the following components:

1. dS_t, which describes a change in the spot price S_t;
2. $rS_t dt$ is the drift component, with r being the risk-free rate; and
3. $\sigma S_t dW_t$ is the noise component, with σ the volatility, and dW_t providing the randomness.

When modelling such a process, it is necessary to change the equation for the infinitesimal change into something that can be used to simulate the underlying. In the case of GBM, we can use an analytical formula to describe the change of the price over a time interval of size Δt, namely

$$S_{t+\Delta t} = S_{\mathrm{t}} e^{(r-\frac{\sigma^2}{2})\Delta t + Z_e \sigma \sqrt{\Delta t}},$$

with Z_t being a standard random normal variable.

It is useful to illustrate the evolution of a stock price under GBM using a (Monte Carlo) simulation. We will discuss Monte Carlo simulations later but we provide an illustration of some paths generated of a stock price using initial stock price $S_0 = 100$, volatility $\sigma = 20\%$, and risk-free rate $r = 5\%$ in Figure 1.

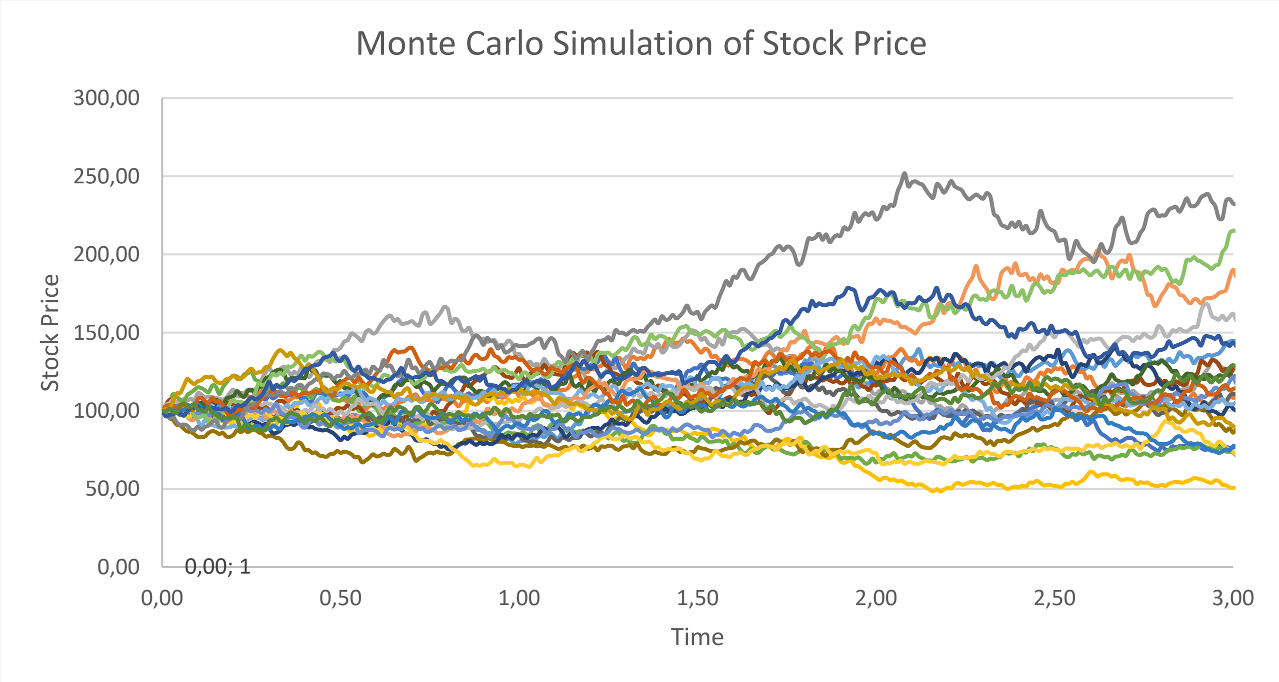


Figure 2- Monte Carlo Simulation of Stock Price

If we perform the simulation using a large number of simulations we can look at the distribution of the terminal spot price, i.e. the spot price at 3-years. We illustrate the distribution by using a histogram which places the terminal spot prices into buckets, and provides the frequency of prices in each bucket. This histogram should resemble the distribution that corresponds to the stochastic model, i.e. the log-normal distribution in the case of GBM. In Figure 2 we provide the distribution of terminal stock prices when using a simulation consisting of 10,000 paths.

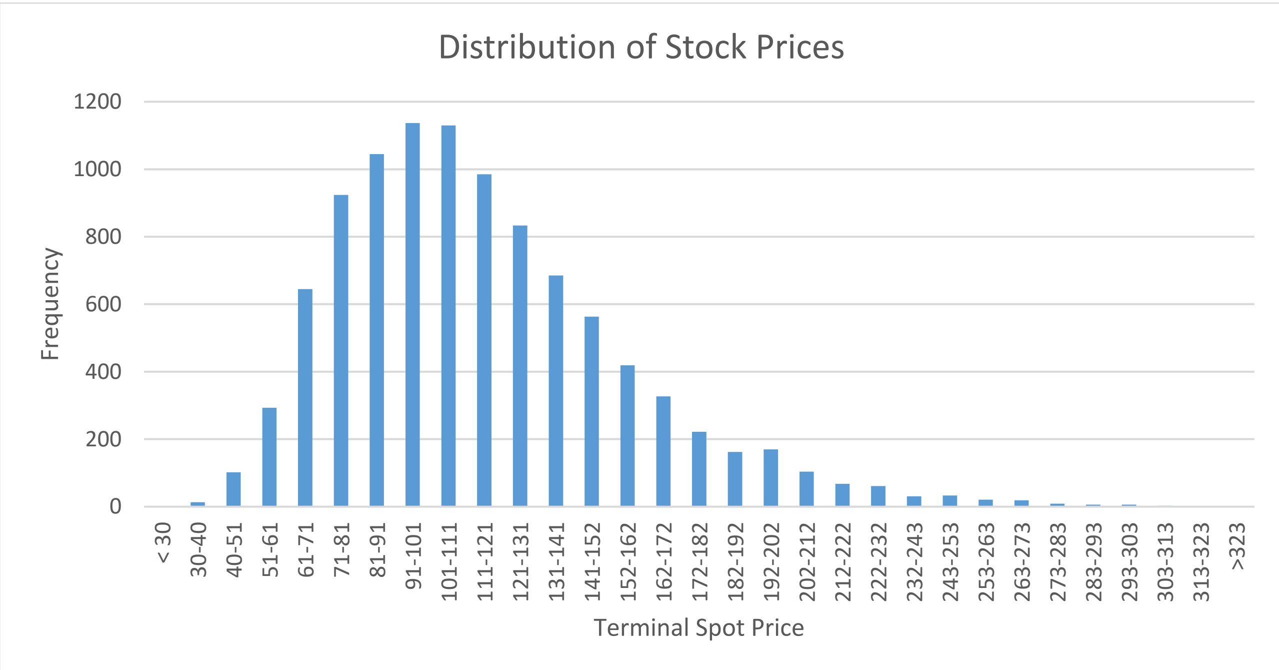


Figure 3 - Distribution of Stock Prices

With regard to the use of GBM, and other stochastic models, for pricing it is important that the model parameters (e.g. the risk-free rate and volatility) are calibrated such that the model reprices instruments with observable quotes. The risk-free rate is, however, not constant, and neither is volatility (which is variable in both the time to expiry, and in strike).

Some examples of stochastic models with different features that are often used in practice include:

i) The Hull-White model, which describes the evolution of an interest rate as a mean-reverting process;

ii) The Heston model, often used for modelling equities, includes stochastic volatility (i.e. there is both a stochastic process for the spot price and the volatility); and

iii) The Merton model, which includes a jump component.

2.2.6 BLACK-SCHOLES MODEL

The Black-Scholes model (also known as the Black-Scholes-Merton model) is widely used for pricing vanilla European options. The model is based on a market which consists of a risky instrument and a money market account. Black and Scholes showed that under a number of assumptions on the instruments and the market, an analytical formula can be derived for valuing European vanilla options. We will discuss the assumptions that underlie the model before going on to the Black-Scholes formula and other considerations.

We discuss the model assumptions using a European vanilla option on a stock as an example:

1. The stock follows a Geometric Brownian motion (GBM), which implies that the returns follow a log-normal distribution. There are a number of implications of this assumptions, notably:

    a. It is readily observed that stock returns are in fact not log-normal and have fatter tails implied by the distribution (i.e. the returns are more likely to deviate significantly from the mean than implied by the model);

    b. The volatility of the distribution is constant, and is not a function of time-to-expiry or strike of the option, contrary to what is observed in market prices of options; and

    c. Stock prices move continuously, and that there are no jumps in the market;

2. There is a constant rate of return that can be achieved in the money market account, and this is risk-free. Any amount can be borrowed or lent from this account. In practice, no investment is risk-free;

3. There are no arbitrage opportunities in the market. Most derivative pricing theory is built upon this assumptions, but arbitrage opportunities do occur in the market;

4. The stock is sufficiently liquid so that any amount can be purchased or short-sold. This is generally not the case, especially in emerging markets;

5. The market is frictionless, i.e. any transactions in the stock or money market account do not incur costs, and there are no taxes;

6. The stock does not pay a dividend, although the model has been extended to include dividends as we will discuss later; and

7. There is no risk of default between the buyer and seller of the option, i.e. no counterparty risk. This can be rectified by introducing a Counterparty Value Adjustment (CVA), same as for other derivatives.

Black and Scholes showed that under the above assumptions the Black-Scholes equation (a partial differential equation for the price evolution of European options), can be solved to price European call and put options using the following formulae:

$$V_c = S\Phi(d_1) - e^{-rT}K\Phi(d_2)$$

and

$$V_p = e^{-rT}K\Phi(-d_2) - S\Phi(-d_1)$$

where

$d_1 = \frac{\ln(S/_K) + \left(r + \sigma^2/_2\right)T}{\sigma\sqrt{T}}$,

$d_2 = d_1 - \sigma\sqrt{T}$,

T is the time to expiry of the option,

r is the risk-free rate;

S is the underlying spot price,

K is the strike price,

$\Phi(x)$ is the standard normal cumulative distribution function,

V_c is the price of the call option,

V_p is the price of the put option.

Although the Black-Scholes formula might appear complex, it has straight forward interpretations that are intuitive in the financial context. The model outputs the present value of the expected payoff of an option at maturity. The first term of the formula $S\Phi(d_1)$ represents a holding of $\Delta = \Phi(d_1)$ in the stock (referred to as the delta of the option) and the second term, $e^{-rT}K\Phi(d_2)$ represents the financing component, i.e. the holding in the money market account. This interpretation directly speaks to the hedging of the option as holdings of the stock and money market account, referred to as a replicating portfolio. The price of the option is such that if the option is continuously hedged (by re-balancing the replicating portfolio) through the life of the option, then the profit & loss on the option is equal to the price of the option plus the profit & loss on the hedges.

Although a number of model assumptions are not reasonable in practice the model has been extended to cater for some of these; for example, to include dividends and to include a term structure of (deterministic) interest rates and volatilities. In practice, volatilities exhibit skew / smile, i.e. for the same expiry options with different strikes have different volatilities. This is handled by constructing a volatility surface for pricing options. We will discuss skew / smile in the Black-Scholes framework in section 2.5 in this appendix on volatility surfaces.

There are straight forward extensions to the model that can be used for pricing options on different instrument classes, e.g. Garman-Kohlhagen for FX options, and the Black-76 model for pricing bond options and swaptions.

For options with American or Bermudan exercise, or even for options that have European exercise but are path-dependent (e.g. Asian options), the Black-Scholes formula is not appropriate. In such cases one has to resort to other approaches, as previously discussed.

The Black-Scholes model remains widely in use. This is largely due to the ease of implementation and the intuitive financial interpretation of the model.

2.2.7 MONTE CARLO METHODS

Monte Carlo methods have become widely used in finance for a range of applications. This is largely due to the flexibility that Monte Carlo methods over alternative approaches. One is able to incorporate path-dependency and early exercise with relative ease, and also to separate the pay-out of derivative (and the calculation of its fair value / risk metrics) from the dynamics (as given by a Stochastic Model) of the instrument. This means that different models can be used for valuing the same derivative; this is a desirable feature for pricing of exotic derivatives or xVAs (e.g. CVA or DVA) where the price is model dependent. We will introduce xVAs in section 2.8 of this appendix.

A Monte Carlo method is a simulation-based method used to estimate the expected value of a given random variable (e.g. a stock price) or function of the underlying variable, like the pay-off of an option on a stock. For derivative valuations, the method consists of simulating a large number of scenarios (paths) of the underlying using a stochastic model, and calculating the fair value of the derivative as the discounted expectation of the pay-off. The stochastic model is calibrated to market observables, i.e. when calculating the prices of vanilla instruments (e.g. forwards and vanilla options) from the stochastic model then the prices agree to the observed market prices. By accurately calibrating the model and using the risk-free curve for discounting one is in the risk-neutral framework, as desired.

The application of the method is based on two statistical premises, namely, the Law of Large Numbers and the Central Limit Theorem. In simple terms, the former states that the greater the size of a random sample, the closer the sample mean is to the true population mean. On the other hand, the Central Limit Theorem states that as the sample size increases, the distribution of a sample mean approaches (in probability) to a normal distribution. In unison, the two ideas allow one to calculate an estimate of the expected value of an underlying random variable by calculating the sample mean across the selected sample, while also assessing the convergence of the calculated sample mean to the true underlying mean.

As previously stated, Monte Carlo methods can be used for the pricing of a multitude of options. The method can handle the pricing of European options where the option payoff is dependent only on the value of the underlying variable as at the maturity date, but also where the ultimate payoff is dependent on the path of the underlying over the life of the option. Monte Carlo methods are also particularly useful in the pricing of American options. The least-squares Monte Carlo method of Longstaff and Schwartz [2001] is a simple algorithm used in the valuation of American options, and is a powerful alternative to the binomial option pricing model described below.

In order to implement Monte Carlo methods to adequately value derivatives one needs to have intricate knowledge of Stochastic Calculus. Depending on the complexity of the derivative, the type of dynamics that are to be modelled, and the dimension of the problem, knowledge of various branches of Mathematics and Statistics are needed. These models should thus be implemented by teams who have sufficient experience in Quantitative Finance.

The reader is referred to Glasserman [2003], who provides a comprehensive treatise of Monte Carlo methods in Finance.

2.2.8 BINOMIAL OPTION PRICING MODEL

The binomial option pricing model is a simulation-based option pricing model which is most frequently used in the pricing of Bermudan and American options, but can also be used for the pricing of path-dependent European options in which the final payoff depends on the values of the underlying variable between the valuation date and the maturity date.

Binomial models are generally easier to understand than Monte Carlo methods since they are more algorithmic in approach, and also knowledge of Stochastic Calculus is not required to understand or implement a Binomial Model. They are also more efficient than Monte Carlo methods from a computational point of view. Where calculation time / computational power is a constraint then these methods become attractive. On the downside they are less versatile than Monte Carlo methods, and can be challenging to calibrate depending on the type of derivative to be priced.

The model can be describe by a sequence of steps. We describe these steps below, using equity options as examples, although the model can be used for other instrument classes as well.

1. Create the tree

Starting from the valuation date, create a number of time steps to the maturity of the option. These time steps are the nodes of the tree. Generally the nodes are chosen such that the time interval between consecutive nodes are of equal size. In the case of American or Bermudan style options, the nodes often represent the times at which an option exercise decision can be made.

2. Simulate underlying variable

The underlying variable (share price in our example) are simulated as at each node. There are two possible values of the underlying variable at each node, hence the name "binomial" option pricing model. Assuming a share price S, at a given node date, we calculate the value at the next two nodes as $S_u = uS$ (the "up" node), and $S_d = dS$ (the "down" node). The up and down factors are often calculated using the technique established by Cox, Ross and Rubinstein [1979]. Various other techniques are considered in practice, depending on the instrument class and type of derivative to be priced.

We apply this process for all nodes in the tree, starting from the node at the valuation date. We display this diagrammatically for a two-step tree in Figure 4.

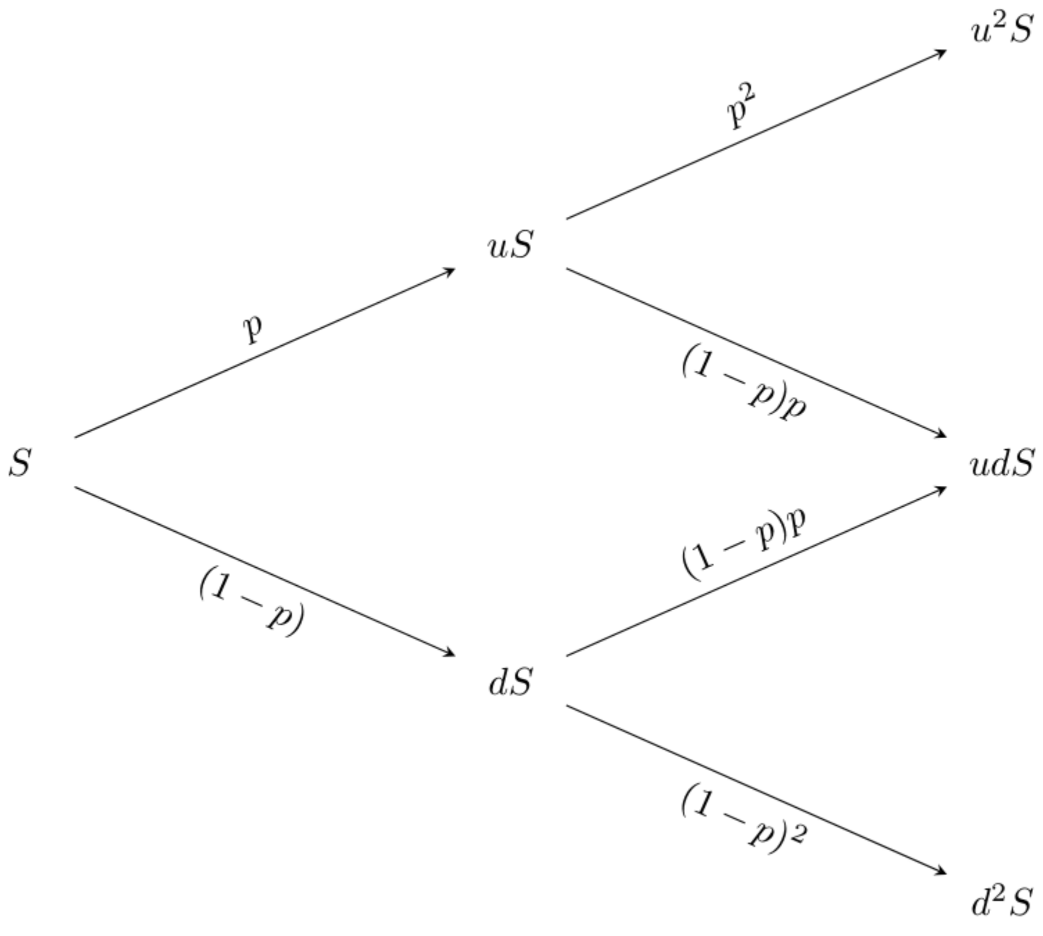


Figure 4 - Binomial Model: Stock Price Evolution

3. Calculate option pay-off

At the maturity date of the option we evaluate the pay-off under all scenarios, i.e. at each of the leaves (final node dates of the tree) of the tree we calculate the pay-off. For a vanilla call option with strike K, we would calculate $(S^{(i)} - K)^+ = \max\{S^{(i)} - K, 0\}$, for each final share price $S^{(i)}$ of the tree.

4. Calculate option value at earlier nodes

Ultimately we want to calculate the option value at the valuation date. In order to do so we calculate the option value at each of the prior node dates, starting at the end of the tree.

In the risk-neutral framework we can calculate the value of the option, C, at a node as the discounted expectation of the values (of the subsequent up and down nodes), i.e.

$$C = e^{-rt}(pC_u + (1-p)C_d),$$

where r is the risk-free rate, p is the probability of the share price going up from S to S_u, and C_u and C_d is the value of the subsequent up and down nodes. The probability is a risk-neutral probability (and does not correspond to the actual probability of the share price going up). In the equity example that we are giving, one could calculate the probability to correspond to a Geometric Brownian Motion as follows:

$$p = \frac{e^{(r-q)t} - d}{u - d},$$

where q is the dividend yield of the share. As described, we would apply this formula starting at the back of the tree, moving backwards through all nodes, until we get back to the valuation date.

We note that in the case where we are assuming that the share price follows a Geometric Brownian Motion, the price of a vanilla European option priced using a binomial model will converge (when using very small time steps) to the price given by the Black-Scholes formula. This will also agree to the price computed by a Monte Carlo process (if a large number of paths are used).

Steps 3 and 4 are illustrated in Figure 5.

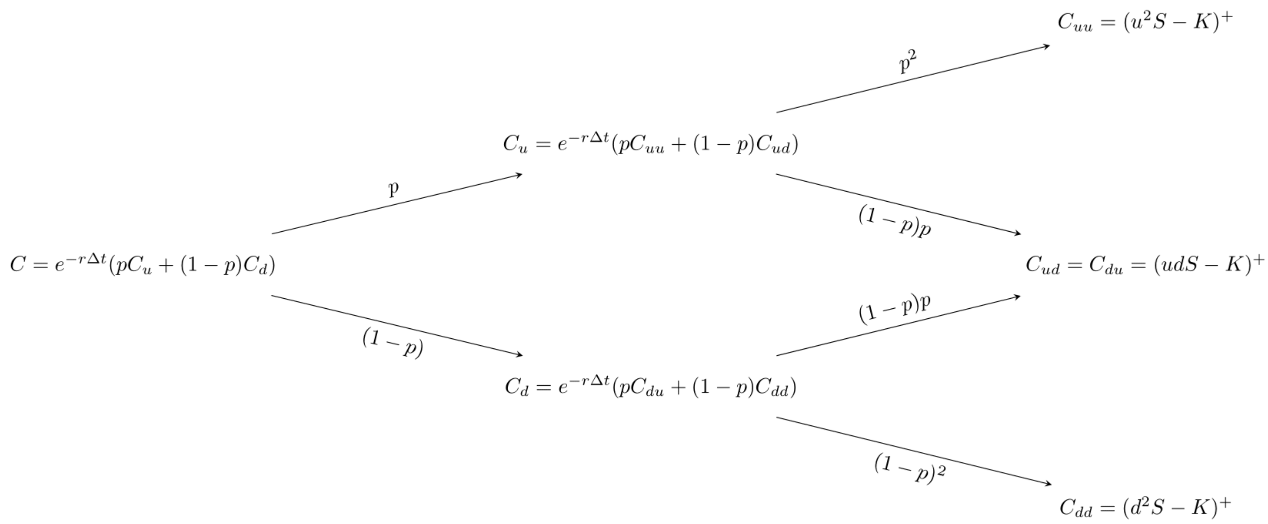


Figure 5 - Binomial Model: Calculation of Call Option Price

2.3 MARKET DATA

The models used for valuations should make use of inputs reflecting observable prices as far as possible in order to ensure consistent pricing and to reduce model uncertainty. The principles for the determination of suitable inputs were discussed in section 3.5 of Chapter 3. Collectively, we refer to these inputs as market data. Example market data include interest rates, volatilities, and survival probabilities amongst others.

In this section we will discuss some of the most common market data used for pricing derivatives in various instrument classes. We start off by considering interest rates, and curves specifically, as these are used in all derivative valuations (at the very least for discounting future cash flows, contingent or otherwise).

We will spend most of the remainder of the chapter focusing on interest rate market data given the extent to which it is used.

2.4 INTEREST RATES

The valuation of all derivatives depend on interest rates. In order to calculate the present value of a future cash flow it needs to be discounted using a suitable interest rate that reflects the time value of money. Interest rates are not constant for different maturities (also referred to as tenors), e.g. if we make a deposit for a fixed term of 6-months we do not expect to generally receive the same interest on the deposit as if it were invested for 1-year. This is reflected by the term structure of rates.

An interest rate curve is used to reflect the term structure of rates. Curves consists of rates per date that are implied from traded market instruments, interpolation method(s) and potentially an extrapolation method. Curves are constructed such that they reprice the input instruments, but also provide rate expectations for dates (points on the curve) for which there are no observable quotes.

The use of curves in valuations are ubiquitous; they are used for determining discount factors, which are applied to cash flows to determine their present values, for calculating forward rates (representing the market expectations of an underlying rate) and for calculating survival probabilities, to name a few.

Curves are generally constructed via a process called bootstrapping, or alternatively by an optimization process which aims to construct the curve to satisfy various constraints. We will give a brief introduction to curve construction in section 4.3.1.4.

It is important to note that while curves are useful constructs for valuation purposes they are not observable in the market, and there is no consensus on the best way of constructing curves. This leads to differences in pricing of instruments that are not quoted in the market.

In the sections that follow, we will introduce some of the different types of curves that are used in evaluations, e.g. fixed-income instruments, interest rate derivatives and other instrument classes. These sections do not aim to be a comprehensive treatise on curves and their construction, but rather an introduction with some relevant information and citations to existing literature.

2.4.1 DISCOUNT CURVES

In order to measure the fair value of an instrument, a discount curve is constructed at the valuation point, which is then used for calculating the present values of the cash flows of the instrument.

As previously described, under the risk-neutral framework there is a unique risk-free rate that is used for discounting future cash flows. The curve that gives the market expectation of the risk-free rate is known as the risk-free curve and is generally the discount curve that is used for fair valuation. This curve will be discussed in section 2.4.3 of this appendix. Alternate curves used for discounting are funding curves and survival probability curves.

There is no universal consensus on the instruments that are to be used in the construction of any single discount curve. Judgement must be applied in the selection of inputs used in the construction of the discount curve. One would generally want to use as many traded instruments which rely on the underlying rate taking into account the liquidity of these instruments. It is necessary to ensure that the resultant curve is reflective of the risks and characteristics inherent in the instrument being valued at the valuation point.

2.4.2 FORECAST CURVES

A forecast curve is used for calculating the expected value of a reference rate at future dates. In the South African market, examples include curves for forecasting JIBAR (separate 3-month, 6-month and 1-year curves), CPI, and Prime. Although it might be possible to use a forecasting curve for discounting, the ZAR swap curve (referencing 3-month JIBAR curve), for example, is also used as a risk-free curve. However, forecast and discount curves should generally be thought of as distinct curves. Forecast curves used in valuations should correspond to the contractually specified reference rate.

2.4.3 RISK-FREE CURVES

In order to construct a risk-free curve it is necessary to establish what will be used for the risk-free rate, and then what are the traded market instruments that can be used to give the term structure of the risk-free rate to arrive at a risk-free curve.

The risk-free rate is the rate of return on a hypothetical investment that bears no financial risk (whether it be credit, liquidity or otherwise). It is important to note that there is no risk-free rate, and in practice there are only proxies. Various proxies are in use and each have their shortcomings, so the choice is not always obvious. The proxies most considered are:

i) The inter-bank lending rate in the market, e.g. USD LIBOR or ZAR JIBAR: this is probably based on the idea that banks have an implicit guarantee from central banks (being the lender of last resort). However, the merit of this argument should be considered against the events of the financial crisis of 2007. Curves that are constructed from instruments that reference the inter-bank lending rate are called swap curves;

ii) Government Bonds: based on the premise that Government debt is risk-free, especially on short-dated debt. However, empirically, it has been shown that Governments can, and do, default on both local and offshore debt;

iii) Overnight rates on central bank reserves: the rate at which depository institutions lend reserve balances to each other overnight; for example, the effective Federal Funds rate, which in the United States of America is the rate at which institutions lend reserves (that are held in the Federal Reserve) to each other, on an un-collateralised basis, to meet their respective reserve requirements. Curve constructed from instruments that reference overnight rates are called OIS curves; and

iv) Alternative reference rates
Interest rate benchmarks such as interbank offered rates play a key role in global financial markets and index trillions of dollars in financial products. However, as part of a reference rate reform, work is underway in multiple jurisdictions to transition to alternative risk free rates. Several reasons have driven this move. Systemic risk concerns have been raised due to instances of fraudulent submissions by banks and underlying markets not being sufficiently active for some of the interbank offered rates, together with the key reliance of financial transactions on these rates.

Against this background, the G20 asked the Financial Stability Board to undertake a fundamental review of major interest rate benchmarks. Following the review, the Financial Stability Board published a report setting out its recommendations to reform some major interest rate benchmarks such as interbank offered rates. As a result, alternative risk free rates have been selected in key currency jurisdictions by working groups, with the objective that such rates will be based on liquid underlying market transactions, and not dependent on submissions based on expert judgement. This will result in rates that are more reliable and provide a robust alternative for products and transactions that do not need to incorporate the credit risk premium embedded in the interbank offered rates. This has led to uncertainty about the long-term viability of some existing interest rate benchmarks.

The reference rate reform will have an impact on the selection of a risk-free rate for valuation purposes. This is an evolving space, and should be monitored for progress, but we note that in selecting a reference rate, due consideration should be afforded to the underlying nature and composition of the rate to ensure valuation assumptions remain valid and internally consistent. As a guide, IOSCO have issued a statement highlighting aspects to consider when using a financial benchmark (*IOSCO – Statement on Matters to Consider in the Use of Financial Benchmarks, 2018)*

There are various decisions that inform the choice of risk-free proxy off which to construct the risk-free curve, but notably there should be market instruments which are sufficiently liquid in order to construct a term structure of rates (refer to section 3.2 and section 3.5 of Chapter 3).

We note that as of the time of writing, in the South African market the swap curve is the one that is most often treated as risk-free, followed by the government bond curve.

Most developed markets employ Overnight Indexed Swaps ("OIS") that reference an overnight rate (secured / unsecured) and use curves that are constructed from these instruments. Theoretically these so-called OIS curves are the best proxy of risk-free curves; see Hull and White [2013] who shows that there is general consensus in developed markets regarding their use. Even in the lack of an active OIS market, certain proxy approaches are often used for constructing overnight based risk-free rates.

2.4.4 SWAP CURVE

INTRODUCTION

In the South African market the term swap curve is used for the curve which is constructed from instruments that reference 3-month JIBAR. Typical instruments include deposits (e.g., overnight, 1-month and 3-month) for the very short end of the curve; forward rate agreements (e.g. 3x6, 6x9, …, 21x24) for the short to mid end of the curve; and swaps (2-yr, 3-yr,etc.) for the long end of the curve. Swap curves are used for projecting forward rates of these instruments (for the reference rate of the instrument as defined the trade contract). These instruments generally contain an element of bank credit risk and as such, are not completely risk-free. However, in the South African market swap curves are generally assumed to be risk-free and are consequently used for both the discounting and forecasting of cash flows.

There are various swap curves that are published by data providers and regulatory authorities. Example sources/data providers include the JSE, Bloomberg, Reuters and large banks. These curves are constructed from different input instruments and using different interpolation and extrapolation methods, and as such will differ.

CURVE CONSTRUCTION

There is an extensive body of literature on curve construction, and it is beyond the scope of this Guideline to give a comprehensive treatise of the subject. In what follows, we give a brief introduction to the construction of a swap curve in the self-discounting framework, i.e. where the swap curve is used both for forecasting and discounting of cash flows, lending on the work of Hagan and West [2008], who give a good deal of information on curve construction and interpolation methods. The principles described below can be extended for constructing other curves, e.g. bond curves and inflation curves.

We wish to construct a curve $r(t)$, which gives the zero rates for given maturity dates. Assume we can observe the par rates $\{S_1, S_2, \dots, S_n\}$ of a set of swaps with given maturity dates $\{T_1, T_2, \dots, T_n\}$, where $T_{i-1} < T_i$.

The key property of any curve is that it must reprice all instruments that were used in the construction thereof. We must thus construct the swap curve $r(t)$ such that the forward rates and discount factors that are derived from it produces the observed par rates $\{S_1, S_2, \dots, S_n\}$.

In order to calculate the price of each swap we have to be able to calculate a zero rate for each of the cash flow dates of the swap, e.g. for a 1-year swap that pays quarterly we would need zero rates for 3-month, 6-month, 9-month and 1-year, and we can't generally observe all these rates. We thus need to employ a curve construction methodology that incorporates interpolation (we will not consider extrapolation here). The par rate S_n of a swap with maturity T_n, is given by

$$S_n = \frac{1 - \mathrm{df}_n}{\mathrm{PV01}_n},$$

where $\mathrm{PV01}_n = \sum_{i=1}^{n} \mathrm{df}_i \tau_i$ (i.e. the annuity factor of swap maturing at T_n), with $i = 1,2, \dots, n$ corresponding to the cash flow dates of the swap, df_i the discount factor (from the respective cash flow date to valuation date), τ_i the day count fraction from the accrual start to accrual end date.

As shown by Hagan and West [2008], we can rewrite the previous equation as:

$$r_n = -\frac{1}{T_n}\ln\left(\frac{1 - S_n \sum_{i=1}^{n-1} \mathrm{df}_i \tau_i}{1 + S_n \tau_n}\right) = -\frac{1}{T_n}\ln\left(\frac{1 - S_n \mathrm{PV01}_{n-1}}{1 + S_n \tau_n}\right),$$

i.e. for a given swap with maturity T_n, we write the zero rate $r_n = r(t_n)$ as a function of the swap rate S_n, and the rates (discount factors) at the previous node dates (all dates used for pricing the swap). We can use this to construct a curve with rates at all node dates (and any other dates) even if we can't observe the rates for these; this can be done using the following iterative algorithm:

1. Guess initial zero rates for each of the maturity dates of the swaps;
2. Interpolate these rates (using a desired interpolation scheme) to get a rate at each of the node dates;
3. Use the given formula to calculate a new estimate of each zero rate;
4. Calculate each of the swap rates from the new zero rates;
5. Calculate the difference between these and the observed swap rates, using the sum-squared error (SSE) for example; and
6. Repeat the above steps until the error is under some defined threshold.

We give an example of this algorithm where we have a curve consisting of a 1-year swap with a par rate of 7.25%, and a 2-year swap with a par rate of 7.50%, each having quarterly payments. We thus have node dates at 3-months, 6-months, 9-months, etc. We construct the curve as follows:

1. Guess initial NACC zero rates of 7.25% and 7.50% for the 1-year and 2-year zero rates respectively;
2. Interpolate the rates at each of the node dates; we use so-called raw interpolation in this example, interpolating linearly in log-discount factors;
3. Calculate the new estimate rates from the formula using a PV01 calculated from the interpolated rates (converted to discount factors) and day count fractions (which are 0.25 for quarterly node dates);
4. Proceed to calculate the new estimate swap rates, and differences to the observed swap rates.

The results of the above are shown in the following table (columns headers with numbers correspond to the numbered items in the above list):

t	Par Rate (Market)	1. Zero Rate Guess	2. $r(t)$ (Interp)	Discount Factor	PV01	3. Zero Rate New	4. Par Rate (Curve)	Diff
0.25			7.2500%	0.9820	0.2455			
0.50			7.2500%	0.9644	0.4866			
0.75			7.2500%	0.9471	0.7234			
1.00	7.2500%	7.2500%		0.9301	0.9559	7.1833%	7.3161%	0.0661 %
1.25			7.3500%	0.9122	1.1839			
1.50			7.4167%	0.8947	1.4076			
1.75			7.4643%	0.8775	1.6270			
2.00	7.5000%	7.5000%		0.8607	1.8422	7.4357%	7.5612%	0.0612 %
							SSE	8.12E-07

We repeat these steps by using the new estimate zero rates as the initial guess for each iteration. We can then solve for the zero rates by minimizing the SSE for different initial guesses using a numerical routine, e.g. by using Solver in Excel. The resultant zero curve obtained is as follows:

t	Zero Rate (Solved)	Par Rate (Market)	Par Rate (Curve)	Difference
0.25	7.1851%			
0.50	7.1851%			
0.75	7.1851%			
1.00	7.1851%	7.2500%	7.2500%	0.0000%
1.25	7.2871%			
1.50	7.3550%			
1.75	7.4036%			
2.00	7.4400%	7.5000%	7.5000%	0.0000%
			SSE	9.54E-14

PRACTICAL CONSIDERATIONS

As per explained above, using the same curve for forecasting and discounting is generally not appropriate. Consider the valuation of a USD swap referencing 3-month LIBOR. The correct approach is to use the 3-month LIBOR forecast curve for calculating the expected future cash flows, and to use the OIS curve for discounting the future cash flows to get a present value. This requires changes to the curve construction method described in the previous section. This is beyond the scope of this Guideline, but the reader is referred to the literature on multi-curve frameworks for more information, see Ametrano and Bianchetti [2013] for a comprehensive treatise.

2.4.5 BOND CURVE

A bond curve consists of bonds issued by a corporate or sovereign entity.

In South Africa the government bond curve consists of local debt issued by the Republic of South Africa. As with the swap curve there are curves published by different providers; e.g. JSE, Prudential Authority, etc. Liquidity considerations should be taken into account in selecting the most appropriate instruments for inclusion in the curve.

Bond curves are constructed using the same principles as discussed in 4.4.4, but poses its own challenges. Contrary to swap curves, one of the main challenges with bond curve construction is that there is generally less consensus regarding the selection of bonds to be included in the curve. The discussion of the construction of bond curves is beyond the scope of this Guideline.

When valuing debt issued by a corporate a bond curve is sometimes constructed for that entity by using spreads over the government bond curve or by considering companion bonds.

2.4.6 OIS CURVE

Prior to the Global Financial Crisis, trades were discounted at an inter-bank lending rate or reference rate (e.g. London Interbank Offered Rate ("LIBOR")), which was assumed to be a suitable proxy for the risk-free rate. The inter-bank lending rate (e.g. Libor) is based on submissions from a panel of contributing banks.

During the crisis, basis spreads exploded which prompted a valuation framework where fully cash collateralised trades are discounted off a curve that is reflective of the rate earned on collateral (hence the need for curves constructed using Overnight Index Swaps) and uncollateralized trades are discounted off an unsecured funding rate. The change further implied that LIBORs of different tenors cannot be forecasted off the same curve.

The construction of these curves follow a similar approach to what was outlined in 1.4.4 in that curves are bootstrapped to ensure that market observable instruments are priced back to par. The difference here is that the underlying collateral assumptions need to be taken into account in order to determine which curve is used for discounting (for example ZAR cash flows needs to be discounting off a ZAR OIS curve if ZAR collateral is in place and off a ZAR adjusted curve if the collateral is instead in USD). This new framework can further lead to the concept of multi-curve framework if some of the curves need to be solved for simultaneously based on the available market data, see Ametrano and Bianchetti [2013] for a comprehensive treatise.

2.4.7 MONEY MARKET YIELD CURVE / FUNDING CURVE

In order to measure the fair value of a money market instrument for which no quoted price is available, a money market yield curve is constructed at each valuation point. In the current South African market the majority of money market instruments are unlisted, and as such no daily valuation or price is published. In order to obtain an independent valuation of these instruments on a daily basis, a money market yield curve is used to calculate the market value price of each instrument.

In some instances, it may be appropriate to construct the money market yield curve using observable market prices of liquid NCD's as quoted in the principal market for the money market instrument being valued. Depending on the nature and terms of the money market instrument being valued, NCD rates published by a particular bank or alternatively, an average of the NCD rates published by the major banks in the principal market may be used in constructing the yield curve.

Should the resultant term structure of the constructed money market yield curve not be commensurate with the term of the money market instrument being valued, term deposit rates or bond yields may be considered for the long end of the money market yield curve.

There is no single yield curve that can be used to describe the cost of money for everybody. The lending rate across various institutions differ, this is largely due to creditworthiness. The most important factor in determining a yield curve is the currency in which it is denominated. The economic situation of the countries and companies using each factor is the primary factor in determining the yield curve.

2.4.8 CROSS-CURRENCY BASIS CURVE

In a theoretical setting FX forward rates for a certain currency pair can be determined by interest rate parity, i.e. purely using the FX spot rate and interest rates of the domestic and foreign currency. In practice this is not the case and there is a basis spread that is empirically observed in the prices of FX instruments (e.g. FX forwards and cross-currency swaps). The cross-currency basis spread largely reflects the credit and/or liquidity risk of the sovereign, and can vary significantly over time.

Cross-currency basis curves are interest rate curves that are constructed from FX forwards and resetting cross-currency swaps, and are used to calculate expectations of future FX spot prices or for discounting the cash flows of a leg of a currency instrument. The convention is that the basis curve is calculated as a spread over the non-USD curve. Cross-currency basis curves are constructed using the same principles as discussed in 4.4.4

As an example, when valuing a USD/ZAR cross-currency swap, one can value the swap in ZAR by one of the following identical approaches:

i) Convert the expected USD cash flows (USD leg) to ZAR by multiplying by the FX forward rates (determined using FX spot and the basis curve). All ZAR cash flows (the USD and ZAR leg) are then discount using USD/ZAR basis curve.

ii) Discount the USD leg using the USD risk-free curve and convert to ZAR using FX spot, and add this value to the ZAR leg discounted using the USD/ZAR basis curve.

2.4.9 INFLATION CURVE

The cash flows of some financial instruments are dependent on the rate of inflation in a specified currency. These financial instruments typically aim to protect the real returns, i.e. inflation-adjusted returns, of the holder of the instrument. In order for one to project the cash flows dependent on inflation into the future, it becomes necessary to project the expected future inflation rates at the valuation point. An inflation curve is a forecasting curve that is used for this purpose.

In the South African market, the CPI Index is published on a monthly basis. The month-on-month and annual changes in the CPI index give indications of the prevailing inflation rate in the market. Given an initial CPI level, it is possible to create a CPI Projection curve which projects the expectation of future inflation index levels.

This CPI Projection curve is constructed by calibrating the expected future inflation rates to those implied by market-traded real rate swaps/bonds, depending on the instrument to be valued. The cash flows involved in real rate swaps/bond are dependent on the expectations of future levels of inflation, and so producing a curve that reprices real rate swaps/bonds infers an inflation curve that represents the market's best estimate of future inflation levels. As part of this calibration methodology, a seasonal trend adjustment is often applied to the projected inflation levels as it is clear from historical inflation data that inflation rates are seasonal in nature. Wheelwright et al. [1998] provide details of the Census II method that is one such method used to apply seasonal trend adjustment to a projected series.

Inflation-linked instruments generally depend on lagged values of an inflation index. In South Africa, the index used to determine cash flows on traded inflation related instruments is the CPI, published by Statistics South Africa (Stats SA) every month. This index is constructed by observing prices of a basket of goods and services, then applying weights to them so as to arrive at a summary statistic of general price levels. Year-on-year percentage changes in this index gives an indication of inflation in the economy. It is important to note that the CPI value for a particular month is only published in the following month. For example, the July CPI index number is only published in August and the August number in September. This has implications in the market when determining how much a real cash flow needs to be uplifted to provide a real return.

2.4.10 PRIME CURVE

The prime rate is the interest rate at which commercial banks lend funds in the South African economy. In order to calculate future interest cash flows on loans, overdrafts and swaps that reference the prime rate, it is necessary to project the prime rate into the future. This is done by using a prime curve.

eThe construction of a prime curve is done in line with the principles described in 4.4.4, in which the future prime rates are calibrated to the market prices of prime swaps. Prime swaps are similar to vanilla interest rate swaps, in that one of the legs of these swaps typically reference a JIBAR rate. However, rather than the other leg of the prime swap being dependent on a fixed rate, the contra leg also references a floating rate, namely, the prevailing prime rate.

In the absence of a liquid prime swap market, alternative approaches for constructing a prime curve can be considered. One such method is described by West [2008], and is based on a cointegration / regression analysis between the historical levels of JIBAR and the prime rate.

2.4.11 REPO CURVE

Repos are short-term money market instruments in which the buyer purchases a security, e.g. Government bonds or Treasury bills, from the seller and agrees to sell the security back at the end of the term of the transaction at a higher price. The buyer of the repo effectively lends the seller an amount of money over a short-term in exchange for repayment of the principal plus interest. The effective yield on this transaction is termed the repo rate, and is effectively a short-term lending rate. Note that this repo rate is different to the repo rate that is set by the Reserve Bank of South Africa, which is the rate at which banks can lend funds from the central bank.

In a similar way to the construction of the prime curve from prime swaps, the repo curve is constructed from a selected set of market-traded repos. The selected repos used for curve calibration are typically large deals made by market-makers in the short-term money market. The curve that is produced effectively indicates the short-term cost of funding. Due to the short-term nature of the repo transactions, the curve that is constructed typically does not extend beyond a one year tenor.

Repo curves are used in calculating the forward prices of instruments (like Government Bonds). Repo transactions are also performed on Stocks for scrip lending purposes but these are not discussed here.

2.5 VOLATILITY

Volatility is a measure of the expected uncertainty of returns (or price) of a particular underlying. From a statistical point of view this measure is the standard deviation of returns, but from a valuation point of view, we are interested in the volatility as a forward-looking expectation of variability in the underlying returns.

Volatilities are used in the pricing of options on all instrument classes. Examples of products in which they are used include equity single-stock options, interest rate swaptions, bond options, and foreign exchange options.

We generally consider two types of volatilities, namely implied volatilities and realised volatilities. These are discussed in the sections that follow.

2.5.1 IMPLIED VOLATILITY

It is readily observed from option prices that volatility has a term structure and a so-called skew/smile. The term structure reflects that the volatility is not constant as a function of the time-to-expiry. The skew/smile reflects that the volatility is not constant for options with different strikes and the same expiry.

An implied volatility is one such that when it is used as the volatility input to an option pricing model, e.g. Black-Scholes, it returns the price of the option observed in the market. Considering the Black-Scholes model, all the parameters apart from the volatility are known. When combined with the fact that option prices are an increasing function of volatility, it is possible to determine a unique volatility for an option with a given expiry and strike. The implied volatility can be calculated by using a root-solving algorithm.

In the same vein as creating an interest rate curve to reflect the term structure of rates, we can create a matrix that consists of all observable implied volatilities as a function of strike and time-to-expiry. Such a matrix is known as volatility surfaces and is used for calculating the prices of options that are not liquidly traded in the market.

Suitable methods for interpolating / extrapolating the volatility surface have to be chosen as to avoid arbitrage opportunities. The consideration of such methods, as well as broader discussion of volatility surfaces is beyond the scope of this Guideline.

As described in section 3.2 of Chapter 3, the maximum use of observable inputs must be made for valuation purposes. To this end implied volatilities are the preferred inputs to be used in option pricing, to the extent that they are observable in the market.

2.5.2 REALISED (HISTORIC) VOLATILITY

The realised volatility of an instrument is measured using the standard deviation of historic returns (calculated from time series data). For example, when calculating the 1-year realised volatility of a stock, we start by calculating 1-year of daily returns (log-return) for the stock. We would then proceed to calculate the standard deviation of these returns. The standard deviation gives the realised volatility for a 1-business day period. In order to scale a realised daily volatility to an annual volatility we would multiply by the square root of the number of business days in the year.

2.6 CREDIT

Valuation of credit derivatives, e.g. Credit Default Swaps, Credit Linked Notes, and Extinguishable Cross-Currency Swaps, require attention to be given to the following key inputs.

2.6.1 SURVIVAL CURVES

Valuation of a credit-linked derivatives (like Credit Default Swaps) requires the availability of a survival curve, which allows for the extraction of survival probabilities and default probabilities throughout the tenor of the contract.

Survival curves are typically characterised by hazard rates. These hazard rates form a curve that provide the instantaneous probability of default. In the case where an entity has a constant hazard rate, the survival probability is given by

$$SP(T) = e^{-\lambda T},$$

where $SP(T)$ is the probability of the entity surviving to time T. The default probability is given by

$$PD(T) = 1 - SP(T).$$

In practice the hazard rate is a function of time $\lambda(s)$, and the survival probability is given by

$$SP(T) = e^{\int_0^T \lambda(s)ds}.$$

Typically piecewise constant hazard rates are assumed for constructing a hazard rate curve. An example hazard rate curve is shown in Figure 6.

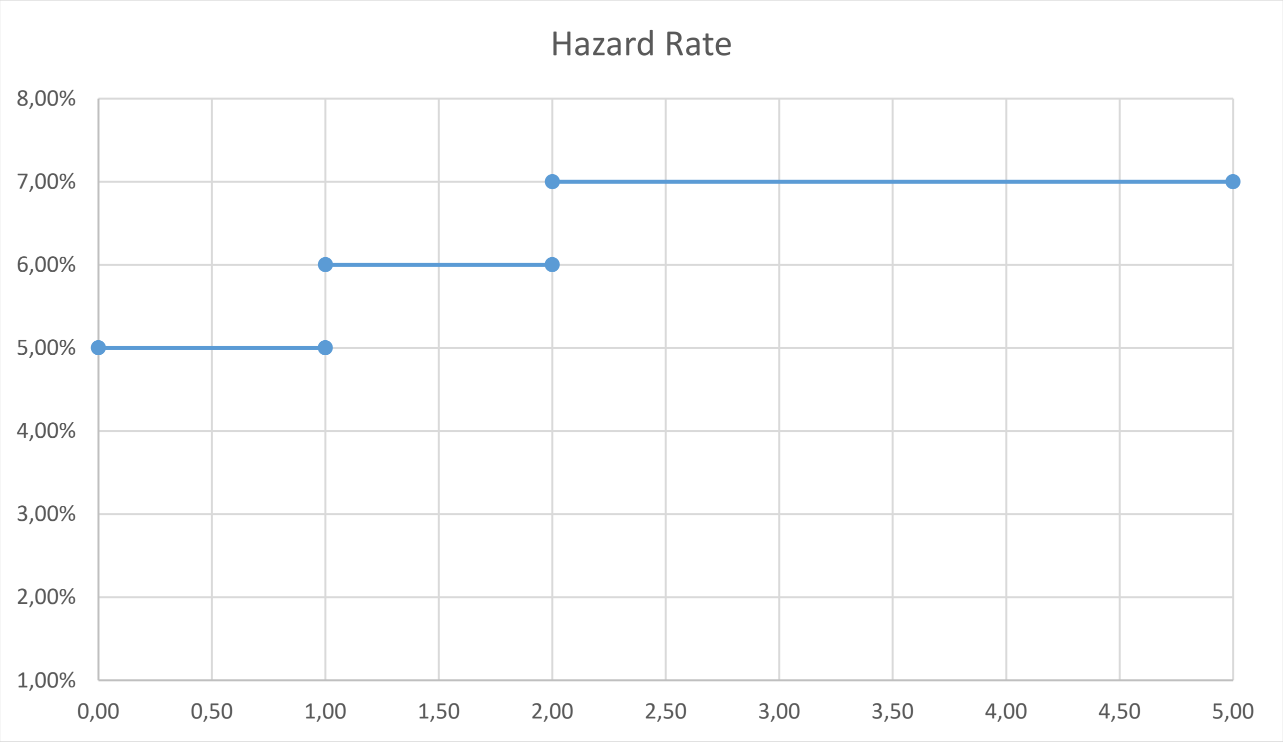


Figure 6 - Hazard Rate Term Structure

In the case where there is a liquid market in Credit Default Swaps ("CDS"), these are used for bootstrapping the survival probability curve. This is done using the same principles described in 4.4.4. Specifically, the piecewise constant hazard rates are solved such that CDS price to par. We will elaborate on the pricing of CDS in section 4.13 of Appendix 4.

A useful approximation for estimating survival probabilities is by noting that the hazard rate (instantaneous default probability) can be estimated as

$$\lambda = \frac{s}{1-R},$$

where s is the observable CDS spread for a certain maturity, and R is the recovery rate. The survival probability is then given by

$$SP(T) = e^{-\frac{sT}{1-R}}$$

In the absence of a CDS market, default probabilities could be approximated from traded debt instruments of the reference entity, e.g. by using instrument swap spreads on bonds. Failing this, various proxy methods could be considered; e.g. proxy CDS / bonds (for a peer company), index CDS, rating-based mapping approaches, etc. (refer to section 3.8 of Appendix 3).

2.7 EQUITIES

In this section we describe inputs that are commonly used in equity derivative valuations.

2.7.1 DIVIDEND YIELD / FORECAST DIVIDEND

An equity instrument provides two main sources of return to an investor: capital growth and dividends.

In order to perform the valuation of an equity instrument or another instrument with returns linked to an equity instrument (e.g. equity futures, index futures, dividend futures, total return swaps), it is necessary to develop an estimate of the forecast dividends expected over a specified period of time into the future.

The development of an estimate of dividends expected on an underlying equity instrument is based on judgement, taking into account market conditions and market participant expectations at the valuation point. Consensus pricing services aggregate the dividend forecasts developed by market participants and may be used as a means of corroborating estimates (refer to section 3.5 of Chapter 3). It is important that any estimates used should be reflective of information reasonably available to a market participant (and exclude any information solely available to the CIS).

2.8 xVA's

The classic risk-neutral framework does not cater for many of the real-world factors that affect the market price of derivatives. In this section we will introduce and briefly discuss valuation adjustments (referred to as xVA's) that are made in practice. A full discussion of xVA's is beyond the scope of this Guideline.

INTRODUCTION

Valuation adjustments (xVA's) are adjustments to the risk-neutral value of a derivative in order to arrive at a market related price. The theory and practice of xVA's are a large and complex field, so we will introduce it by means of a simple example and go on to discuss some common xVA's.

We consider the valuation of foreign exchange forward prices - it is easily shown from no-arbitrage principles that the fair forward price should be given by covered interest rate parity. A cross-currency basis spread (an interest rate differential) is readily observed in foreign exchange forward prices (and cross-currency swaps). The formula for the forward price is of the form:

$$\text{Forward Price} = \text{Spot Price} \times (\text{Domestic Rate - Foreign Rate} + \text{Basis}) \times (\text{Time to Maturity}).$$

When considering a Foreign Exchange Contract ("FEC"), the value is simply the discounted difference between the forward rate (as per above formula) and contractually agreed fixed rate. There is clearly no inclusion of counterparty credit risk, whereas we know that if we were in the money on an FEC, and our counterparty were to default, we would lose some portion of the mark-to-market of the position. This is remedied by adding a Credit Value Adjustment ("CVA") to the risk-neutral price of the FEC. All valuation adjustments can be seen in this light (i.e. they are adjustments to the risk-neutral prices of derivatives).

CVA / DVA

The CVA adjustment is a function of the counterparty default risk (measured by a probability of default) and the amount we expect to lose (referred to as the expected exposure) at any point in time in the case of a counterparty default.

Unfortunately, the calculation of CVA can be complex even for simple products such as FECs. This is due to the non-linearity introduced by the expected exposure, i.e. we will only incur a loss if we are in the money if / when the counterparty defaults. This is very similar to the pay-off of a call option, i.e. the exposure is the mark-to-market value (adjusted to include a recovery rate) if it is larger than zero, $\text{Exposure} = \max\{\text{MtM}, 0\}$. The calculation of CVA is thus more aligned to approaches used to value products with embedded optionality. We will not go into the detail, but the calculation is generally more complex due to a number of factors. Some of these factors include: exposure to all derivatives on netting sets with the counterparty, collateral agreements, correlation between different underlying market factors and instances of illiquid market data.

We can also consider the CVA from our counterparty's point of view (i.e. their risk to us defaulting), and this is the premise of the Debit Value Adjustment ("DVA"). This is calculated in much the same way as the CVA, but using the reverse of the expected exposure and our own default probabilities instead.

The reader is referred to section 3.3 of Chapter 3 for further details on the concept of valuation adjustments within the context of the fair value measurement framework.

OTHER xVA'S

CVA and DVA are the most common of the xVA's (arguably the most understood) and there is broad agreement that these should be included in the price of derivatives. We discuss some of the other xVA's that are considered for more accurate pricing of derivatives and risk management below. The inclusion of valuation adjustments in derivative pricing are often heavily debated due to their subjective nature, and the lack of transparency and standardisation in market practice.

The Funding Value Adjustment ("FVA") is generally taken into account by market participants. FVA reflects the funding cost arising from the absence of daily margining applied to the mark-to-market of derivative transactions. Specifically, it reflects the difference between the funding rates (where dealers fund derivatives) and the risk-neutral rate used in valuations. This adjustment can be split between a cost (Funding Cost Adjustment) and a benefit (Funding Benefit Adjustment).

Other notable xVA's that are emerging as of time of writing are the:

- **Margin Value Adjustment ("MVA")**
  Special type of funding cost arising from having to post initial margin. This can be the result of paying/receiving bilateral initial margin or of executing a trade with an end-user but hedging it with a cleared transaction that leads to having to post initial margin to a central counterparty (commonly referred to as a CCP); and

- **Capital Value Adjustment ("KVA")**
  Capital cost of the Value-at-Risk ("VaR") on CVA capital introduced by Basel III. This adjustment is often included by banks as a charge in pricing derivative trades.

PRACTICAL CONSIDERATIONS

A list of practical considerations arising from the content in this section is provided below:

- The fundamental concept and objective of xVA's aligns to the principle of fair value measurement introduced in Chapter 3 (refer to section 3.2 and section 3.3 of Chapter 3).

  A measure of fair value is required to take into account all risks and characteristics of an instrument, consistent with the assumptions a market participant would consider. These assumptions may either be incorporated as part of the inputs into a valuation model (e.g. reducing cash flow forecasts to take into account the uncertainty in whether the forecasts will be realised) or considered as direct adjustments to the output from a valuation technique.

  The suite of xVA's essentially represent a valuation adjustment to the risk-neutral value of a derivative instrument. The need for the quantification and application of xVA is to ensure that the final estimate of the fair value of the derivative instrument is reflective of an exit price, taking into account all relevant risks and characteristics.

  Appendix 4 of this Guideline provides an overview of valuation principles and guidelines for the determination of the risk-neutral value of a selection of derivative instruments. However, the risk-neutral value cannot be considered equal to the fair value of the derivative instrument. In order to determine the fair value of a derivative instrument at the valuation point, it is necessary to take into consideration the existence of any risks inherent in the characteristics of the instrument that a market participant would take into account in determining the exit price. This assessment may give rise to the need to quantify and apply a valuation adjustment (e.g. one or more of the xVA's).

- Although practice continues to develop with regard to the scope and application of xVA's, there currently exist differing treatments with respect to DVA in particular. For the purposes of financial reporting, the accounting standards require the measurement of fair value to take into account an entity's own credit risk (generally through the quantification of DVA on a derivative instrument). On the other hand, from a regulatory reporting perspective, it is generally not permissible to take into account DVA. As with any valuation adjustment, the inclusion of DVA should be considered in relation to the principles of fair value measurement (i.e. whether the incorporation of DVA assists in producing a fair value measure that is reflective of an exit price in the relevant principal market).

- Not all of the xVA's will be applicable to every derivative instrument held in a CIS portfolio. The scope of application will be driven by the nature of the derivative instruments traded and the underlying governing legal terms. For example, exposure to a specific counterparty may be mitigated through the existence of collateral agreements which should be taken into account in the quantification of CVA.

- In most instances, the valuation of an instrument is performed on an individual basis. However, for the purposes of quantifying an xVA adjustment, the underlying risk drivers need to be assessed before making this determination. For example, where a CIS has a master netting agreement in place with a counterparty which allows for the netting of all asset and liability derivative positions held at any point in time. In this instance, the quantification of CVA may be performed on a counterparty basis (aggregating all positions held with the counterparty in question).

- The inclusion of xVA's into the valuation process is an area of judgement requiring careful consideration by the CIS manager. Despite the inherent complexity of xVA, the underlying concept of a valuation adjustment ties into the core principle of fair value measurement: the fair value of an instrument must be equal to the exit price for the instrument (i.e. how much would a market participant in the principal market pay to acquire the asset or require to take over a liability from the CIS at the valuation point). The reference to exit price in the definition of fair value implies that the valuation is required to be performed on the basis of the assumption that the asset or liability will continue to exist after the valuation point (i.e. the asset or liability is not settled or extinguished). This means that any risk factors inherent in the asset (such as counterparty risk of default) will survive the valuation point and should therefore be considered in measuring fair value. Practice continues to evolve in this regard and it is recommended that the CIS manager continues to monitor trends in this space and the scope of applicability.

2.9 MARKET CONVENTIONS & CONCEPTS RELEVANT TO VALUATION

In this section we discuss market conventions and concepts that are applicable to the instruments most considered in this Guideline.

2.9.1 DAY COUNT CONVENTIONS

Day count conventions specify the method used in determining the length of a period of time for the purposes of calculating interest accruals. For example, the day count convention is used to determine the interest accrual on a bond, at any point during a coupon period.

Day count conventions are generally expressed in the form of X/Y where X indicates the manner in which the number of days between two dates are determined while Y indicates the manner in which the total number of days in the reference period are determined.

The day count convention is generally contractually stipulated.

Commonly used day count conventions are set out in the table below:

Convention	Description
Act/Act	The actual number of days between two dates is used for the numerator. 365 days is used for the denominator (366 days for leap years).
Act/365 (Fixed)	The actual number of days between two dates is used for the numerator. For the denominator, all years are assumed to have 365 days.
Act/360 (Fixed)	The actual number of days between two dates is used for the numerator. For the denominator, all years are assumed to have 360 days (12 months of 30 days each).
30/360 (Fixed)	Each month is assumed to have 30 days, resulting in a 360 day year (the actual number of days is used for a fraction of month, divided by 360).
30/360E	The period is determined on the basis of a year of 360 days with twelve 30-day months, unless the termination date is the last day of the month in February, which is not lengthened to a 30-day month.

2.9.2 BUSINESS DAY CONVENTIONS

The business day convention dictates the method applicable when adjusting contractually stipulated dates (such as payment dates on a bond) that fall on a non-business day.

Commonly used business day conventions are set out in the table below:

Convention	Description
Following / Next Good Business Day	If the calculated date falls on a weekend or public holiday, move forward to the next business day.
Preceding / Previous Good Business Day	If the calculated date falls on a weekend or public holiday, move to the first preceding business day.
Modified Following Business Day	If the calculated date falls on a weekend or public holiday, move to the following business day, unless that day falls in the next calendar month, in which case the date will be the first preceding day that is a good business day.

The business day convention applicable to an instrument must be considered in relation to the public holidays for the currency and/or financial centre specified.

2.9.3 SETTLEMENT DAY CONVENTIONS

The settlement day convention determines the number of days between the trade date and the settlement date of an instrument.

The table below depicts the settlement day conventions for a selection of currencies and instrument types.

Currency	Bond	Money market	Forward Rate Agreement	Swap
ZAR	*t+3*	*t+0*	*t+0*	*t+0*
USD	*t+1*	*t+2*	*t+2*	*t+2*
GBP	*t+1*	*t+2*	*t+2*	*t+2*
EUR	*t+3*	*t+2*	*t+2*	*t+2*
JPY	*t+3*	*t+2*	*t+2*	*t+2*

2.9.4 SWAP DATES

Trade date: A record of when the trade was executed.

Effective date: The effective date is the starting date of the swap. For a vanilla swap it is generally the trade date, which is adjusted by a spot lag (e.g. 2 business days for USD swaps, or 0 days for ZAR swaps). The effective date can be a future date to reflect a forward starting swap.

Maturity date: The tenor of the swap dictates the maturity date. The effective date plus the tenor, adjusted for the business day convention, gives the maturity date of the swap. The maturity date of a swap is denoted by T_N, where N is the number of cash flows.

Accrual dates: The accrual dates are the periods over which the interest on the fixed and floating leg of the swap accrues. The accrual dates of the swap are denoted as a set of dates $\{t_0, t_1, \dots, t_N\}$, where each pair of successive dates form an accrual period consisting of an accrual start date and accrual end date; e.g. $\{t_0, t_1\}$, $\{t_1, t_2\}$ and $\{t_{N-1}, t_N\}$.

Fixing (reset) dates: The fixing dates (also known as reset dates) are the dates on which the floating reference index is observed for payments on the floating leg. The fixing dates are determined from the accrual start dates of the swap $\{t_0, t_1, \ldots, t_{N-1}\}$ and by adjusting each date in accordance with the rolling convention (e.g. Modified Following) and adding the fixing lag (USD LIBOR has a spot lag of 2 days, whereas ZAR JIBAR has none) if applicable, taking holidays into account. Although the fixing dates are, in vanilla ZAR swaps at least, often equal to the accrual dates, this is not true for most currencies, and we thus denote the fixing dates by $\{\tilde{t}_0, \tilde{t}_1, \ldots, \tilde{t}_{N-1}\}$, to reflect the fact that the accrual dates have been adjusted.

Payment dates: The payment dates are the dates on which cash flows are settled. There is one payment date that corresponds to each accrual period. Generally the payment dates and accrual end dates are the same, but this does not have to be the case, and is not when payment happens in advance; to this end we denote the payment dates by $\{T_1, T_2, \ldots, T_N\}$.

EXAMPLES

Example 1:
As an example of the generalized case, in Figure 6 - Swap dates we illustratee the future value of a single fixed and floating cash flow at the payment date, where the fixing date, accrual dates and payment dates don't co-incide with each other. In the figure the notation *e* reflects the reference rate value at the fixing date, *K* is the fixed rate of the swap, and *dcf(Accr Start, Accr End)* is the day count fraction between the accrual start and end date.

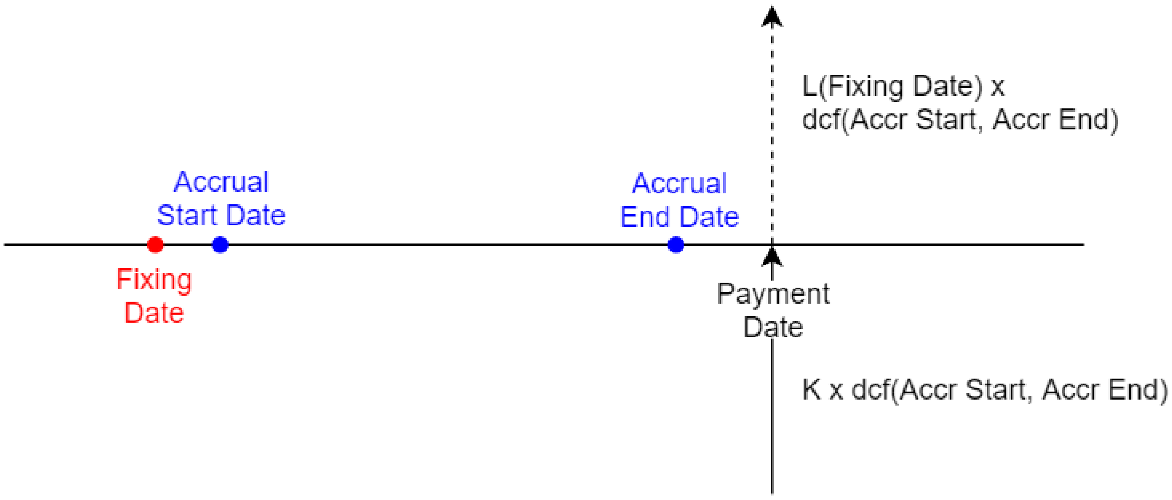


Figure 7 - Swap dates

Example 2:
Consider a vanilla ZAR interest rate swap which has an effective date of 10-January-2018, pays 3-month JIBAR quarterly and matures 10-January-2019. This swap will have four cash flows; we list the accrual dates, fixing dates and payment dates below:
Accrual dates = $\{t_0, t_1, \ldots, t_N\}$ = {10-Jan-2018, 10-Apr-2018, 10-Jul-2018, 10-Sep-2018, 10-Jan-2019}
Fixing dates = $\{\tilde{t}_0, \tilde{t}_1, \ldots, \tilde{t}_{N-1}\}$ = {10-Jan-2018, 10-Apr-2018, 10-Jul-2018, 10-Sep-2018}
Payment dates = $\{T_1, T_2, \ldots, T_N\}$ = {10-Apr-2018, 10-Jul-2018, 10-Sep-2018, 10-Jan-2019}

Example 3:
Consider a vanilla **USD** interest rate swap which has an effective date of 10-January-2018, pays 3-month LIBOR quarterly and matures 10-January-2019. This swap will have four cash flows; we list the accrual dates, fixing dates and payment dates below:
Accrual dates = $\{t_0, t_1, \ldots, t_N\}$ = {10-Jan-2018, 10-Apr-2018, 10-Jul-2018, 10-Sep-2018, 10-Jan-2019}
Fixing dates = $\{\tilde{t}_0, \tilde{t}_1, \ldots, \tilde{t}_{N-1}\}$ = {08-Jan-2018, 06-Apr-2018, 06-Jul-2018, 08-Sep-2018}
Payment dates = $\{T_1, T_2, \ldots, T_N\}$ = {10-Apr-2018, 10-Jul-2018, 10-Sep-2018, 10-Jan-2019}
Notice that the fixing dates have changed due to the spot lag of 2 business days on LIBOR.

2.9.5 INTEREST RATE CALCULATION FORMULAE

There are two main methods employed for the calculation of interest earned or incurred: simple and compound interest.

In simple interest contracts, interest is calculated as a percentage of the principal amount.

A compound interest contract is essentially a series of simple interest contracts. The length of each simple interest contract is equal to one compounding period. At the end of each period the interest earned on each simple interest contract is added to the principal amount.

Methods	Description	Formula
Simple	No compounding	$= N \cdot (1 + r \cdot \tau(t,T))$
Discrete compounding	Compounds interest, m times per year • naca – nominal annual compounded annually (m = 1) • nacs – nominal annual compounded semi-annually (m = 2) • nacq – nominal annual compounded quarterly (m = 4) • nacm = nominal annual compounded monthly (m = 12)	$= N \cdot (1 + \frac{r}{m})^{m \cdot \tau(t,T)}$
Continuous compounding	Compounds on an infinite basis • nacc – nominal annual compounded continuously	$= N \cdot e^{r \cdot \tau(t,T)}$

APPENDIX 3:
FIXED INCOME INSTRUMENTS

3.1 INTRODUCTION

A fixed income instrument is an investment that provides a return in the form of interest and the eventual repayment of the principal at maturity. Examples of fixed income instruments include bonds and money market instruments.

There are two main types of fixed income instruments:

- **Interest-bearing instruments**
  An instrument that earns interest at a contractually stipulated rate (which may be fixed or variable), payable either periodically or at maturity; and

- **Discount instruments**
  An instrument issued at an amount less than face value and redeemed at par. The difference between the issue value and the par amount constitutes the interest earned on the discount instrument.

Money market instruments held in a constant NAV portfolio must be measured at amortised cost (refer to section 3.9 of Chapter 3). In terms of IFRS, a money market instrument measured at amortised cost must reflect the cumulative amortisation of the instrument at the valuation point using the effective interest method. In addition, a money market instrument measured at amortised cost must be assessed for impairment at each valuation point and if appropriate, a loss allowance should be recognised.

In all other instances, fixed income instruments must be measured at fair value.

The contents of this appendix may also be applied to the valuation of preference shares with debt-like characteristics (i.e. with features akin to the fixed income instruments addressed in this appendix).

This appendix should be read in conjunction with Appendix 2, which provides an overview of key fundamental principles underpinning the concepts addressed in this chapter (including guidance with respect to the development of relevant model inputs).

The valuation formulae and guidance provided in this appendix is intended to illustrate the fundamental valuation principles for a selection of instruments. Simplifying assumptions regarding the nature and characteristics of each instrument have been made. As a result, the use of the guidance in this appendix should be adapted, as appropriate, to take into account the specific terms and conditions of the instrument being valued, as well as current market best practice.

In applying the valuation guidance set out in this appendix, it is important that the fair value measurement principles introduced in Chapter 3 are consistently applied. This may require the application of additional valuation adjustments to the result obtained in order to quantify an appropriate fair value measure for an instrument.

In valuing an instrument, the timing of future cash flows is a critical consideration and it is therefore important to take into account the settlement date conventions for the relevant market (refer to section 2.9 of Appendix 2). For example, the settlement date of a contract occurs after a pre-specified number of business days following the maturity date of the contract – as a result, the timing of the future cash flows under the contract should be determined accordingly when performing the valuation.

To the extent that local industry bodies or exchanges have issued guidance or pricing specifications pertinent to a specified instrument, these may be considered as an additional source of information to the reader (e.g. the Johannesburg Stock Exchange Pricing Specifications). It is important to provide due consideration as to whether the use of these additional sources are reflective of best market practice and will result in an appropriate measure of fair value, in accordance with the fair value measurement principles outlined in Chapter 3.

3.2 VANILLA MONEY MARKET INSTRUMENTS

DEFINITION

Money market instruments are short term (generally, but not limited to, less than one year maturity), fixed income instruments, that provide a specified amount of interest plus the repayment of principal, both at maturity. These instruments offer low risk and are easily converted into cash.

FEATURES OF INSTRUMENT

The characteristics of money market instruments are used to categorise an instrument as either:

- **Interest-bearing money market instruments**
  Interest-bearing money market instruments are issued at par and at maturity, are redeemed at par plus the interest earned over the term of the instrument. Examples include but are not limited to, Negotiable Certificate of Deposit ("NCD"), fixed deposit, coupon Certificate of Deposit ("CD"), bridging bond, yield promissory note and coupon Stock.

- **Discount money market instruments**
  Discount money market instruments are issued at a discount to face value and at maturity, are redeemed at face value. The differential between the face value and the issue price represents the interest earned on the instrument. Examples include but are not limited to, commercial paper, promissory note, bankers acceptance, treasury bills.

  The prices of discount instruments are often quoted using a discount rate. This is the interest amount earned as a percentage of the face value rather than as a percentage of the initial price paid for the instrument.

FAIR VALUE MEASUREMENT

i) Key valuation inputs

In order to measure the fair value of the money market instrument employing a present value technique, the following valuation inputs are required:

- Contractual terms of instrument;
- Forward rate curve; and
- Discount curve (money market or funding curve).

Refer to Appendix 2 for guidance regarding the relevant considerations in developing the required market inputs.

ii) Valuation methodology

The amount and timing of the contractually specified future cash flows arising from the money market instrument are determined. The related discount factor applicable to each cash flow is obtained from the constructed discount curve. Each future cash flow is discounted using the corresponding discount factor. The all-in price for the money market instrument is formulated as the sum of the discounted future cash flows.

Once the all-in price has been calculated, the accrued interest on the money market instrument at the valuation point is calculated. Finally, the clean fair value is calculated as the difference between the all-in price and the accrued interest.

Interest-bearing money market instruments

All-in price:

$$V(t) = \left(N \cdot K \cdot \tau(t_0, T) \cdot \mathrm{df}(t, T) \right) + \ (N \cdot \mathrm{df}(t, T))$$

Accrued interest (if $t > t_0$ and $t < t_1$):

$$AI \ = \ N \cdot K \cdot \tau(t_0, t)$$

where

$V(t)$ = value of instrument at the valuation point,

t = valuation point,

N = principal amount,

K = fixed rate,

t_0 = instrument issue date,

T = maturity date,

$\mathrm{df}(t, T)$ = discount factor from maturity date to the valuation point, derived from the discount curve,

$\tau(t_0, t)$ = day count fraction between the issue date and the valuation point,

AI = accrued interest on instrument.

The formulae provided above assume that a fixed rate of interest is earned on the money market instrument and a single cash flow of the nominal amount plus interest occurs upon maturity. To the extent that alternative terms exist for the money market instrument being valued, the formulae should be adjusted accordingly.

Examples

Example – Linear instrument acquired at inception:

In this example, the investor acquires the instrument upon issuance, for the principal amount. Interest is earned on the instrument from trade date.

Variable	**Value**
Principal N	1 000 000
Interest rate – simple annual rate K	10%
Issue date t_0	1 January 2009
Maturity date T	1 January 2010
Yield to maturity y	7.26065%
Trade date t_{trade}	1 January 2009
Settlement date (assume a settlement date convention of $t+0$)	1 January 2009
Valuation point t	31 August 2009
Day count convention applicable	Actual / 365 Fixed

Variable	**Value**
Original term of instrument $(T - t_0)/365$	365/365
Period interest earned $(t - t_{trade})/365$	242/365
Period instrument outstanding $(t - t_0)/365$	242/365
Period to maturity $(T - t)/365$	123/365
Maturity amount	1 100 000
Discount factor from T to t $\mathrm{df}(t,T) = \frac{1}{1 + (y \cdot \tau(T - t))}$	$\frac{1}{1 + (7.26065\% \cdot 123/365)} = 0.976$
All-in price $V(t) = N \cdot \mathrm{df}(t,T) + N \cdot K \cdot \tau(t_0,T) \cdot \mathrm{df}(t,T)$	1 073 728.66
Accrued interest on instrument $AI = N \cdot K \cdot \tau(t_0, t)$	66 301.37
Clean price $V(t) - AI$	1 007 427.29

Example – Linear instrument acquired in secondary market:
In this example, the investor acquires the instrument in the secondary market, subsequent to its issuance.

Variable	**Value**
Principal N	1 000 000
Interest rate – simple annual rate	10%
Issue date t_0	1 January 2009
Maturity date T	1 January 2010
Yield to maturity (on trade date) y	6.68%
Trade date t_{trade}	31 August 2009
Settlement date (assume a settlement date convention of $t+0$)	31 August 2009
Valuation point t	31 August 2009
Day count convention applicable	Actual / 365 Fixed

Variable	**Value**
Original term of instrument $(T - t_0)/365$	365/365
Period interest earned $(t - t_{trade})/365$	1/365
Period instrument outstanding $(t - t_0)/365$	242/365
Period to maturity $(T - t)/365$	123/365
Maturity amount	1 100 000
Discount factor from T to t $\mathrm{df}(t,T) = \frac{1}{1 + (y \cdot \tau(T - t))}$	$\frac{1}{1 + (6.68\% \cdot 123/365)} = 0.978$
All-in price $V(t) = N \cdot \mathrm{df}(t,T) + N \cdot K \cdot \tau(t_0,T) \cdot \mathrm{df}(t,T)$	1 075 783.38
Accrued interest on instrument $AI = N \cdot K \cdot 242/365$	66 301.37
Clean price $V(t) - AI$	1 009 482.01

Discount instruments

All-in price:

$$V(t) = N \cdot \mathrm{df}(t, T)$$

Accrued interest (if $t > t_0$ and $t < t_1$):

$$AI = \frac{(N - IP) \cdot \tau(t_0, t)}{\tau(t_0, T)}$$

where

$V(t)$ = value of instrument at the valuation point t,

t = valuation point,

N = principal amount,

T = maturity date,

$\mathrm{df}(t, T)$ = discount factor from the maturity date to the valuation point, derived from the discount curve,

AI = accrued interest on instrument,

IP = Initial price,

t_0 = instrument issue date,

$\tau(t_0, t)$ = day count fraction between the issue date and the valuation point,

$\tau(t_0, T)$ = day count fraction between the issue date and the maturity date.

The formulae provided above assume a single cash flow of the face value of the money market instrument occurs upon maturity. To the extent that alternative terms exist for the money market instrument being valued, the formulae should be adjusted accordingly.

Examples

Example – Discount instrument acquired at inception:

In this example, the investor acquires the instrument upon issuance, for the issue price. Interest is earned on the instrument from trade date.

Variable	Value
Principal N	1 000 000
Interest rate - simple annual rate r	10%
Issue date t_0	1 January 2009
Maturity date T	1 January 2010
Yield to maturity y	7.26065%
Trade date t_{trade}	1 January 2009
Settlement date (assume a settlement date convention of t+0)	1 January 2009
Valuation point t	31 August 2009
Day count convention applicable	Actual / 365 Fixed

Variable	Value
Original term of instrument $(T - t_0)/365$	365/365
Period interest earned $(t - t_{trade})/365$	242/365
Period instrument outstanding $(t - t_0)/365$	242/365
Period to maturity $(T - t)/365$	123/365
Maturity amount	1 000 000
Issue price $IP = \frac{N}{1+(r \cdot \tau(T - t_0)}$	$\frac{1\ 000\ 000}{1 + (0.1 \cdot 365/365)} = 909\ 090.9$
Discount factor from T to t $\mathrm{df}(t,T) = \frac{1}{1 + (y \cdot \tau(T - t))}$	$\frac{1}{1 + (7.26065\% \cdot 123/365)} = 0.976$
All-in price $V(t) = N \cdot \mathrm{df}(t,T)$	976 116.97
Accrued interest on instrument $AI = \frac{(N - IP) \cdot \tau(t_0, t)}{\tau(t_0, T)}$	60 273.97
Clean price $V(t) - AI$	915 842.99

Example – Discount instrument acquired in secondary market:
In this example, the investor acquires the instrument in the secondary market, subsequent to its issuance.

Variable	Value
Principal N	1 000 000
Interest rate – simple annual rate	10%
Issue date t_0	1 January 2009
Maturity date T	1 January 2010
Issue price IP	909 090.91
Yield to maturity y	6.68%
Trade date t_{trade}	31 August 2009
Settlement date (assume a settlement date convention of $t+0$)	31 August 2009
Valuation point t	31 August 2009
Day count convention applicable	Actual / 365 Fixed

Variable	Value
Original term of instrument $(T - t_0)/365$	365/365
Period interest earned $(t - t_{trade})/365$	1/365
Period instrument outstanding $(t - t_0)/365$	242/365
Period to maturity $(T - t)/365$	123/365
Maturity amount	1 000 000
Discount factor from T to t $\mathrm{df}(t,T) = \frac{1}{1 + (y \cdot \tau(T - t))}$	$\frac{1}{1 + (6.68\% \cdot 123/365)} = 0.978$
All-in price $V(t) = N \cdot \mathrm{df}(t,T)$	977 984.89
Accrued interest on instrument $AI = \frac{(N - IP) \cdot \tau(t_0,t)}{\tau(t_0,T)}$	60 273.97
Clean price $V(t) - AI$	917 710.92
Accrued interest attributable to portfolio $(N - IP) \cdot 1/365$	249.07

3.3 NON-VANILLA MONEY MARKET INSTRUMENTS

Non-vanilla money market instruments include variable rate certificate of deposits and stepped coupon certificate of deposits. These securities are variations of linear money market securities and therefore similar valuation methodologies are applicable.

3.3.1 VARIABLE RATE CERTIFICATE OF DEPOSIT (VCD)

DEFINITION

A CD with a fixed term but a fluctuating interest rate.

FEATURES OF INSTRUMENT

The factors that will determine the interest rate earned on a VCD vary across markets and issuers and may include movements in the prime rate, Consumer Price Index ("CPI"), Treasury Bill yields or a specified market index.

FAIR VALUE MEASUREMENT

i) Key valuation inputs

In order to measure the fair value of a VCD employing a present value technique, the following valuation inputs are required:

- Contractual terms of instrument; and
- Discount curve; and
- Forward rate curve (depending on underlying floating rate e.g. prime rate).

Refer to Appendix 2 of this document for guidance regarding the relevant considerations in developing the required market inputs.

ii) Fair valuation methodology

The amount and timing of the contractually specified future cash flows arising from the money market instrument are determined. The forward rates used in the quantification of the expected future cash flows are obtained from the relevant forward rate curve constructed. To the extent that the rate applicable to the first coupon after the valuation point is known, the actual rate is used in the calculation of the first coupon, rather than the rate implied from the constructed forward rate curve.

The related discount factor applicable to each cash flow is obtained from the constructed discount curve. Each future cash flow is discounted using the corresponding discount factor. The all-in price for the money market instrument is formulated as the sum of the discounted future cash flows.

Once the all-in price has been calculated, the accrued interest on the money market instrument at the valuation point is determined. Finally, the clean fair value is calculated as the difference between the all-in price and the accrued interest.

The assumption applied in the formulae below is that the instrument makes periodic interest payments (that are not reinvested), with the return of the principal amount to the investor on maturity.

All-in price:

$$V(t) = \sum_{i=1}^{n} N \cdot (f_{i-1} + s) \cdot \tau(t_{i-1}, t_i) \cdot \mathrm{df}(t, T_i)) \; + N \cdot \mathrm{df}(t, T_n)$$

Accrued interest (if $t > t_0$ and $t < t_1$):

$$AI \;=\; N \cdot (r_0 + s) \cdot \tau(t_0, t)$$

where

$V(t)$ = value of instrument at the valuation point,

t = valuation point,

N = principal amount,

$f_{i-1} = f(t; \tilde{t}_{i-1}, \tilde{t}_{i-1} + tenor)$ = the forward rate for the reference index that resets at time $\tilde{t}_{i-1}$,

$\{\tilde{t}_0, \tilde{t}_1, \ldots, \tilde{t}_{n-1}\}$ = reset dates,

$tenor$ = floating rate period of the reference index,

s = contractually specified fixed spread over the benchmark rate,

$\{t_0, t_1, \ldots, t_n\}$ = accrual dates,

$\tau(t_{i-1}, t_i)$ = day count fraction function over the relevant period,

$\{T_1, T_2, \ldots, T_n\}$ = payment dates,

$\mathrm{df}(t, T_i)$ = discount factor from the relevant payment date to the valuation point, derived from discount curve,

T_n = maturity date,

$\mathrm{df}(t, T_n)$ = discount factor from maturity date to the valuation point, derived from discount curve,

AI = accrued interest on instrument,

r_0 = fixing value of the reference index at $\tilde{t}_0$.

ALTERNATIVE SIMPLIFIED FAIR VALUATION METHOD

If an instrument:

- Has floating rate payments plus a principal amount due at maturity; and
- The same curve is used for forecasting and discounting purposes (i.e. no spread between forecasting and discounting curves),

Then the value of the instrument at each reset date is equal to the principal amount (the forecasting and discounting effectively cancels out).

The value of the instrument at the valuation point is effectively equal to the discounted principal from the next reset date (which reflects the present value of all future cash flows at the next reset date) plus the present value of the existing coupon expected to be paid at the next reset date (i.e. this is separate from the previous term because the forecasting and discounting curve is different (the forecast rate was fixed at the previous reset date).

This relationship holds exactly if there is no spread– with the accuracy of the approximation dependent on the size of the spread.

Note that the use of this approach is only appropriate in instances where the manager can demonstrate that the resultant value reasonably approximates the fair value of the money market instrument at each valuation point.

All-in price:

$$V(t) = (N + (N \cdot r \cdot \tau(t_0, t_1))) \cdot \mathrm{df}(t, T_1)$$

where

$V(t)$ = value of instrument at the valuation point,

t = valuation point,

N = principal amount,

r = actual rate applicable to next coupon (payable after the valuation point),

$\tau(t_0, t_1)$ = day count fraction function over first accrual period (ending after the valuation point),

$\mathrm{df}(t, T_1)$ = discount factor from the first payment date (after the valuation point) to the valuation point, derived from discount curve.

Note: Appropriate adjustments to estimate the clean fair value are required to the formula above.

3.3.2 STEPPED COUPON CERTIFICATE OF DEPOSIT (FRA STRIP)

DEFINITION

A CD where the coupon rates are updated at specific, contractually specified points over the life of the instrument.

FEATURES OF INSTRUMENT

Since the built-in coupon increases eliminate the uncertainty of future yields associated with fixed rate CD's, stepped coupon CD's are less sensitive to market interest rates.

The term of a stepped coupon CD is generally between six months and four years.

FAIR VALUE MEASUREMENT

i) Key valuation inputs

In order to measure the fair value of a stepped coupon CD employing a present value technique, the following valuation inputs are required:

- Contractual terms of instrument;
- Discount curve; and
- Forward rate curve (if instrument references a floating rate).

Refer to Appendix 2 of this document for guidance regarding the relevant considerations in developing the required market inputs.

ii) Valuation methodology

The contractually specified future cash flows and the timing thereof arising from the stepped coupon CD are determined. If the rate referenced by the instrument is a floating rate, the forward rates used in the quantification of the expected future cash flows are obtained from the relevant forward rate curve constructed. To the extent that the rate applicable to the first coupon after the valuation point is known, the actual rate is used in the calculation of the first coupon, rather than the rate implied per the constructed forward rate curve.

The related discount factor applicable to each cash flow is obtained from the constructed discount curve. Each future cash flow is discounted using the corresponding discount factor and an all-in price for the stepped coupon CD is formulated as the sum of the discounted future cash flows.

Once the all-in price has been calculated, the accrued interest on the stepped coupon CD at the valuation point is determined. Finally, the clean fair value is calculated as the difference between the all-in price and the accrued interest.

All-in price:

$$V(t) = \sum_{i=1}^{n} N \cdot s_i \cdot \tau(t_{i-1}, t_i) \cdot \mathrm{df}(t, T_i) + N \cdot \mathrm{df}(t, T_n)$$

Accrued interest (if $t > t_0$ and $t < t_1$):

$$AI = N \cdot s_0 \cdot \tau(t_0, t)$$

where

$V(t)$ = value of instrument at the valuation point,

t = valuation point,

N = principal amount,

s_i = stepped coupon,

$\{t_0, t_1, \ldots, t_n\}$ = accrual dates,

$\tau(t_{i-1}, t_i)$ = day count fraction function over the relevant period,

$\{T_1, T_2, \ldots, T_n\}$ = payment dates,

$\mathrm{df}(t, T_i)$ = discount factor from the relevant payment date to the valuation point, derived from discount curve,

T_n = maturity date,

$\mathrm{df}(t, T_n)$ = discount factor from maturity date to the valuation point, derived from discount curve,

AI = accrued interest on instrument,

s_0 = actual coupon rate applicable in the period.

3.4 FIXED RATE INSTRUMENTS

DEFINITION

A debt instrument that pays a fixed coupon (interest) rate for its entire term (e.g. fixed rate bond issued by a government or a corporate).

FEATURES OF INSTRUMENT

As the return on a fixed rate bond is determined up front, a key risk of holding a fixed rate bond is interest rate risk. This is due to the inverse relationship between bond prices and interest rates – as interest rates increase, the fair value of the bond decreases. In addition, the longer the fixed rate bond's term, the greater the risk that interest rates might rise and make the bond less valuable.

FAIR VALUE MEASUREMENT

i) Key valuation inputs

In order to measure the fair value of the fixed rate instrument employing a present value technique, the following valuation inputs are required:

- Contractual terms of instrument; and
- Discount curve (government bond curve plus a credit spread, where appropriate).

Refer to Appendix 2 of this document for guidance regarding the relevant considerations in developing the required market inputs.

ii) Fair valuation methodology

The contractually specified future cash flows and the timing thereof arising from the fixed rate bond are determined. The related discount factor applicable to each cash flow is obtained from the constructed discount curve. Each future cash flow is discounted using the corresponding discount factor and an all-in price for the fixed rate bond is formulated as the sum of the discounted future cash flows.

Once the all-in price has been calculated, the accrued interest on the fixed rate bond at the valuation point is determined. Finally, the clean fair value is calculated as the difference between the all-in price and the accrued interest.

All-in price:

$$V(t) = \sum_{i=1}^{n} N \cdot c \cdot \tau(t_{i-1}, t_i) \cdot \mathrm{df}(t, T_i) + N \cdot \mathrm{df}(t, T_n)$$

Accrued interest (if $t > t_0$ and $t < t_1$):

$$AI = N \cdot c \cdot \tau(t_0, t)$$

where

$V(t)$ = value of instrument at the valuation point,

t = valuation point,

N = principal amount,

c = coupon rate (contractually specified),

$\{t_0, t_1, \ldots, t_n\}$ = accrual dates,

$\tau(t_{i-1}, t_i)$ = day count fraction function over the relevant period,

$\{T_1, T_2, \ldots, T_n\}$ = payment dates,

$\mathrm{df}(t, T_i)$ = discount factor from the relevant payment date to the valuation point, derived from discount curve,

T_n = maturity date,

$\mathrm{df}(t, T_n)$ = discount factor from maturity date to the valuation point, derived from discount curve,

AI = accrued interest on instrument.

Note that a fixed rate bond may also, under appropriate circumstances (such as in the case of liquidly traded bonds), be valued with reference to the bond's yield to maturity. In this instance, the formulae above would be applied with the exception that the discount factor would be determined from the yield to maturity.

Example
Fixed rate bond valuation (assume settlement date convention is $t+0$):

Input / Calculation	**Variable**
Valuation point	1 June 2011
Bond	R 157
Issuer	REPUBLIC OF SOUTH AFRICA
ISIN No.	ZAG000010547
Nominal	100
Coupon (simple annual rate)	13.5%
Yield to maturity	7.425%
Issue date	18 January 1991
Maturity date	15 September 2016
Pricing redemption date	15 September 2015
Last coupon date	15 March 2011
Next coupon date	15 September 2011
Cum- / Ex-Dividend	Cum-Dividend
Days interest earned	78
Days between last coupon date and next coupon date	184
Day count convention applicable	Actual / 365 Fixed
All-in Price $V(t)$	124.79727
Accrued Interest AI	2.88493
Clean Price	121.91234

3.5 FLOATING RATE INSTRUMENTS

DEFINITION

A floating rate note is a debt instrument that makes periodic coupon payments. The interest rate on a floating rate note is variable and is generally set to a benchmark rate plus, in most cases, a fixed spread. Floating rate notes are generally issued by governments and financial institutions.

FEATURES OF INSTRUMENT

Floating rate notes reference a certain benchmark rate which may differ across markets.
The fixed spread added on to the benchmark rate is indicative of the credit risk of the issuer at inception, and the liquidity spread for the duration of the note. Coupon payments are calculated at the beginning of each coupon period, and paid in arrears.

The reset of the coupon rate may occur monthly, quarterly or semi-annually. Generally reset dates coincide with the tenor of the benchmark rate (eg. quarterly resets of the 3 month-JIBAR). To the extent that this is not the case, appropriate adjustments to the benchmark rate should be made in valuing the note.

Floating Rate Notes carry little interest rate risk. A floating rate note has duration close to zero, and its price shows very low sensitivity to changes in interest rates. As floating rate notes are almost immune to interest rate risk, they are considered conservative investments for investors who believe interest rates will increase. The risk that remains is credit risk and / or funding risk.

FAIR VALUE MEASUREMENT

i) Key valuation inputs

In order to measure the fair value of a floating rate note employing a present value technique, the following valuation inputs are required:

- Contractual terms of instrument;
- Discount curve (the funding curve); and
- Forward rate curve.

Refer to Appendix 2 of this document for guidance regarding the relevant considerations in developing the required market inputs.

ii) Fair valuation methodology

The contractually specified future cash flows and the timing thereof arising from the floating rate note are determined. The forward rates used in the quantification of the expected future cash flows are obtained from the relevant forward rate curve constructed. To the extent that the rate applicable to the first coupon after the valuation point is known, the actual rate is used in the calculation of the first coupon, rather than the rate implied per the constructed forward rate curve.

The related discount factor applicable to each cash flow is obtained from the constructed discount curve. Each future cash flow is discounted using the corresponding discount factor and an all-in price for the floating rate note is formulated as the sum of the discounted future cash flows.

Once the all-in price has been calculated, the accrued interest on the floating rate note at the valuation point is determined. Finally, the clean fair value is calculated as the difference between the all-in price and the accrued interest.

All-in price:

$$V(t) = \sum_{i=1}^{n} N \cdot (f_{i-1} + s) \cdot \tau(t_{i-1}, t_i) \cdot \mathrm{df}(t, T_i) \; + N \cdot \mathrm{df}(t, T_n)$$

Accrued interest (if $t > t_0$ and $t < t_1$):

$$AI \; = \; N \cdot (r_0 + s) \cdot \tau(t_0, t)$$

where

$V(t)$ = value of instrument at the valuation point,

N = principal amount,

t = valuation point,

$f_{i-1} = f(t; \tilde{t}_{i-1}, \tilde{t}_{i-1} + tenor)$ = the forward rate for the reference index that resets at time $\tilde{t}_{i-1}$,

$\{\tilde{t}_0, \tilde{t}_1, \ldots, \tilde{t}_{n-1}\}$ = reset dates,

$tenor$ = floating rate period of the reference index,

s = contractually specified fixed spread over the benchmark rate,

$\{t_0, t_1, \ldots, t_n\}$ = accrual dates,

$\tau(t_{i-1}, t_i)$ = day count fraction function over the relevant period,

$\{T_1, T_2, \ldots, T_n\}$ = payment dates,

$\mathrm{df}(t, T_i)$ = discount factor from the relevant payment date to the valuation point, derived from discount curve,

T_n = maturity date,

$\mathrm{df}(t, T_n)$ = discount factor from maturity date to the valuation point, derived from discount curve,

AI = accrued interest on instrument,

r_0 = fixing value of the reference index at $\tilde{t}_0$.

3.6 CALLABLE OR REDEEMABLE BONDS

DEFINITION

A redeemable bond (also referred to as a callable bond) is a debt instrument in terms of which the issuer retains a right of redeeming the bond at some point before its maturity date. In other words, on the contractually specified call date(s), the issuer has the right, but not the obligation, to buy back the bonds from the bondholders at a predetermined call price.

FEATURES OF INSTRUMENT

In substance, the holder of a redeemable bond has sold a call option to the issuer. The strike price or call price in the option is the predetermined price that must be paid by the issuer to the holder. In certain cases, mainly in the high-yield debt market, there can be a substantial call premium.

Thus, the issuer has an option, for which it pays in the form of a higher coupon rate. If interest rates in the market have gone down by the call date, the issuer will be able to refinance its debt at a cheaper level and so will be incentivised to call the bonds it originally issued. Another way to look at this interplay is that as interest rates go down, the price of the bond (price excluding optionality i.e. present value of coupons plus principal) goes up. Therefore, it is advantageous for the issuer to buy the bonds back at par value

Callable bonds cannot usually be called for the first few years of their life. After that, the call price is usually a decreasing function of time.

FAIR VALUE MEASUREMENT

i) Key valuation inputs

In order to measure the fair value of a callable bond employing a present value technique, the following valuation inputs are required:

- Contractual terms of instrument;
- Discount curve;
- Forward rate curve (assuming the coupon rate is floating); and
- Bond volatilities (price/yield and related term structure).

Refer to Appendix 2 of this document for guidance regarding the relevant considerations in developing the required market inputs.

ii) Fair valuation methodology

A callable bond is, in substance, the combination of a straight bond and a call option.

The price of a callable bond can be determined as follows:

Price of callable bond = Price of straight bond – Price of call option on bond

Calculate the price of the bond component:
Refer to guidance provided in previous sections of this appendix for guidance on the valuation of the bond component.

Calculate the price of the call option:
If the option is European, the Black-76 models may be applied (refer to section 2.26 of Appendix 2 and section 4.4.4 of Appendix 4)).

In the case of an American- or Bermudan-style options, the following models may be considered:

- Binomial or trinomial option pricing models (e.g. Black-Derman-Toy model);
- Monte Carlo model with CIR or Vasicek; or
- Measured by an option adjusted spread (e.g. the Bloomberg model).

Refer to section 2.2 of Appendix 2 for a brief overview of option pricing theory.

ALTERNATIVE FAIR VALUATION METHOD

Latest valuation models described for callable bonds do not value the call option in its own right. The proposed valuation methodology in fact indicates that the value of the call option is determined by valuing the security firstly as an option free bond and then secondly as a callable bond utilising the binominal interest rate tree methodology.

Once we allow for embedded options, consideration must be given to interest rate volatility. The binomial interest rate tree is utilised to express interest volatility in the valuation model. The binomial tree is nothing more than a discrete representation of the possible evolution over time of the one-period rate based on some assumption about interest rate volatility.

Please refer to the section 2.28 of Appendix 2 for the application of the binomial interest rate tree valuation methodology.

3.7 INFLATION-LINKED BONDS

DEFINITION

Inflation-linked bonds offer investors protection against inflation by linking a bond's coupon payments and / or the principal repayment to a measure of inflation (such as an index of consumer prices).

FEATURES OF INSTRUMENT

A nominal bond's stated coupon rate represents the nominal interest rate received by bondholders. But inflation reduces the actual value of the interest received. The interest rate that bondholders actually receive, net of inflation, is the real interest rate. By increasing the coupon payments and / or the principal repayment in line with increases in the price index, inflation-linked bonds reduce inflation risk.

An inflation-indexed bond references CPI, or some other nationally recognised inflation index, that measures price changes in a basket of goods and services. In South Africa, inflation-linked bonds are generally indexed to the South African CPI as distributed by Statistics South Africa ("Stats SA"). Please note that it is the headline CPI that is used (i.e. the CPI for the historical metropolitan areas –all items) and not CPIX (Consumer Price Index excluding interest rates on mortgage bonds).

Inflation-linked instruments generally depend on lagged values of an inflation index (refer to section 2.4.9 of Appendix 2).

FAIR VALUE MEASUREMENT

i) Key valuation inputs

In order to measure the fair value of an inflation-linked bond employing a present value technique, the following valuation inputs are required:

- Contractual terms of instrument;
- Discount curve; and
- Inflation curve (in South Africa, CPI values are lagged).

Refer to Appendix 2 of this document for guidance regarding the relevant considerations in developing the required market inputs.

ii) Fair valuation methodology

The timing and amount of the contractually specified future cash flows arising from the inflation-linked bond are determined. The inflation rates used in the quantification of the expected future cash flows are obtained from the relevant inflation rate curve constructed. To the extent that the inflation rate applicable to the first coupon after the valuation point is known, the actual rate is used in the calculation of the first coupon, rather than the rate implied from the constructed inflation rate curve.

The related discount factor applicable to each cash flow is obtained from the constructed discount curve. Each future cash flow is discounted using the corresponding discount factor and an all-in price for the inflation-linked bond is formulated as the sum of the discounted future cash flows.

Once the all-in price has been calculated, the accrued interest on the inflation-linked bond at the valuation point is determined. Finally, the clean fair value is calculated as the difference between the all-in price and the accrued interest.

All-in price:

$$V(t) = \sum_{i=1}^{n} (N \cdot r_e \cdot \tau(t_{i-1}, t_i) \cdot \frac{CPI_{t_i}}{Base\ CPI} \cdot \mathrm{df}(t, T_i)) + (N \cdot \frac{CPI_{T_n}}{Base\ CPI} \cdot \mathrm{df}(t, T_n))$$

Accrued interest (if $t > t_0$ and $t < t_1$):

$$AI = N \cdot r_e \cdot \tau(t_0, t) \cdot \frac{CPI_{t_1}}{Base\ CPI}$$

where

$V(t)$ = value of instrument at the valuation point,

t = valuation point,

N = principal amount,

r_e = real interest rate (contractually specified and assumed to be fixed),

$\{t_0, t_1, \ldots, t_n\}$ = accrual dates,

$\tau(t_{i-1}, t_i)$ = day count fraction function over the relevant period,

CPI_{t_i} = reference CPI applicable in order to determine the amount payable in relation to the interest period ended t_i, determined in accordance with the contractual terms of the instrument and projected off the inflation curve,

$Base\ CPI$ = specific to a particular bond issue (contractually specified) and is equal to the CPI Index for the settlement date of the issue date of the bond (adjusted for the appropriate lag),

$\{T_1, T_2, \ldots, T_n\}$ = payment dates,

$\mathrm{df}(t, T_i)$ = discount factor from the relevant payment date to the valuation point, derived from discount curve,

T_n = maturity date,

$\mathrm{df}(t, T_n)$ = discount factor from maturity date to the valuation point, derived from discount curve,

AI = accrued interest on instrument.

Note – the formulae above have been simplified based on assumed characteristics of the instrument. The valuation approach applied should be adapted accordingly to take into account the specific nature, characteristics and terms of the instrument being valued.

3.8 ILLIQUID OR UNLISTED FIXED INCOME INSTRUMENTS

Prior to the introduction of fair value measurement principles into the accounting standards, when applying a mark-to-model approach, it was acceptable practice to value fixed income instruments at fair value with respect to changes in the discount curve (for example the swap curve, bond curve etc.) and, in the absence of any observed, significant deterioration in credit quality, assume that the spread over and above the discount curve charged for credit risk, liquidity risk and other factors remained constant since inception (referred to as the "at-inception spread").

For example, to value a loan at fair value under these assumptions, the at-inception spread would be determined such that, at inception, the instrument's cash flows discounted using the corresponding discount curve plus the at-inception spread, would equate to the instrument's issue price. At each subsequent valuation point, the discount curve would be updated, but the at-inception spread would be kept constant, unless objective evidence of the impairment of the instrument existed.

This approach is no longer permitted and the spread over and above the discount curve, along with the discount curve itself, must be assessed and updated, as appropriate, at each valuation point. However, in many instances, the spread cannot be directly observed in the market. It is therefore necessary to apply judgement in order to establish an appropriate approach to estimating the spread and determining the fair value of the instrument at the valuation point.

Regardless of the method used, due consideration should be afforded to ensuring meets the fair value measurement principles summarised in section 3.2 of Chapter 3.

AT-INCEPTION SPREAD

This approach has been described above and would only be considered acceptable in terms of the principles of fair value measurement if the instrument being valued had been issued or purchased recently (in relation to the valuation point). An assessment of whether market conditions or the credit quality of the issuer has changed significantly since the issue date or trade date of the instrument would be required in order to ensure that the spread is still reflective of conditions at the valuation point.

UPDATED SPREAD USING RECENT TRADE INFORMATION

Under this approach, a proxy instrument which has recently been issued (in relation to the valuation point), originated or purchased is identified. Similar to the above, it is important to consider that there have been no significant market movements leading up to the valuation point that would invalidate the use of the proxy instrument to determine the spread at the valuation point.

The at-inception spread for the proxy instrument over and above the discount curve as at the issue date of the proxy instrument is determined. This at-inception spread is subsequently added to the valuation point discount curve and used to discount the future cash flows arising from the instrument being valued in order to determine the fair value at the valuation point. Term to maturity, industry and credit quality are key factors, among others, to consider in selecting a proxy instrument. It is important to establish a suitable framework to assist in the identification of suitable proxy instruments, aligned to principles of fair value measurement.

SURVEY SPREAD

One possible source of updated spread information may be an appropriately constituted market consensus view of the appropriate spread ("survey spread") to be applied at the valuation point over and above the discount curve on instruments of similar maturity and credit quality to the instrument being valued. These spreads could be applied in different ways to fair value an instrument:

- The minimum and maximum survey spread quotes for a specific issuer type, credit rating and maturity bucket may be used to infer a reasonable range of spreads. Should the at-inception spread fall within this range, the use of the at-inception spread to value the instrument at the valuation point may be justified as reasonable. Should the at-inception spread fall outside of this range, another valuation methodology would need to be implemented.

- A curve per issuer type per credit rating is constructed at the valuation point by using the discount curve and the survey spread. The constructed curve is used to discount the future cash flows of the instrument and determine the fair value at the valuation point. This method captures the absolute spread.

- The at-inception spread would be determined such that, at inception, the instrument's cash flows discounted using the corresponding discount curve plus the at-inception spread, would equate to the instrument's issue price.

- To capture only the change in the spread, as opposed to the absolute spread, the curve constructed using the discount curve and survey spread at the inception / last trade date of the instrument (or a proxy instrument) is used to calibrate the model by determining a fixed, residual spread that, when added to the at-inception discount curve constructed using the at-inception survey spread, prices the instrument back to its inception value / trade price. This residual spread is kept constant and applied to the valuation point discount curve constructed using the valuation point survey spread to discount the future cash flows arising from the instrument and determine the instrument's fair value at the valuation point.

UPDATED PRICING FACTORS

In the absence of information regarding a total, updated spread, it may be possible to disaggregate the spread into its component factors and source information to update each significant component from the inception date to the valuation point. Key components of the spread are credit risk and liquidity risk, but other factors play a role as well, such as the regulatory capital requirements and required return on equity of the originator of the instrument, and supply / demand factors. For originators of instruments specifically, this approach of updating the various pricing factors is the most theoretically correct. Even if it is not possible to update all pricing factors, to update the most significant ones is more aligned to the principles of fair value measurement than to keep the at-inception spread constant.

This approach is applied by using the same model that was used to fair value the instrument at inception, updating the pricing factors for a similar instrument over the remaining term to maturity of the instrument being valued, with reference to current market conditions at the valuation point. A constant spread over and above the discount curve that would price this hypothetical instrument back to its model price (i.e. result obtained from the valuation model used) at the valuation point is determined. This spread is then used in the valuation of the instrument being valued.

In sourcing the information to update each significant component of the spread, it is important to consider the following key principles of fair value measurement (refer to section 3.9 of Chapter 3):

- Fair value is estimated from the perspective of a market participant that is independent, knowledgeable, willing and able to enter into the transaction);

- Information should be sourced from the principal market or, in the absence of a principal market, the most advantageous market).

CREDIT-ADJUSTED CASH FLOWS PLUS LIQUIDITY-ADJUSTED CURVE

Under this approach the valuation is updated for changes in credit risk and liquidity risk. The assumption is made that the spread over the discount curve in respect of all other risk factors remains constant from the inception / last trade date of the instrument (or a proxy instrument).

Cash flows are probability-weighted with reference to Probabilities of Default ("PDs") and loss given default ("LGD") parameters, in the same way as a credit default swap ("CDS") is valued (refer to section 4.13 of Appendix 4). In addition, the principles of fair value measurement recommend that consideration should be given to building in credit migration risk into the probability-weighted cash flows.

The probability-weighted cash flows are discounted using a discount curve that has been adjusted for liquidity risk such as a bank funding curve (a curve reflecting the difference between banks' funding spreads and the swap rates is an indication of the market price of liquidity – refer to Appendix 2 for additional information).

The model is calibrated by solving for the residual spread over and above the liquidity-adjusted curve that would price the instrument (or a proxy instrument) back to its inception / trade price, and then keeping this spread constant throughout the term of the instrument.

APPENDIX 4: DERIVATIVE INSTRUMENTS

4.1 INTRODUCTION

A derivative is a financial instrument or other contract that derives its value from one or more underlying financial or non-financial variables (also referred to as the 'underlying'). A derivative is a contract between two or more parties that requires either no initial net investment or an initial net investment that is smaller than would be required for other contracts with a direct exposure to the underlying.

The most common underlying assets referenced in derivative contracts include equity instruments, bonds, commodities, currencies, interest rates, market indices and other derivative contracts. Futures contracts, forward contracts, options and swaps are the most common types of derivative instruments.

Derivative instruments are employed for a number of purposes, including arbitrage, hedging and speculative trading.

Derivative instruments may be traded on an exchange or OTC. Exchange-traded derivatives are standardised while OTC derivative instrument contracts are generally customised to the needs of the parties to the derivative contract.

An investor in an exchange-traded derivative is obliged to place a margin deposit with the exchange upon entering into a trade, known as the initial margin. The initial margin is an amount determined by the exchange and is usually a percentage of the value of the contract. Subsequently, the derivative contract is marked-to-market on a daily basis by the exchange (procedure of adjusting the margin account balance for daily movements in the instrument price) and to the extent that adverse price movements have caused the margin deposit to fall below the required margin level, a variation margin becomes payable by the investor. Margin requirements imposed by exchanges reduce the counterparty credit risk to which the investor is exposed when compared to OTC derivative contracts that in some instances do not impose similar requirements. However, the introduction of margin requirements on OTC derivatives is expected, consistent with international developments.

All derivative instruments must be measured at fair value.

The derivative universe continues to expand as investment professionals continue to structure and develop instruments. This appendix provides an overview of valuation principles and guidelines for the most commonly traded derivative instruments and does not comprise an exhaustive list.

The valuation formulae and guidance provided in this appendix is intended to illustrate the fundamental valuation principles for a selection of instruments. Simplifying assumptions regarding the nature and characteristics of each instrument have been made. As a result, the use of the guidance in this appendix should be adapted, as appropriate, to take into account the specific terms and conditions of the instrument being valued, as well as current market best practice.

For each instrument type addressed in this appendix, the fair value measurement guidance provided is focused on risk-neutral valuation methodologies. However, in order to determine a measure of fair value, there may be a need to take into account adjustments for aspects that a market participant would consider when pricing the instrument. Examples may include a liquidity discount for a thinly-traded instrument or an xVA adjustment to take into account the risk of counterparty default. Refer to section 3.3 of Chapter 3 and section 2.8 of Appendix 2 for further details with respect to fair value adjustment considerations.

This appendix should be read in conjunction with Appendix 2, which provides an overview of key fundamental principles underpinning the concepts addressed in this chapter (including guidance with respect to the development of relevant model inputs).

Finally, in valuing an instrument, the timing of future cash flows is a critical consideration and it is therefore important to take into account the settlement date conventions for the relevant market (refer to section 2.9 of Appendix 2). For example, the settlement date of a contract occurs after a pre-specified number of business days following the maturity or expiry date of the contract – as a result, the timing of the future cash flows under the contract should be determined accordingly when performing the valuation.

4.2 FUTURES CONTRACTS

DEFINITION

A futures contract is similar to a forward contract, with the key exception that it is an exchange-traded product. A futures contract is a formalised, legally binding agreement to buy or sell a certain amount of an instrument at a specified price and future date (i.e. maturity date or expiration date). The terms of futures contracts are highly standardised.

The underlying asset in a futures contract varies from agricultural products to various indices. Most futures positions are not held to take delivery of the underlying asset and are instead closed out or rolled forward prior to the settlement date of the contract.

FEATURES OF INSTRUMENT

The purchaser of a futures contract holds a long position, while the seller of a futures contract has taken a short position. The long has contracted to buy the instrument at the contract price at contract expiration and the short has an obligation to sell at that price. However, because a futures contract is exchange-traded, the buyer and the seller each face the clearinghouse as the opposite side to the transaction (refer to section 3.6 of Chapter 3 for an overview of the interaction between an exchange and a clearinghouse).

The spot price of an instrument is the price for immediate delivery. The futures price is the price today for delivery at some future point in time (i.e. the maturity date). The basis is the difference between the spot price and the futures price. As the maturity date approaches, the basis converges to zero. At expiration, the spot price must equal the futures price because the futures price has become the price today for delivery today, which is the same as the spot. Arbitrage will force the prices to be the same at contract expiration.

A futures contract may be terminated in one of three different ways:

- The delivery by the short futures position and the acceptance by the long futures position, of the underlying asset upon maturity of the futures contract (all the terms of delivery are established up front by the exchange);

- Cash settlement of the marked-to-market settlement amount at the maturity date of the futures contract (i.e. net cash settlement); or

- Reversal or offsetting of trades when an exact opposite trade to the futures position held is executed on the exchange. The clearinghouse nets the two positions leaving a zero balance.

Futures contract terms are standardised by the exchange. Terms specified may include, quality of the underlying asset, contract size, expiry dates and time, delivery location and time, price quotation and other terms specific to the exchange (e.g. limits). For example, in the case of a bond futures contract, some exchanges may afford the short position a choice from a pre-specified list of bonds that may be delivered to close out the position.

Futures contracts may be used by speculators to gain exposure to changes in the price of the asset underlying a futures contract. A hedger, in contrast, uses futures contracts to reduce exposure to price changes in the instrument (e.g. a CIS that is seeking to reduce the uncertainty about the price it will receive upon the sale of a specified portfolio instrument).

Futures contracts are marked-to-market by the exchange on a daily basis (based on the futures price), meaning that the accumulated gains and losses from the previous days' trading session are deducted from the margin accounts of investors holding loss-making positions and transferred to the margin accounts of investors holding profit-making positions. This daily settling allows a futures exchange to provide a credit guarantee for the successful execution of a futures contract, facilitated through the use of a clearinghouse. An important consequence of the use of margin accounts is the effect of the interest earned or incurred on the margin account which allows for the quantification of daily profit or loss.

FAIR VALUE MEASUREMENT

As a futures contract is, by definition, an exchange-traded product, price information for the instrument will be provided by the exchange. Provided the price of the futures contract is sourced from an active market at the valuation point and is based on actual transaction data, the exchange price (multiplied by the contract size (e.g. number of instruments, nominal amount of currency or tonnage of a commodity)) will equal the risk-neutral fair value of the futures contract.

Refer to section 3.5 of Chapter 3 for guidance with respect to the sourcing of price information.

If the exchange price for a futures contract is not considered to be representative of fair value, the development and application of an alternative valuation technique to measure fair value at the valuation point is required. It is suggested that in these instances, consideration should be afforded to the fair value measurement principles set out in Chapter 3, in conjunction with the guidance on the valuation of forward contracts (refer to section 4.3 of this appendix), adapted for the distinguishing characteristics of a futures contract.

4.3 FORWARD CONTRACTS

DEFINITION

A forward contract is traded in the OTC market and specifies the price and quantity of an instrument to be delivered at a pre-determined point in the future (i.e. maturity / expiration date). There is no standardisation for forward contracts. One party takes the long position, agreeing to purchase the underlying asset at a future date for a specified price, while the other party is the short position, agreeing to sell the instrument on that same date for that same price. For example, forward contracts may be used to hedge foreign currency risk by fixing the exchange rate to be applied at some point in the future.

A distinguishing feature of the OTC market is that it is bilateral market, with counterparty's facing each other directly. A key implication of this is that each counterparty is directly exposed to the credit risk of the other (counterparty credit risk).

Since the terms of OTC contracts are not specified by an exchange, participants in the OTC market have more flexibility to negotiate mutually agreeable, customised trades,

FEATURES OF INSTRUMENT

Futures contracts and forward contracts are similar in that both:

- Allow for settlement to take place at a future date at a price agreed upon today; and
- Can be settled in cash or through the delivery of the underlying asset.

Futures contracts and forward contracts differ in the following ways:

- Futures contracts trade on organised exchanges. Forward contracts are private contracts and do not trade on an exchange;
- Futures contracts are highly standardised. Forward contracts are customised contracts to meet the needs of the parties involved; and
- A clearinghouse is the counterparty to all futures contracts. Forward contracts are contracts with the originating counterparty.

The payoff for a forward contract, both a long position and a short position, are expressed in the formulae below:

The simplified payoff to a long position is:

$$\text{payoff} = S_T - K$$

The simplified payoff to a short position is:

$$\text{payoff} = K - S_T$$

where

S_T = Spot price at maturity

K = strike price / delivery price.

The payoff is graphically depicted in Figure 1 below:

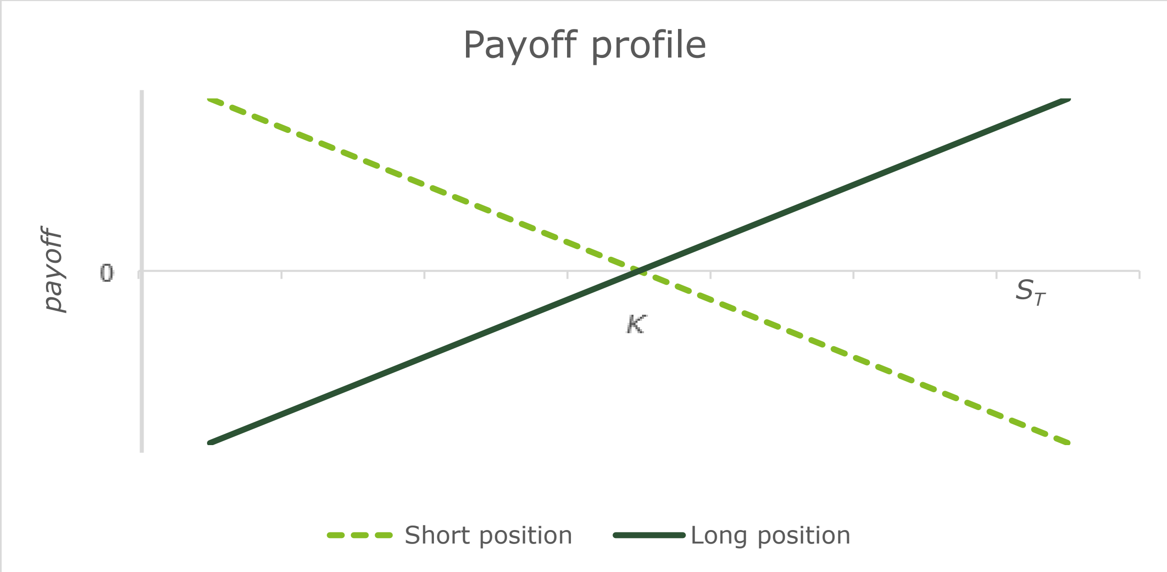


Figure 8 – Forward Contract Pay-off Profile

FAIR VALUE MEASUREMENT

The key driver of the value of a forward contract is the differential between the expected spot price at maturity and the strike price (or exercise price) agreed in the forward contract.

The pricing model used to compute forward prices makes the following assumptions:

i) No transaction costs or short-sale restrictions;

ii) Same tax rates on all net profits;

iii) Borrowing and lending at the risk-free rate; and

iv) Arbitrage opportunities do not exist.

The general formula for the determination of a forward price is:

$$F_T = S_t \, e^{r \, \tau(t,T)}$$

where

F_T = forward price at time maturity,

T = maturity date,

S_t = Spot price at time t,

t = valuation point,

r = risk-free rate plus a spread (may be repo spread, basis, cost of carry, dividend yield depending on nature of underlying asset),

$\tau(t,T)$ = day count fraction between the valuation point and the maturity date.

The right hand side of the above equation is the cost of borrowing funds to buy the underlying asset and carrying it forward to time *T*. This cost is equal to the forward price. If $F_t > S_t \, e^{r_f \, \tau(t,T)}$, then arbitrageurs will profit by selling the forward and buying the instrument with borrowed funds. If $F_t < S_t \, e^{r_f \, \tau(t,T)}$, arbitrageurs will profit by selling the instrument, lending out the proceeds, and buying the forward.

Therefore, the equation for the forward price, as specified above, must hold. Note that this model assumes perfect markets. Refer to section 2.2 of Appendix 2 for further detail regarding the concept of no-arbitrage arguments.

The forward price formula above can be adjusted to take into account specific characteristics of the underlying asset, such as costs of carry and dividends. Similarly, the settlement terms of forward contracts require specific consideration in determining the appropriate valuation applicable (i.e. the valuation of non-deliverable forward contracts (forward contracts settled net in cash) compared to deliverable forward contracts (forward contracts settled gross in cash and the physical delivery of the underlying asset)).

The fair value of a forward contract is equal to the present value of the payoff:

$$V(t) = (F_T - K) \cdot \mathrm{df}(t, T)$$

where

$V(t)$ = value of forward contract at the valuation point,

t = valuation point,

F_T = forward price at maturity,

T = maturity date,

K = strike price for instrument under the forward contract,

$\mathrm{df}(t, T)$ = discount factor from the maturity date to the valuation point, derived from the discount curve,

This is different to the valuation of a futures contract which is equal to the exchange futures price (refer below).

Section 4.3.1 to 4.3.5 of this appendix provide specific application of the principles described above to selected forward contracts referencing varying instrument classes.

COMPARING THE PRICING OF FUTURES CONTRACTS AND FORWARD CONTRACTS

Because the mark-to-market of a futures contract is settled daily and interest on the margin is applicable, there is no discounting of the payoff when performing the valuation of a futures contract.

When interest rates are deterministic and fixed over the life of the contract, forward and futures prices can be shown to be the same. Various relationships can be derived, depending on the assumptions made between the value of the underlying and the level of change in interest rates.

4.3.1 EQUITY FORWARD CONTRACT / EQUITY INDEX FORWARD CONTRACT

DEFINITION

An equity forward contract is an agreement that requires the buyer of the contract to purchase (long position), or the seller of the contract to sell (short position), an underlying equity instrument at a predetermined future date (i.e. maturity date) and price (i.e. strike price). The underlying may also reference an equity index (in the case of an equity index forward contract).

FEATURES OF INSTRUMENT

The value of the forward contract is directly correlated to the underlying equity instrument price or equity index price.

The terms of a forward contract (including settlement terms) are customised according to the needs of the parties to the contract.

Generally, no dividends are paid on an equity forward contract or an equity index forward contract, unless traded alongside a dividend forward contract (refer to section 4.3.2 of this chapter).

FAIR VALUE MEASUREMENT

i) Key valuation inputs

In order to measure the fair value of an equity forward contract using the methodology set out below, the following valuation inputs, determined at the valuation point, are required:

- Contractual terms of the forward contract (including the strike price, maturity date, underlying asset details);
- Equity or equity index spot price (in the absence of a quoted price in an active market, refer to the guidance in Appendix 5 for guidance);
- Dividend yield or forecast dividend amounts on underlying equity instrument or equity index (including forecast dividend payment dates); and
- Discount curve.

Refer to Appendix 2 for guidance regarding the relevant considerations in developing the required market inputs.

ii) Risk-neutral valuation methodology

The value of a forward contract is determined as the difference between the forward price and strike price under the futures contract, discounted to the valuation point by applying the discount factor corresponding to the expected timing of the cash flow. The discount factor is derived from the constructed discount curve.

To determine the risk-neutral value of an equity forward contract or an equity index forward contract:

Value of a long forward contract:

$$V(t) = (F_T - K) \cdot \mathrm{df}(t, T)$$

Value of a short forward contract:

$$V(t) = (K - F_T) \cdot \mathrm{df}(t, T)$$

The forward price of the underlying asset is determined in accordance with the following formulae, adjusted for any dividends earned on the underlying asset, from the valuation point until the maturity of the forward contract:

- Forward price (F_T) - instrument pays no dividends:

$$F_T = S_t \, e^{r_f \, \tau(t,T)}$$

- Forward price (F_T) - instrument pays discrete dividends:

$$F_T = (S_t - I(t))e^{r_f \, \tau(t,T)}$$

  and the present value of dividends on the underlying asset, at the valuation point ($I(t)$):

$$I(t) = \sum_{i=1}^{n} D_i \cdot \mathrm{df}(t, T_i)$$

- Forward price (F_T) - instrument provides known yield:

$$F_T = S_t e^{(r_f - q)\, \tau(t,T)}$$

where

$V(t)$ = value of forward contract at the valuation point,

t = valuation point,

F_T = forward price (applicable at maturity of the contract) determined at the valuation point,

T = forward contract maturity (delivery) date,

K = strike price for instrument under the forward contract,

$\mathrm{df}(t,T)$ = discount factor from the maturity date to the valuation point, derived from the discount curve,

S_t = Spot price of underlying asset at the valuation point,

r_f = risk-free rate, determined at the valuation point,

$\tau(t,T)$ = day count fraction between the valuation point and the maturity date,

$I(t)$ = present value, at the valuation point, of known dividend income on the underlying asset,

D_i = expected dividend payment amount from underlying asset on each payment date T_i,

$\{T_1, T_2, \ldots, T_n\}$ = dividend payment dates over the remaining term of the forward contract,

$\mathrm{df}(t,T_i)$ = discount factor from the relevant dividend payment date to the valuation point, derived from the discount curve,

q = average annualised dividend yield rate over term of forward contract with continuous compounding, determined at the valuation point.

4.3.2 DIVIDEND FORWARD CONTRACT

DEFINITION

A dividend forward contract is an agreement that allows an investor to take a position (long or short position) on the amount of dividends paid out on a single equity instrument or an index over a defined period of time. The dividend forward contract effectively pays out the difference between the implied / assumed dividend and the actual dividend declared on the equity instrument / index, at a specified point in time (i.e. maturity date).

In some instances, dividend forward contracts are traded along with the associated equity or index forward contract for the purpose of hedging against the dividend assumption risk inherent in the contract.

FEATURES OF INSTRUMENT

There are two types of dividend forward contracts:

- Dividend forward contracts referencing a single equity instrument (referred to as single stock dividend forward contract); and
- Dividend forward contracts referencing a specific index (referred to as index dividend forward contract).

Dividend forward contracts settle to the realised value of dividend payments in a future period, as referenced in the forward contract. For index dividend forward contracts specifically, the final settlement price is based on the index level of the underlying dividend point index. The dividend point index is calculated on a daily basis by the exchange and measures the total cash dividend value for all constituents of the underlying index expressed in terms of index points.

The dividend forward price should only include future assumed dividends. As a result, actual dividends, from the ex-dividend date corresponding to the underlying equity instrument or index, are removed from the valuation of the forward contract.

The terms of a forward contract (including settlement terms) are customised according to the needs of the parties to the contract.

FAIR VALUE MEASUREMENT

i) Key valuation inputs

In order to measure the fair value of a dividend forward contract using the methodology set out below, the following valuation inputs, determined at the valuation point, are required:

- Contractual terms of the forward contract (including the strike price, maturity date, underlying asset details);
- Expected dividend yield or forecast dividend amounts on underlying equity instrument or index (including forecast dividend payment dates);
- Discount curve derived from relevant risk-free rates.

Refer to Appendix 2 for guidance regarding the relevant considerations in developing the required market inputs.

ii) Risk-neutral valuation methodology

The value of a dividend forward contract at inception is zero. Thereafter and in general, the value of a forward contract is determined as the difference between the forward price and the strike price specified in the forward contract, discounted to the valuation point by applying the discount factor corresponding to the expected timing of the cash flow. The discount factor is derived from the constructed discount curve.

The forward price of a dividend forward contract is the discounted sum of dividends expected on the underlying asset, from the valuation point until the maturity of the forward contract.

Value of a long forward contract:

$$V(t) = \left(\sum_{i=1}^{n} D_i \cdot \mathrm{df}(t, T_i)\right) - (K \cdot \mathrm{df}(t, T))$$

Value of a short forward contact:

$$V(t) = (K \cdot \mathrm{df}(t, T)) - \left(\sum_{i=1}^{n} D_i \cdot \mathrm{df}(t, T_i)\right)$$

where

$V(t)$ = value of forward contract at the valuation point,

t = valuation point,

D_i = expected dividend payment on underlying asset on each payment date T_i,

$\{T_1, T_2, \ldots, T_n\}$ = dividend payment dates over the remaining term of the forward contract,

$\mathrm{df}(t, T_i)$ = discount factor from the relevant dividend payment date to the valuation point, derived from the discount curve,

K = contractually specified dividend (strike) under the dividend forward contract,

T = forward contract maturity (delivery) date,

$\mathrm{df}(t, T)$ = discount factor from the maturity date to the valuation point, derived from the discount curve.

4.3.3 COMMODITY FORWARD CONTRACT

DEFINITION

A commodity forward contract is an agreement that requires the buyer of the contract to purchase (long position), or the seller of the contract to sell (short position), an underlying commodity at a predetermined future date (i.e. maturity date) and price (i.e. strike price).

FEATURES OF INSTRUMENT

The value of the future is directly correlated to the underlying commodity.

When considering the valuation of a forward contracts, it is important to distinguish the underlying as either an investment instrument or a consumption instrument. An investment instrument is an instrument that is held for investment purposes by significant numbers of investors (e.g. equity instruments, bonds, gold, silver). A consumption instrument is an instrument that is held primarily for consumption purposes (e.g. copper, oil).

The valuation of a commodity forward contract referencing an underlying consumption asset introduces the following additional considerations (compared to a forward contract referencing an underlying investment asset):

- **Convenience yield**
  The convenience yield refers to the benefits from holding the physical instrument (e.g. holding of an instrument capable of being used by a manufacturer in a production process will not be regarded in the same way as a forward contract on the instrument in question); and

- **Storage costs**
  Storage costs increase the carrying costs of a consumption instrument and relate to the costs of storing the instrument, according to its requirements, over the term of the forward contract;

FAIR VALUE MEASUREMENT

i) Key valuation inputs

In order to measure the fair value of a commodity forward contract using the methodology set out below, the following valuation inputs, determined at the valuation point, are required:

- Contractual terms of the forward contract (including the strike price, maturity date, underlying asset details);
- Spot price of underlying asset;
- Expected yield or forecast income on underlying asset (including forecast income payment dates) (e.g. lease income earned);
- Convenience yield (where underlying is a consumption asset);
- Storage costs rate (where underlying is a consumption asset); and
- Discount curve derived from relevant risk-free rates.

Refer to Appendix 2 for guidance regarding the relevant considerations in developing the required market inputs.

ii) Risk-neutral valuation methodology

The value of a commodity forward contract at inception is zero. Thereafter and in general, the value of a forward contract is determined as the difference between the forward price and strike price specified in the forward contract, discounted to the valuation point by applying the discount factor corresponding to the expected timing of the cash flow. The discount factor is derived from the constructed discount curve.

To determine the risk-neutral value of a commodity forward contract:

Value of a long forward contract:

$$V(t) = (F_T - K) \cdot \mathrm{df}(t, T)$$

Value of a short forward contract:

$$V(t) = (K - F_T) \cdot \mathrm{df}(t, T),$$

The determination of the forward price of the underlying asset will be influenced by the type of instrument (investment instrument or consumption instrument). The forward price of an investment instrument will be adjusted for any income earned on the underlying asset, from the valuation point until the maturity of the forward contract. The forward price of a consumption instrument, on the other hand, requires adjustment for the costs of storage as well as any benefits that a market participant would assign to the physical holding of the instrument, applicable from the valuation point until the maturity of the forward contract.

Investment assets (underlying)

- Forward price (F_T) – underlying asset provides no income:

$$F_T = S_t e^{r_f \, \tau(t,T)}$$

- Forward price (F_T) – underlying asset provides known income:

$$F_T = (S_t - I(t))e^{r_f \, \tau(t,T)}$$

  and the present value of known income ($I(t)$) on the underlying asset, at the valuation point:

$$I(t) = \sum_{i=1}^{n} m_i \cdot \mathrm{df}(t, T_i)$$

- Forward price (F_T) – underlying asset provides a known yield:

$$F_T = S_t \, e^{(r_f - q) . \, \tau(t,T)}$$

Consumption assets (underlying)

- Forward price (F_T) – underlying asset provides income and requires storage costs:

$$F_T = S_t e^{(c-y) \, . \, \tau(t,T)}$$

  and the cost of carry (c) – the cost of carry which measures the interest paid to finance the instrument plus the storage costs, reduced by the income earned on the instrument:

$$c = r_f + u - q$$

where

$V(t)$ = value of forward contract at the valuation point,

t = valuation point,

F_T = forward price (applicable at maturity of the contract) determined at the valuation point,

T = forward contract maturity (delivery) date,

K = strike price under the forward contract,

$\{T_1, T_2, \dots, T_n\}$ = dividend payment dates over the remaining term of the forward contract,

$\mathrm{df}(t, T)$ = discount factor from the maturity date to the valuation point, derived from the discount curve,

S_t = Spot price of underlying asset at the valuation point,

r_f = risk-free rate, determined at the valuation point,

$\tau(t, T)$ = day count fraction between the valuation point and the maturity date,

$I(t)$ = present value, at the valuation point, of known income on the underlying asset,

m_i = expected income payment on underlying asset on each payment date T_i,

$\mathrm{df}(t, T_i)$ = discount factor from the relevant income payment date to the valuation point, derived from the discount curve,

q = average annualised income yield rate over remaining term of forward contract with continuous compounding, determined at the valuation point,

c = cost of carry (average annualised rate with continuous compounding), determined at the valuation point,

y = convenience yield (average annualised rate with continuous compounding), determined at the valuation point,

u = average annualised storage costs rate over life of forward contract with continuous compounding, determined at the valuation point.

4.3.4 BOND FORWARD CONTRACT / BOND INDEX FORWARD CONTRACT

DEFINITION

A bond forward contract is an agreement that requires the buyer of the contract to purchase (long position), or the seller of the contract to sell (short position), an underlying bond at a predetermined future date (i.e. maturity date) and price (i.e. strike price).

A bond index forward contract is similar to a bond forward contract with the exception that the underlying references a bond index. A bond index forward contract allows investors to gain exposure to an underlying basket of bonds (without actually owning the basket or its constituents).

Bond forward contracts trade at a yield to maturity and are quoted on this basis. Bond index forward contracts are generally quoted on the basis of an index level.

FEATURES OF INSTRUMENT

The value of the forward contract is directly correlated to the underlying bond or bond index.

The terms of a forward contract (including settlement terms) are customised according to the needs of the parties to the contract.

Since a forward contract provides the right to purchase an instrument (e.g. a bond) at a future date, the holder of the forward contract is generally not entitled to the income (e.g. coupon payments on the bond) until maturity of the forward contract. If, at maturity, the forward contract is settled by delivery of the underlying asset, from this point onwards the forward contract holder becomes the holder of the instrument and is entitled to receive any income generated by the instrument. Bond index forward contracts are, however, generally settled in cash (i.e. physical delivery is not permitted).

FAIR VALUE MEASUREMENT

i) Key valuation inputs

In order to measure the fair value of a bond forward contract using the methodology set out below, the following valuation inputs, determined at the valuation point, are required:

- Contractual terms of the forward contract (including the strike price, maturity date, underlying asset details (i.e. principal amount, interest calculation and payment terms etc.));
- Spot price of the bond or bond index (in the absence of a quoted price in an active market, refer to the guidance in Appendix 3 for guidance);
- Forward rate curve (if underlying bond references a floating benchmark rate); and
- Discount curve.

Refer to Appendix 2 for guidance regarding the relevant considerations in developing the required market inputs.

ii) Risk-neutral valuation methodology

The value of a bond forward contract at inception is zero. Thereafter and in general, the value of a forward contract is determined as the difference between the forward price and strike price specified in the forward contract, discounted to the valuation point by applying the discount factor corresponding to the expected timing of the cash flow. The discount factor is derived from the constructed discount curve.

To determine the risk-neutral value of a bond forward contract (the formulae below are generic and are applicable for both fixed and floating rate bonds.)

Value of a long forward contract:

$$V(t) = (F_T - K) \cdot \mathrm{df}(t, T)$$

Value of a short forward contract:

$$V(t) = (K - F_T) \cdot \mathrm{df}(t, T)$$

The forward price is the underlying bond's current spot price plus the cost of holding the bond until maturity of the forward contract (i.e. the interest on the funds that would have been borrowed to buy the bond and hold it until expiry of the forward contract), minus any income from coupons:

- Bond forward price (F_T) (note that the term $e^{r_b\,\tau(t,T)}$ may be referred to as the cost of carry):

$$F_T = (S_t - I(t)) \cdot e^{r_b\,\tau(t,T)}$$

  and the value of the coupons on the underlying asset ($I(t)$), **earned and paid over the remaining term of the forward contract** (i.e. coupon payments that will not be received by the holder of the forward contract – note that these will be determined in accordance with the settlement and book-close conventions of the market within which the bond forward contract is traded). All coupons where $T_i > t$ and $T_i < T$:

$$I(t) = \sum_{i=1}^{n} N \cdot (f_{i-1} + s) \cdot \tau(t_{i-1}, t_i) \cdot \ \mathrm{df}(t, T_i)$$

where

$V(t)$ = value of forward contract at the valuation point,

t = valuation point,

F_T = forward price (applicable at maturity of the contract) at the valuation point,

T = forward contract maturity (delivery) date,

K = strike price under the forward contract,

$\mathrm{df}(t, T)$ = discount factor from the maturity date to the valuation point, derived from the discount curve,

S_t = all-in spot price of the underlying bond at the valuation point,

$I(t)$ = present value, at the valuation point, of known income on the underlying asset,

r_b = the risk-free rate derived from discount curve (or the yield to maturity) inclusive of the repo rate, determined at the valuation point,

$\tau(t, T)$ = day count fraction between the valuation point and the maturity date,

N = principal amount of the underlying bond,

$f_{i-1} = f(t; \tilde{t}_{i-1}, \tilde{t}_{i-1} + tenor)$ = in the case of a floating rate bond, the forward rate for the reference index that resets at time $\tilde{t}_{i-1}$, else in the case of a fixed rate bond it is zero,

$\{\tilde{t}_0, \tilde{t}_1, \ldots, \tilde{t}_{n-1}\}$ = reset dates with respect to the coupons on the underlying bond,

$tenor$ = floating rate applicable for underlying bond (in the case of a floating rate bond),

s = contractually specified coupon in the case of a fixed rate bond or a fixed spread over the benchmark rate in the case of a floating rate bond),

$\{t_0, t_1, \ldots, t_n\}$ = interest accrual dates on the underlying bond that coincide with the remaining term of the forward contract,

$\tau(t_{i-1}, t_i)$ = day count fraction function over the relevant period,

$\{T_1, T_2, \ldots, T_n\}$ = coupon payment dates on the underlying bond that coincide with the remaining term of the forward contract,

$\mathrm{df}(t, T_i)$ = discount factor from the relevant dividend payment date to the valuation point, derived from the discount curve.

Example
The price of a bond forward contract is the underlying bond's current spot price plus the cost of carry to hold this bond until the future delivery date (t+3 of the futures maturity date) minus any income from coupons.

Bond futures price = Spot Price + Cost of Carry – Income from coupons

where

- Bond futures price: The price of the bond forward;
- Valuation point**:** The day on which the bond future is valued;
- Spot price: The spot price used to calculate the forward price, is the spot price of the underlying bond. This is the current all-in-price of the relevant bond (for settlement t+3).
- Cost of carry: The interest on the funds that would have been borrowed to buy the bond and hold it until the date the underlying bond will be physically delivered, once the forward expires. The funds will be the current spot price of the bond. The funds will accrue interest at the market related risk-free rate.

Note the adjustments for settlement date conventions in the examples below (refer to refer to section 2.9.3 of Appendix 2 for further details in this regard).

The first step in performing the valuation of a bond forward contract is to quantify the value of the coupons, $I(t)$). The income from coupons that will be paid out by the underlying bond during the term of the forward contract, are subtracted from the forward price. The coupon dates that affect the forward price are all coupons paid out in the period between the valuation point, t, and the maturity date, T. It will also include the coupon payment date, directly following the maturity date (T), if the maturity date falls within the books-close period.

- Example 1:
  Consider a bond forward contract with the following specifications:

Underlying	Bond X
Maturity date	04/02/2016
Maturity settlement date (T)	09/02/2016

The R186 bond has the following features:

Maturity date	21/12/2026
Coupon rate	10.5%
Coupon dates	21 June and 21 December
Books-close dates	11 June and 11 December

Valuation point is 5 May 2015.
Valuation settlement date is 8 May 2015.
Then the coupon dates affecting the bond forward price are **=** 21 June 2015 and 21 December 2015 (i.e. these coupons will be used in the calculation of $I(t)$).

- Example 2:
  Consider a bond forward contract with the following specifications:

Underlying	Bond Y
Maturity date	07/05/2015
Maturity settlement date	12/05/2015

  Valuation point is 5 May 2015.
  Valuation settlement date is 8 May 2015.
  There are no coupon dates affecting the bond forward price (i.e. there is no value for $I(t)$).

- Example 3:
  Consider a bond future with the following specifications:

Underlying	Bond Z
Maturity date	09/06/2016
Maturity settlement date	14/06/2016

  Valuation point is 5 May 2015.
  Valuation settlement date is 8 May 2015.
  The coupon dates affecting the bond forward contract are 21 June 2015 and 21 December 2015 (included because the settlement date of the bond forward contract, falls within the book-close period for the bond coupon payment (all holders of the bond at book-close are entitled to receive the coupon payment)).

Once the value of the coupons have been determined, the valuation of the bond forward can be determined. The following consolidated example represents all the calculation steps:

- Example 4:
  Consider a long position in a bond forward contract with the following specifications:

Underlying	Bond ABC
Strike price (K)	110
Maturity date	4 February 2016
Maturity settlement date (based on market's settlement cycle) (T)	9 February 2016

  Bond ABC is a fixed rate bond and has the following features:

Maturity date	21 December 20X9
Principal amount (N)	100
Coupon rate (coupons payable semi-annually)	10.5%
Semi-annual coupons ($N \cdot (f_{i-1} + s) \cdot \tau(t_{i-1}, t_i)$)	5.25
Coupon dates	21 June and 21 December
Book-close dates	11 June and 11 December
Day count convention	Actual / 365 Fixed
All-in spot price of Bond ABC at valuation point (S_t)	121.98

Valuation point (t) is 5 May 2015.

The coupon dates affecting the bond forward price are **=** 21 June 2015 and 21 December 2015 (i.e. these coupons will be used in the calculation of $I(t)$).

- The period from the valuation point to the first coupon date, in accordance with the relevant day count convention is (21 June 2015 – 5 May 2015)/365 ($\tau(t, T_1)$).
- The period from the valuation point to the second coupon date, in accordance with the relevant day count convention is (21 December 2015 – 5 May 2015)/365 ($\tau(t, T_2)$).

Assume a flat risk-free rate (r_b) of 6.715% (assume the rate is continuously compounded) was determined at the valuation point and applies up to the maturity of the forward contract (note that in practice a term structure of interest rates would need to be sourced):

- The discount factor from the first coupon date to the valuation point is 0.999815839 ($\mathrm{df}(t, T_1) = e^{-(6.715\% \cdot \tau(t,T_1))}$),
- The discount factor from the first coupon date to the valuation point is 0.958569032 $\mathrm{df}(t, T_2) = e^{-(6.715\% \cdot \tau(t,T_2))}$,
- The discount factor from the first coupon date to the valuation point is 0.949791940 ($\mathrm{df}(t, T) = e^{-(6.715\% \cdot \tau(t,T))}$).

As income is generated on the underlying asset over the term of the forward contract, the value of the coupons is calculated:

$$I(t) = \sum_{i=1}^{n} N \cdot (f_{i-1} + s) \cdot \tau(t_{i-1}, t_i) \cdot \mathrm{df}(t, T_n)$$

$$I(t) = \left(5.25 \cdot \mathrm{df}(t, T_1)\right) + \left(5.25 \cdot \mathrm{df}(t, T_2)\right) = 10.2859$$

The forward price of the bond, determined on the valuation point, is:

$$F_T = (S_t - I(t))e^{r_b \, \tau(t,T)}$$

$$F_T = (121.98 - 10.2859)e^{6.715\% \cdot \tau(t,T)} = 117.5984$$

The value of the long forward contract, at the valuation point, is:

$$V(t) = (F_T - K) \cdot \mathrm{df}(t, T)$$

$$V(t) = (117.5984 - 110) \cdot \mathrm{df}(t, T) = 7.22$$

4.3.5 CURRENCY FORWARD CONTRACTS (FORWARD EXCHANGE CONTRACTS)

DEFINITION

A currency forward contract, also known as a Forward Exchange Contract ("FEC") is an agreement to exchange one currency for another at a predetermined future date (i.e. maturity date) and exchange rate (i.e. strike).

FEATURES OF INSTRUMENT

The value of the forward contract is directly correlated to the exchange rate differential between the underlying currencies specified in the contract.

The terms of a forward contract are customised according to the needs of the parties to the contract. Currency forward contracts are generally settled in cash.

FAIR VALUE MEASUREMENT

i) Key valuation inputs

In order to measure the fair value of a currency forward contract using the methodology set out below, the following valuation inputs, determined at the valuation point, are required:

- Contractual terms of the instrument (including the contractual exchange rate, maturity date, notional amount, underlying currency pair);
- Spot exchange rate at valuation point (amount of domestic currency per unit of foreign currency);
- Risk-free rates for the currency pair referenced in the forward contract; and
- Discount curve (cross-currency basis curve – generally on domestic and foreign curve).

Refer to Appendix 2 of this document for guidance regarding the relevant considerations in developing the required market inputs.

ii) Risk-neutral valuation methodology

The value of a currency forward contract at inception is zero. Thereafter and in general, the value of a forward contract is determined as the difference between the forward price (i.e. the forward exchange rate) and the strike price (i.e. the exchange rate specified in the forward contract), discounted to the valuation point by applying the discount factor corresponding to the expected timing of the cash flow. The discount factor is derived from the constructed discount curve.

The determination of the forward exchange rate is based on the application of the no-arbitrage, interest rate parity relationship, which states that the forward exchange rate (F_T) (measured in domestic per unit of foreign currency), must be related to the spot exchange rate (S_t) and to the interest rate differential between the domestic and the foreign country ($r_{dom} - r_{for}$).

Value of a long futures contract in domestic currency (exchange rate is quoted as number of domestic currency per unit of foreign currency):

$$V(t) = ((F_T - K) \cdot \mathrm{df}(t,T)) \cdot N_{dom}$$

and the value of a short futures contract in domestic currency (exchange rate is quoted as number of domestic currency per unit of foreign currency):

$$V(t) = ((K - F_T) \cdot \mathrm{df}(t,T)) \cdot N_{dom}$$

- Forward exchange rate (i.e. the forward price (F_T)):

$$F_T = S_t e^{(r_{dom} + b - r_{for})\,\tau(t,T)}$$

where

$V(t)$ = value of forward contract at the valuation point,

t = valuation point,

F_T = forward price (forward exchange rate (amount of domestic currency per unit of foreign currency)),

T = forward contract maturity (delivery) date,

K = strike price under the forward contract (amount of domestic currency per unit of foreign currency),

$\mathrm{df}(t,T)$ = discount factor from the maturity date to the valuation point, derived from the domestic discount curve,

N_{dom} = notional amount of the forward contract in domestic currency,

S_t = spot exchange rate (amount of domestic currency per unit of foreign currency) at the valuation point,

r_{dom} = domestic currency risk-free rate,

b =cross-currency basis (cross currency basis arises when pricing in the foreign exchange market diverges from what interest rate differentials would imply),

r_{for} = foreign currency risk-free rate,

$\tau(t,T)$ = day count fraction between the valuation point and the maturity date.

Note: The valuation of a currency swap (for settlement in the future) will follow a similar methodology to that described above.

4.4 OPTIONS

DEFINITION

An option contract provides an investor with the right, but not the obligation, to buy or sell the underlying instrument at a specific price (i.e. strike price or exercise price) on or before a specific date (i.e. expiry date or maturity date).

An option contract may reference any number of underlying instruments including equity instruments, commodities, currencies, bonds and indices.

Options and some of the relevant valuation principles were introduced in Appendix 2, and the reader is encouraged to revise this content before proceeding. In this section we will provide more detail about option contracts.

FEATURES OF INSTRUMENT

- **Option types**
  The following classifications are commonly used to identify option contracts:

  - **Classification by exercise right**
    Options can be classified according to the rights afforded when exercising the option.

    A call option gives the buyer of the option the right to buy the underlying instrument at a predetermined price. The objective is to lock in a purchase price (the strike price of the option) that is lower than the instrument price at the time of exercise, else the option will not be exercised as the instrument can be purchased at a better price in the market.

    A put option gives the buyer of the option the right to sell the underlying instrument at a predetermined price. The objective is to lock in a sale price (the strike price of the option) that is higher than the instrument price at the time of exercise.

    An investor can also write (sell) a call or a put. The objective here is to earn a premium. The call (put) writer takes the opposite side of the contract to that of the call (put) option holder. In the market this is also referred to as being short a call (put).

  - **Classification by exercise type**
    Options can also be differentiated by the time at which the option holder is permitted to exercise the option. There are three main types.

    - An American option can be exercised at any time prior to or on expiration;
    - A European option can be exercised on expiration date only; and
    - A Bermudan option can be exercised on predetermined dates only.

    The implication from a valuation perspective is that, in general, American and Bermudan options are more valuable than European options because the holder has more opportunities to exercise the option. American and Bermudan style options pose additional complexity due to the holder being able to exercise early, and this needs to be adequately modelled when performing a fair value calculation.

  - **Classification by type of underlying**
    Option contracts can also be classified according to the type of underlying instrument.

    - Options on single stocks (or single stock futures) – for example, call option on BHP Billiton stock expiring 15 June 2016 with an exercise price of 210.00 (F95074).
    - Options on index futures – for example, put option on Top 40 index expiring 17 March 2016 with an exercise price of 40500 (F75692).
    - Options on government bond futures – for example, call option on the R214 expiring 04 August 2016 with an exercise price of 11.30 (Y51570).

- Options on foreign currencies – for example, put option on the USD/ZAR exchange rate expiring 14 March 2016 with an exercise price of 15.00 (Y51616).

- **Option payoff profiles**
  Option contracts have asymmetric payoffs. The buyer of an option has the right to exercise the option but is not obligated to exercise. Therefore, the maximum loss for the buyer of an option contract is the loss of the price (premium) paid to acquire the position, while the potential gains in some cases are theoretically infinite. Because option contracts are a zero-sum game, the seller of the option contract could incur substantial losses, but the maximum potential gain is the amount of the premium received for writing the option.

  The pay-off of call and put options, respectively are given by

$$C(T) = (S_T - K)^+ = \max(0, S_T - K)$$

$$P(T) = (K - S_T)^+ = \max(0, K - S_T)$$

  where, $V_C(T)$ is the call option pay-off at maturity, $V_P(T)$ is the put option pay-off, S_T is the spot price of the underlying instrument at maturity T, and K is the strike price of the option.

  At inception of an option contract the buyer pays the seller a premium that is equal to the value of the option (excluding fees). This value is equal to the discounted expectation of the pay-off. We depict a call option pay-off including and excluding premium in Figure 2.

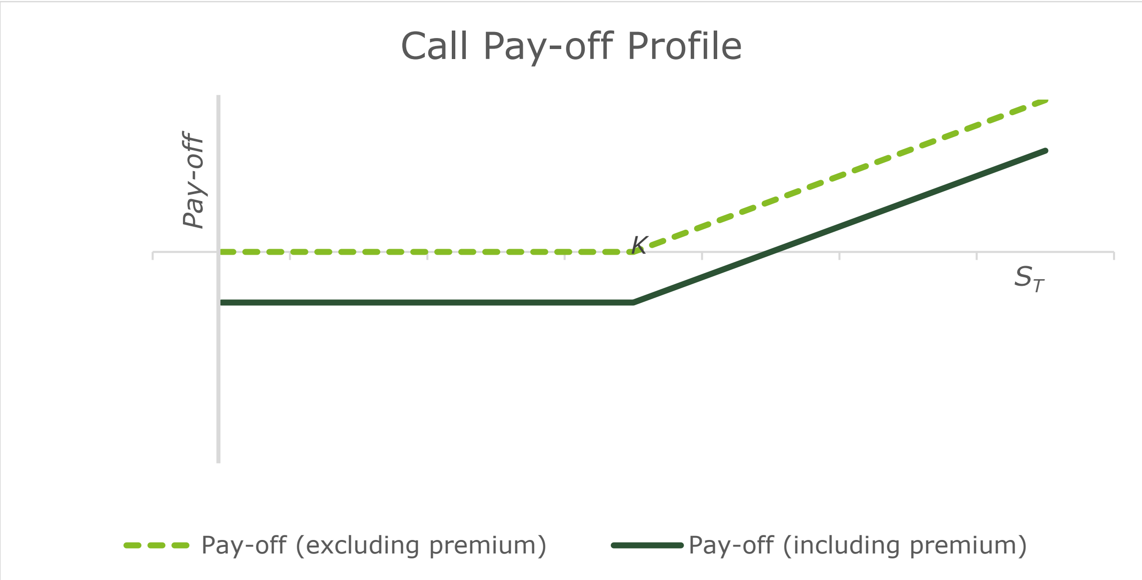


Figure 2 - European Call Option Pay-off

- **Key concepts – option contracts**
  The key terms of an option contract between two parties are as follows:

  - **Option type**
    Whether the option is a call option or a put option.

  - **Underlying instrument**
    Option contracts trade on an underlying instrument. The primary types of instruments underpinning option contracts include equity instruments, currency, futures or forward contracts, swaps and indices (which reference an underlying basket of instruments).

  - **Expiry date**
    Also referred to as maturity date, the expiry date is when the option lapses.

- **Exercise style**
  Options can be American, European or Bermudan style. As mentioned previously, American options can be exercised at any time throughout the life of the option, Bermudan options on certain contractually defined dates, and European options can only be exercised on the expiration date of the option.

- **Strike price**
  The strike price, also known as the exercise price, is specified in an option contract as the price at which the instrument may be bought or sold. Upon exercise of an option, the strike price is the pre-determined price that will be paid for the purchase of the underlying instrument (in the case of a call option) or received for the sale of the underlying instrument (in the case of a put option). The quoting convention for the strike price may differ across markets and instrument classes.

- **Premium**
  The amount per contract the option buyer pays to the option writer.

In addition to the components listed above, exotic and otherwise structured options, generally traded OTC, will include additional components developed to meet the needs of the parties to the contract.

When considering the valuation of options, the following are key factors to consider:

- **Time to expiry**
  The amount of time (in years) from the valuation point until the option expiry date. For example, consider a call option on a bond with an expiry date of 5 May 2020. If the valuation point is 22 April 2020, the time to expiry is 13 days (which must be adjusted in accordance with the relevant market's day count convention (refer to section 4.12 of Appendix 2)).

  Generally, the larger the time to expiry, the larger the value of the option.

- **Moneyness**
  For a call (put), when the underlying instrument price is less (greater) than the strike price, the option is said to be out of the money.

  For both a call and put, when the underlying instrument price is equal to the strike price, the option is said to be at the money.

  For a call (put), when the underlying instrument is greater (less) than the strike price, the option is said to be in the money.

- **Time value and intrinsic value**
  The value of an option prior to expiry or maturity comprises of two components: the time value and the intrinsic value.

  The intrinsic value is the value if the option had to be exercised right now, i.e. the maximum of zero or the difference between the underlying instrument price and the strike price of the option.

  The time value reflects the probability that the spot price can go up or down through the remaining life of the option. The time value is derived from the volatility of the spot price, and the time to expiry. There is thus value in holding the option even it is out of the money.

The fair value of the option can be seen as the sum of the intrinsic and time value of the option. We show the intrinsic value, time value, and fair value of a European call option in Figure 3. We can see the following from looking at the graph:

- When the option is out of the money (spot price is less than the strike price, i.e. $S_t < K$), then the intrinsic value is zero, and the option value is equal to the time value.

- The time value of money is highest around the strike price.

- The deeper in the money the option is (i.e. the higher the spot price is than the strike price), the smaller the time value and the larger the intrinsic value.

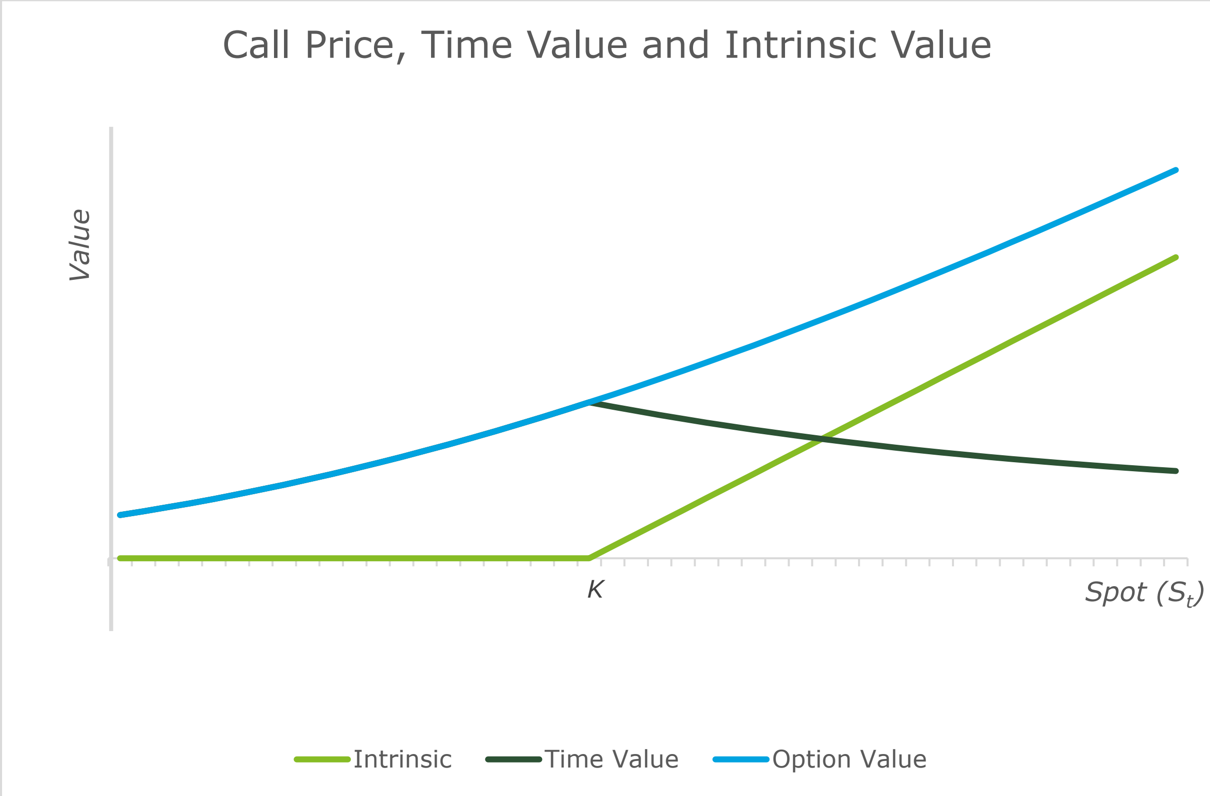


Figure 3 - Call Option: Price, Time Value and Intrinsic Value

- **OTC options**
  Particularly in the OTC market, option contracts can take on a variety of specifications, structured to meet the needs of the parties to the contract. In addition, in some cases, varying combinations of options and / or underlying instruments are used to execute specified trading strategies (e.g. zero-cost collars, straddles, strangles).

  It is important to ensure that a detailed understanding of the characteristics and terms of the option contract is gained in order to assist in the development of a suitable valuation technique to measure fair value (refer to section 3.2 of Chapter 3).

  The variations to the structure of option contracts is extensive and is continuously being updated by the introduction of new products. Examples of structured OTC options include:

  - Digital options – an option contract whose pay-off is either a fixed amount or zero dependant on the option being in the money at expiry.

  - Barrier options – the existence and payoff of the option is dependent on whether the underlying instrument's price reaches a certain barrier level.

  - Forward start options – an option that is traded today but becomes effective at some point in the future.

  - Compound options – options written on other option contracts; e.g. a call option that when exercised gives the holder another call option.

  - Chooser options – these options allow the owner to choose whether the option is a call or a put.

  - One-touch options – the option pays a premium to the holder of the option if the spot price of the underlying instrument reaches the strike price of the option, at any point in time prior to expiry.

  - Digital options – the option pays a fixed amount if the underlying instrument price moves past the strike price .Digital options are also referred to as a "binary" or "all-or-nothing options."

- Asian options – an option with a payoff profile based on the average price of the underlying instrument over the life of the option.
  There are two variations of Asian options:
  - Average price call and put options pay the difference between the average underling instrument price and the strike price. As the average underlying instrument price is, in general, less volatile than the actual price, the price for an Asian average price option will be lower than the price of a comparable standard European or American option.
  - Average strike call and put options pay the difference between the underlying instrument price at expiry of the option and the average price of the underlying instrument over the life of the option.

- **Exchange-traded options**
  Exchange-traded options have standardised terms. In particular each exchange will have specified expiration date cycles which dictate the month and actual expiration date for each option contract.

  Each exchange will have specified quoting conventions for the strike price and the tick size for option contracts. In addition, methodologies for the calculation of option premiums (e.g. the Black-Scholes model) and margin requirements differ across markets.

  An option is automatically exercised if it is in-the-money at expiration (this is determined based on exchange-specific pre-established thresholds (e.g. 0.01 basis points)). Options that are at-the-money or out-the-money will not be exercised. These contracts expire worthless and the option holder's losses are limited to the premium paid for the right to hold the option.

  Options are generally quoted relative to one underlying instruments (and will need to be scaled based on the number or quantity of instruments referenced in the contract).

  Exchange-traded options are generally cash-settled and traded on four primary instruments:

  - **Equity instruments**
    These option contracts are typically American-style and have contract sizes specified by the exchange (e.g. 100 ordinary shares per option contract). Subsequent to issuance, equity option contracts are adjusted in the case of any stock splits or stock consolidations.

  - **Currency**
    Investors holding currency options receive the right to buy or sell an amount of foreign currency based on a domestic currency amount.

  - **Index**
    Options on indices (i.e. referencing a basket of underlying instruments such as equity instruments or commodities) are typically European-style options. The payoff on an index call option is the amount (if any) by which the index level at expiration exceeds the index level specified in the option (the strike price), multiplied by the contract multiplier.

  - **Futures**
    American-style, exchange-traded options are most often utilised for futures contracts. Typically, the futures option expiration date is set to a date shortly before the expiration date of the futures contract. The market value of the underlying instrument for futures options is the value of the underlying futures contract.

  Similar to trading in futures contracts, the trading of options on an exchange are cleared through a clearinghouse and subject to margin requirements (refer to section 3.6 of Chapter 3). The clearinghouse guarantees that the other side of the transaction performs its obligations. With an OTC contract, the investor is exposed to the other party (i.e. the counterparty) not meeting its obligations under the contract. Therefore, while an exchange-traded contract provides exposure to market risk, an OTC contract gives rise to both market and counterparty risk.

FAIR VALUE MEASUREMENT

For exchange-traded options, price information for the instrument will be provided by the exchange. Provided the price of the option contract is sourced from an active market at the valuation point and is based on actual transaction data, the exchange price may be used as a measure of the risk-neutral fair value of the option. Refer to section 3.5 of Chapter 3 for guidance with respect to the sourcing of price information.

For an OTC option contract or in instances where the quoted price for an exchange-traded option is not considered to be representative of fair value (e.g. the option is thinly traded), the application of a suitable valuation technique is required.

- **Factors influencing the value of options**
  In developing a suitable technique, consideration should be afforded to the impact the following factors will have on the fair value of an option:

  - **Current price of the underlying instrument (S_t)**
    As call options offer an investor the right to buy the underlying instrument, an increase in the value of the instrument increases the value of the call option. The value of a put option decreases as the value of the instrument increases due to the investor being able to sell the instrument at a higher price in the open market.

  - **Strike price of the option**
    The effect of strike prices on option values will be exactly the opposite of the effect of the current price of the underlying instrument. The value of a call option decreases as the strike price increases because an investor will pay more for an instrument (i.e. make less profit) when an option is exercised. The value of a put option increases as the strike price increases because an investor will sell the underlying instrument at a higher price (make more profit) when the option is exercised.

  - **Time to expiration**
    For American-style options, increasing time to expiration will increase the option value. With more time, the likelihood of the option being in-the-money increases. A general statement of this form cannot be necessarily made for European-style options. Suppose we have a one-month and three-month call option on the same underlying ordinary share with the same exercise price. Assume a large dividend on the ordinary share is expected to be paid in two months. Because the share price and the three-month option price will fall when the dividend is paid in two months, the one-month option may be worth more than the three-month option.

  - **Risk-free rate over the life of the option:**
    The risk-free rate affects the forward price of the instrument as well as the discounting of the expected future cash flow.

  - **Dividends or other income earned on the underlying instrument over the life of the option:**
    When income generated on an underlying instrument is paid, a reduction in the instrument's future cash flows occurs which, in turn, reduces the price of the underlying instrument (e.g. dividends paid reduce the ordinary share price). The option owner, however, does not have access to the cash flows of the underlying instrument. The valuation of an option requires an adjustment for any income payments forecasted to occur over the life of the option. This decrease in instrument value decreases the value of a call option and increases the value of a put option.

  - **Volatility of the underlying instrument over the life of the option:**
    Due to the asymmetric payoff inherent in options, as the volatility of the underlying instrument increases, the value of both call and put option contracts increase in value. This is because the probability of an option currently out-the-money expiring in-the-money increases when volatility of instrument prices increase.

- **Relationship between the value of a put and call option**
  Put-call parity is a principle that defines the relationship between the price of European put options and European call options of the same class, that is, with the same underlying instrument, strike price and expiration date.

  Put-call parity states that simultaneously holding a short European put and long European call of the same class will deliver the same return as holding one forward contract on the same underlying instrument, with the same expiration, and a forward price equal to the option's strike price.

  If the prices of the put and call options diverge so that this relationship does not hold, an arbitrage opportunity exists.

  Put-call parity shows that the value of a European call with a certain exercise price and exercise date can be deduced from the value of a European put with the same exercise price and exercise date, and vice versa. We can show this by considering the pay-off of a call $C(T)$, put $P(T)$, and forward $F(T)$ (all at maturity T) and contracts with the same strike K, then the pay-offs can be seen to have the following put-call parity relationship

  $$C(T) - P(T) = F(T) - K$$

  Due to the difference between the call and the put pay-off being equal to the difference between the forward and strike pay-off, by the law of one price, these have the same fair value. For example, assuming an option on an instrument which earns a constant dividend or other income yield, we have that

  $$C(t) - P(t) = S_t \, e^{-q \cdot \tau(t,T)} - K \cdot \mathrm{df}(t,T)$$

  where

  $C(t)$ = value of a European call option at the valuation point,

  $P(t)$ = value of European put option at the valuation point,

  t = valuation point,

  S_t = Spot price of the underlying asset at the valuation point,

  q = average annualised dividend or other income yield rate over life of option contract, with continuous compounding,

  T = options contract maturity / expiration date,

  $\tau(t,T)$ = day count fraction between the valuation point and the maturity date,

  K = strike price of option,

  $\mathrm{df}(t,T)$ = discount factor from the maturity date to the valuation point, derived from the discount curve.

  Note that put-call parity only holds for European options. For American options, an inequality can be used to place an upper and lower bound on the difference between American call and put options (assuming no dividends or income on the underlying instrument):

  $$S_t - K \le C(t) - P(t) \le S_t - K \cdot \mathrm{df}(t,T)$$

i) Key valuation inputs

In order to measure the fair value of an option contract using the methodology set out below, the following valuation inputs may be required:

- Contractual terms of the instrument;
- Discount curve;
- Either a forward or a spot price plus relevant factors (such as cost of carry, basis spread etc.);
- Spot price at valuation point; and
- Volatility measure.

Refer to Appendix 2 of this document for guidance regarding the relevant considerations in developing the required market inputs.

ii) Risk-neutral valuation methodology

An assessment needs to be performed as to the most appropriate valuation technique to be applied to the valuation of an OTC option based on the risks and characteristics of the instrument.

As described in Appendix 2, some of the models widely applied in practice to value such options include Black-Scholes, Binomial option pricing model, and Monte Carlo Methods. The features of the underlying option should be considered when assessing whether the aforementioned models are appropriate. Consideration should be given as to whether there are other models that may be considered more appropriate given the features of the option.

Section 4.4.1 to 4.4.4 below provide specific application of the principles described above to selected European-style option contracts referencing varying instrument classes. The Black-Scholes model is used most widely for valuing vanilla European options (refer to section 2.2.6 of Appendix 2).

The valuation of options with path-dependant structures, such as American-style and Bermudan options, require the application of alternative valuation models, such as the binomial model (refer to section 2.2.8 of Appendix 2) or a Monte Carlo simulation (refer to section 2.2.7 of Appendix 2).

The selection of a valuation technique to be applied in the calculation of the fair value of an option requires the exercise of judgement, taking into consideration the risks and characteristics of the option. In performing this assessment, it is recommended that due consideration should be afforded to the content of this section, along with the fair value measurement principles set out in Chapter 3 and the valuation fundamentals described in Appendix 2.

4.4.1 EQUITY OPTIONS / EQUITY INDEX OPTIONS

DEFINITION

An equity option contract provides the investor with the right, but not the obligation, to buy (i.e. call option) or sell (i.e. put option) a specified quantity of an underlying equity instrument at a predetermined price (i.e. strike price) and future date (i.e. expiry date or maturity date).

FEATURES OF INSTRUMENT

The value of an equity option is based on the price movements of the underlying equity instrument and the volatility thereof.

Equity options can be used for speculative purposes as investors can take a long or short position in an equity instrument without actually buying or shorting the underlying equity instrument. This results in a reduction of costs as options are cheaper than an investment in the underlying equity instrument. In addition, hedgers often use options to hedge the risk associated with existing long or short positions.

An equity option may reference a single equity instrument, a basket of single stocks, or an index.

The specific terms across option contracts, specifically OTC option contracts, differ and specific analysis of the contractual terms of the instrument is required in order to identify and develop suitable valuation techniques and inputs. In particular, settlement terms may range from physical delivery to net cash settlement.

The holder of an option is generally not entitled to any dividends paid on the underlying equity instrument over the life of the option. As a result, the valuation technique applied to measure fair value should appropriately reflect this feature.

The cost to the investor of entering into an option contract is called the premium and is usually payable upfront.

FAIR VALUE MEASUREMENT

i) Key valuation inputs

In order to measure the fair value of a European equity option contract using the methodology set out below, the following valuation inputs are required:

- Contractual terms of instrument;
- A risk-free discount curve;
- Spot price of the underlying equity instrument or index (in the absence of a quoted price in an active market, refer to the guidance in Appendix 5 for guidance);
- Implied volatility of the underlying instrument; and
- Expected dividends or dividend yield on underlying instrument.

Refer to Appendix 2 of this document for guidance regarding the relevant considerations in developing the required market inputs.

ii) Risk-neutral valuation methodology

The Black-Scholes model (introduced in section 2.2.6 of Appendix 2) can be used for the valuation of European call and put options:

Value of call option:

$$C(t) = S_t e^{-q \cdot \tau(t,T)} \cdot \Phi(d_1) - K \cdot \mathrm{df}(t,T) \cdot \Phi(d_2),$$

Value of put option:

$$P(t) = K \cdot \text{df}(t,T) \cdot \Phi(-d_2) - S_t e^{-q\,\cdot\,\tau(t,T)} \cdot \Phi(-d_1),$$

where

$$d_1 = \frac{\ln\left(\frac{S_t}{K}\right) + \left(r_f - q + \frac{\sigma^2}{2}\right) \cdot \tau(t,T)}{\sigma \cdot \sqrt{\tau(t,T)}},$$

and

$$d_2 = d_1 - \sigma \cdot \sqrt{\tau(t,T)},$$

where

$C(t)$ = value of a European call option at the valuation point,

$P(t)$ = value of a European put option at the valuation point,

t = valuation point,

S_t = Spot price of underling asset at the valuation point,

q = average annualised dividend yield rate over life of option contract, with continuous compounding,

T = options contract maturity / expiration date,

$\tau(t,T)$ = day count fraction between the valuation point and the maturity date,

Φ = cumulative standard normal distribution function,

K = strike price of option,

$\text{df}(t,T)$ = discount factor from the maturity date of the option contract to the valuation point, derived from the discount curve,

r_f = risk-free rate,

σ = volatility of the underlying asset referenced in the option contract.

Example

- Example 1

  An entity sells a call option on a share. At the valuation point the time to expiry is four days (assume an Actual / 365 Fixed day count convention). No dividends are expected on the share over the remaining life of the option. Other key terms include:

  S_t = 210.59
  K = 205
  r_f = 0.2175%
  σ = 14.04%

  The first step is to calculate d_1:

$$d_1 = \frac{\ln\left(\frac{S_t}{K}\right) + \left(r_f - q + \frac{\sigma^2}{2}\right) \cdot \tau(t,T)}{\sigma \cdot \sqrt{\tau(t,T)}}$$

$$d_1 = \frac{\ln\left(\frac{210.59}{205}\right) + \left(0.2175\% - 0 + \frac{(14.04\%)^2}{2}\right) \cdot (4/365)}{(14.04\%) \cdot \sqrt{(4/365)}}$$

$$d_1 = 1.8394$$

  The next step is to calculate d_2:

$$d_2 = d_1 - \sigma \cdot \sqrt{\tau(t,T)}$$

$$d_2 = (1.8394) - (14.04\%) \cdot \sqrt{(4/365)}$$

$$d_2 = 1.8247$$

Substituting d_1 and d_2 values into the Black-Scholes formula yields:

$$C(t) = S_t e^{-q \cdot \tau(t,T)} \cdot \Phi(d_1) - K \cdot \mathrm{df}(t,T) \cdot \Phi(d_2)$$

$$C(t) = (210.59e^{-(0.2175\%).\ (4/365)}) \cdot \Phi(1.8394) - (205e^{-(0.2175\%).\ (4/365)}) \cdot \Phi(1.8247)$$

$$C(t) = 5.635$$

The value of the put may also be derived from the put-call parity relationship.

- Example 2
  A European call option was traded on 1 of March 2012, with an expiry date of the 16 of January 2013:

  t = 1 March 2012
  q = 9%
  S_t = 7228 (in cents)
  K = 7625 (in cents)
  r_f = 12%
  T = 0.88
  σ = 24%

  $C(t)$ = 519.26

  If the stock price changes to 7302 on the 2nd of March, the value of the call option changes to:
  $C(t)$ = 552.80 and delta would be 0.515

  The valuation of the above option (assuming a contract multiplier of 100 (i.e. one option contract references 100 ordinary shares)), is:
  1 March 2012: 1 x 519.26 x 100 = R51.926
  2 March 2012: 1 x 552.80 x 100 = R55.280

4.4.2 COMMODITY OPTIONS / COMMODITY INDEX OPTIONS

DEFINITION

A commodity option contract provides the investor with the right, but not the obligation, to buy (i.e. call option) or sell (i.e. put option) a specified quantity of an underlying commodity at a predetermined price (i.e. strike price) and future date (i.e. expiry date or maturity date).

FEATURES OF INSTRUMENT

The value of a commodity option is based on the price movements of the underlying commodity.

A commodity option may reference a single commodity (e.g. gold) or an index (e.g. a precious metals index).

The specific terms across option contracts, specifically OTC option contracts, differ and specific analysis of the contractual terms of the instrument is required in order to identify and develop suitable valuation techniques and inputs. In particular, settlement terms may range from physical delivery to net cash settlement.

The holder of an option is generally not entitled to any income paid on the underlying equity instrument over the life of the option. As a result, the valuation technique applied to measure fair value should appropriately reflect this feature.

The cost to the investor of entering into an option contract is called the premium and is usually payable upfront.

When considering the valuation of a commodity option, it is important to distinguish between investment instruments and consumption instruments. An investment instrument is an instrument that is held for investment purposes by significant numbers of investors (e.g. gold). A consumption instrument is an instrument that is held primarily for consumption purposes (e.g. copper, oil).

The valuation of a commodity option contract referencing an underlying consumption instrument introduces the following additional considerations:

- The convenience yield refers to the benefits from holding the physical instrument (e.g. holding of an instrument capable of being used by a manufacturer in a production process will not be regarded in the same way as a forward contract on the instrument in question);
- Storage costs increase the carrying costs of a consumption instrument and relate to the costs of storing the instrument, according to its requirements, over the term of the forward contract;

FAIR VALUE MEASUREMENT

- **Key valuation inputs**

  In order to measure the fair value of a European commodity option contract using the methodology set out below, the following valuation inputs are required:

  - Contractual terms of instrument;
  - Discount curve (driven by nature of underlying);
  - Commodity (or commodity index) spot price / forward price at valuation point;
  - Implied volatility of the underlying commodity; and
  - Expected cost of carry on underlying commodity.

  Refer to Appendix 2 of this document for guidance regarding the relevant considerations in developing the required market inputs.

ii) Risk-neutral valuation methodology

Different valuation formulae and methods are applicable depending on the type of underlying commodity. The assumption of log-normal returns are often not reflective of returns seen on commodities, this is largely due to commodities often exhibiting significant seasonality, mean reversion, and short-lived spikes in volatility. As such, using a Black-Scholes-like formula is not necessarily suitable. The technical details of commodity option pricing is outside the scope of this Guideline and the reader is referred to Clark [2014] for more information on commodity option pricing.

4.4.3 BOND OPTIONS / BOND INDEX OPTIONS

DEFINITION

A bond option contract provides the investor with the right, but not the obligation, to buy (i.e. call option) or sell (i.e. put option) a specified quantity of an underlying bond at a predetermined price (i.e. strike price) on or before the expiration date of the option (i.e. expiry date or maturity date).

FEATURES OF INSTRUMENT

The value of a bond option is based on the price movements of the underlying bond.

Bond options can be used for speculative purposes as investors can take a long or short position in a bond without actually buying or shorting the underlying bond. This results in a reduction of costs as options are cheaper than an investment in the underlying bond. In addition, hedgers often use options to hedge the risk associated with existing long or short positions.

A bond option may reference a single bond instrument or an index.

The specific terms across option contracts, specifically OTC option contracts, differ and specific analysis of the contractual terms of the instrument is required in order to identify and develop suitable valuation techniques and inputs. In particular, settlement terms may range from physical delivery to net cash settlement.

The holder of an option is generally not entitled to any coupons paid on the underlying bond over the life of the option. As a result, the valuation technique applied to measure fair value should appropriately reflect this feature.

The cost to the investor of entering into an option contract is called the premium and is usually payable upfront.

The volatility skew has a significant impact on the bond option value. The skew is expressed as an additive spread (to the implied volatility) at various ranges / percentages of moneyness (a relative position of the current market price in relation to the strike price of the option). The reader is referred to Appendix 2 for more information on volatility skews.

FAIR VALUE MEASUREMENT

i) Key valuation inputs

In order to measure the fair value of a European bond option contract using the methodology set out below, the following valuation inputs are required:

- Contractual terms of the instrument;
- Discount curve generally being the government bond curve;
- Implied volatility for strike (may be either price volatility or yield volatility – appropriate application depending on the nature of the volatility input is required); and
- Bond (or bond index) forward / futures price (as per market convention).

Refer to Appendix 2 of this document for guidance regarding the relevant considerations in developing the required market inputs.

ii) Risk-neutral valuation methodology

European bond options can be valued using the Black-76 model (also known as Black's model).

The Black-76 model is an extension of the Black–Scholes model (refer to section 2.2.6 of Appendix 2) for the valuation of options on future contracts, bond options, interest rate cap and floors and swaptions. Black's model can be derived from the Black-Scholes model by applying Magrabe's formula.

Value of call option:

$$C(t) = [F_T \Phi(d_1) - K\Phi(d_2)]\mathrm{df}(t,T)$$

Value of put option:

$$P(t) = [K\Phi(-d_2) - F_T\Phi(-d_1)]\mathrm{df}(t,T)$$

where

$$d_1 = \frac{\ln\left(\frac{F_T}{K}\right) + \frac{\sigma^2\,\tau(t,T)}{2}}{\sigma\sqrt{\tau(t,T)}}$$

$$d_2 = d_1 - \sigma\sqrt{\tau(t,T)}$$

and

$C(t)$ = value of a European call option at the valuation point,

$P(t)$ = value of a European put option at the valuation point,

t = valuation point,

F_T = underlying bond forward / future price,

T = options contract maturity / expiration date,

Φ = cumulative standard normal distribution function,

K = strike price of option,

$\mathrm{df}(t,T)$ = discount factor from the maturity date to the valuation point, derived from the discount curve,

σ = price volatility of the underlying bond future or forward (including skew adjustment),

$\tau(t,T)$ = day count fraction between the valuation point and the maturity date,

Example
Examples of the guidance provided in this section is set out below. Note the adjustments for settlement date conventions in the examples below (refer to refer to section 2.9.3 of Appendix 2 for further details in this regard).

- Example 1
  In order to determine the risk-neutral value of a R186 May 16 expiry 8.75% strike call option, at the 19 April 2016 valuation point (t).
  The inputs required are as follows:
  - Time to expiry of the option ($\tau(t,T)$)
    Assume the option settlement date is 3 days from 19 April 2016 (i.e. 22 April 2016)
    The expiry settlement date is 3 days from 5 May 2016 (i.e. 10 May 2016)
    The time to expiry of the option, assuming a day count convention of Actual / 365 Fixed, is 0.0493 years (22 April 2016 to 10 May 2016)/365)

– Futures Price (F_T)
  Assume the futures price on 19 April 2016 is 115.082

– Risk-free rate
  Assume the risk-free rate is flat over the life of the option at 7.02% (assume continuous compounding)

– Strike price (K)
  Assume a strike price of 116.119
  (Note that in some markets, such as South Africa, the convention is to quote the strike as a yield (i.e. 8.75%). In such instances, the yield strike must be converted into a strike price for input into the valuation formula.)

– Volatility (σ)
  Assume the volatility at the valuation point is 10.04%

Using the Black-76 Model, we can calculate the call option value using the above inputs:

Parameters	**Result**
Futures Price F_T	115.08203
Strike Price K	116.11900
Risk-free rate	7.02%
Volatility σ	10.04%
Time to Maturity $\tau(t,T)$	0.0493

Calculations using Black-76 Model:

Calculations	**Result**
$\sigma \cdot \sqrt{\tau(t,T)}$	0.022295824
d_1	-0.391185224
d_2	-0.413481048
$\Phi(d_1)$	0.347830165
$\Phi(d_2)$	0.339627102

Call option value calculation:

$$C(t) = \mathrm{df}(t,T) \cdot [F_T \cdot \Phi(d_1) - K \cdot \Phi(d_2)]$$

$$C(t) = e^{-7.02\% \times 0.0493} \cdot [(15.08203)(0.347830165) - (116.119)(0.339627102)]$$

$$C(t) = 0.5890$$

Assuming a nominal amount per option contract of ZAR 100 000, the total risk-neutral fair value per option contract is ZAR589.80.

- Example 2

  In order to determine the risk-neutral value of a R186 Aug 16 expiry 9.25% strike put option, at the 19 April 2016 valuation point (t).
  The inputs required are as follows:

  - Time to expiry of the option ($\tau(t,T)$)
    Assume the option settlement date is 3 days from 19 April 2016 (i.e. 22 April 2016)
    The expiry settlement date is 3 days from 4 August 2016 (i.e. 10 August 2016)
    The time to expiry of the option, assuming a day count convention of Actual / 365 Fixed, is 0.3014 years (22 April 2016 to 10 August 2016)/365)

  - Futures Price (F_T)
    Assume the futures price on 19 April 2016 is 111.9677

  - Risk-free rate
    Assume the risk-free rate is flat over the life of the option at 7.02% (assume continuous compounding)

  - Strike price (K)
    Assume a strike price of 109.6324.
    Note that in some markets, such as South Africa, the convention is to quote the strike as a yield (i.e. 9.25%). In such instances, the yield strike must be converted into a strike price for input into the valuation formula

  - Volatility (σ)
    Assume the volatility at the valuation point is 11.04%

  Using the Black-76 Model, we can calculate the put option value using the above inputs:

Parameters	**Result**
Futures Price F_T	111.9677
Strike Price K	109.6324
Risk-free rate	7.02%
Volatility σ	11.04%
Time to Maturity $\tau(t,T)$	0.3014

  Calculations using Black-76 Model

Calculations	**Result**
$\sigma \cdot \sqrt{\tau(t,T)}$	0.060606469
d_1	0.378079335
d_2	0.317472866
$\Phi(-d_1)$	0.352685829
$\Phi(-d_2)$	0.375442413

Call option value calculation:

$$P(t) = \mathrm{df}(t, T) \cdot [K \cdot \Phi(-d_2) - F_T \cdot \Phi(-d_1)]$$

$$P(t) = e^{-7.02\% \times 0.3014} \cdot [(109.6324)(0.375442413) - (111.9677)(0.352685829)]$$

$$P(t) = 1.63624$$

Assuming a nominal amount per option contract of ZAR 100 000, the total risk-neutral fair value per option contract is ZAR1 636.24.

4.4.4 CURRENCY OPTIONS

DEFINITION

A currency option contract provides the investor with the right, but not the obligation, to buy (i.e. call option) or sell (i.e. put option) a specified quantity of a certain underlying currency at a predetermined exchange rate (i.e. strike price) on or before the expiration date of the option (i.e. expiry date or maturity date).

FEATURES OF INSTRUMENT

The value of a currency option is based on the price movements of the exchange rate movements in the underlying currency pair.

Currency options can be used hedge the risk associated with existing long or short positions in a currency. In addition, currency options allow traders to speculate on the market's overall direction based on economic, political and other news.

The specific terms across option contracts, specifically OTC option contracts, differ and specific analysis of the contractual terms of the instrument is required in order to identify and develop suitable valuation techniques and inputs. In particular, settlement terms may range from physical delivery to net cash settlement.

The cost to the investor of entering into an option contract is called the premium and is usually payable upfront.

FAIR VALUE MEASUREMENT

i) Key valuation inputs

In order to measure the fair value of a currency option contract using the methodology set out below, the following valuation inputs are required:

- Contractual terms of the instrument;
- Discount curve for each referenced currency in the option contract;
- Spot exchange rate at valuation point (amount of domestic currency per unit of foreign currency); and
- Implied volatility of the option contract.

Refer to Appendix 2 of this document for guidance regarding the relevant considerations in developing the required market inputs.

ii) Risk-neutral valuation methodology

As in the Black–Scholes model for stock options and the Black model for certain interest rate options, the value of a European option on a foreign exchange rate is typically calculated by assuming that the rate follows a log-normal process. In 1983 Garman and Kohlhagen extended the Black–Scholes model to cope with the presence of two interest rates (one for each currency).

Suppose that r_{dom} is the risk-free interest rate to expiry of the domestic currency and r_{for} is the foreign currency risk-free interest rate (where the domestic currency is the currency in which we obtain the value of the option and exchange rates are quoted in terms of units of domestic currency per unit of foreign currency).

The Garman and Kohlhagen modified Black-Scholes Model can be used for the valuation of European currency call and put options:

Value of call option in domestic currency (exchange rate is quoted as number of domestic currency per unit of foreign currency):

$$C(t) = S_t \cdot \mathrm{df}_{for}(t,T) \cdot \Phi(d_1) - K \cdot \mathrm{df}_{dom}(t,T) \cdot \Phi(d_2)$$

Value of put option in domestic currency (exchange rate is quoted as number of domestic currency per unit of foreign currency):

$$P(t) = K \cdot \mathrm{df}_{dom}(t,T) \cdot \Phi(-d_2) - S_t \cdot \mathrm{df}_{for}(t,T) \cdot \Phi(-d_1)$$

where

$$d_1 = \frac{\ln\left(\frac{S_t}{K}\right) + \left(r_{dom} - r_{for} + \frac{\sigma^2}{2}\right) \cdot \tau(t,T)}{\sigma \cdot \sqrt{\tau(t,T)}}$$

$$d_2 = d_1 - \sigma \cdot \sqrt{\tau(t,T)},$$

and

$C(t)$ = value of a European call option (in domestic currency) at the valuation point,

$P(t)$ = value of a European put option (in domestic currency) at the valuation point,

t = valuation point,

S_t = Spot price at the valuation point (number of domestic currency per unit of foreign currency),

T = options contract maturity / expiration date,

$\mathrm{df}_{for}(t,T)$ = discount factor derived from foreign currency discount curve, from the option contract maturity date to the valuation point,

$\mathrm{df}_{dom}(t,T)$ = discount factor derived from local currency discount curve, from the option contract maturity date to the valuation point,

Φ = cumulative standard normal distribution function,

K = strike price of option (number of domestic currency per unit of foreign currency),

r_{dom} = domestic currency risk-free rate,

r_{for} = foreign currency risk-free rate,

σ = volatility of the underlying asset referenced in the option contract,

$\tau(t,T)$ = day count fraction between the valuation point and the maturity date.

4.5 CONTRACT FOR DIFFERENCE ("CFD")

DEFINITION

A Contract for Difference ("CFD") provides for the net cash settlement of the difference between the time at which a contract is opened and the time at which it is closed. Settlement cannot occur by the delivery of the underlying instrument. Effectively, the parties to a CFD speculate on the movement of the price of an underlying instrument over a specified period of time (generally over the short term).

FEATURES OF INSTRUMENT

Traders who expect an upward movement in the price of the underlying instrument will buy a CFD (i.e. long position). On a long position, if the security price rises, the buyer receives cash from the seller, and vice versa.

Note that a CFD is not a forward or a futures contract because CFDs do not have specified maturity dates and do not contain strike prices. CFDs trade like other securities with bid and ask prices.

Traders who expect a downward movement in the price of the underlying instrument will sell a CFD (i.e. short position). On a short position, the seller receives cash from the buyer if the security drops in price, and vice versa.

A CFD consists of an agreement to exchange the difference in the value of an underlying instrument between the time the contract is opened and the time at which it is closed. The cost of entering into a CFD is contractually specified as is generally specified as an interest rate on a specified notional amount (the notional amount may be fixed or may vary based on movements in the value of the underlying).

CFDs provide investors with all the benefits and risks arising from the underlying instrument without actually owning it. CFDs can be used to trade a variety of underlying instruments including ordinary shares, currency, commodities, bonds, futures or forward contracts and various indices.

Since CFDs mirror corporate actions taking place, a CFD owner may be entitled to receive cash dividends (or other income earned on the underlying instrument) This feature needs to be considered and incorporated as part of the valuation technique used to measure fair value.

CFDs are generally traded OTC.

FAIR VALUE MEASUREMENT

i) Key valuation inputs

In order to measure the fair value of a CFD using the methodology set out below, the following valuation inputs are required:

- Contractual terms of the instrument;
- Spot price of underlying as at valuation point;
- Spot price of underlying as at inception of CFD; and
- Lending / borrowing interest rate and specified notional amount (as stipulated in the CFD).

Refer to Appendix 2 of this document for guidance regarding the relevant considerations in developing the required market inputs.

ii) Risk-neutral valuation methodology

The value of a CFD is determined as the aggregate of:

- The difference between the spot price of the underlying at the valuation point and the spot price of the underlying at inception of the CFD; and
- The cost of the CFD contract (interest on the notional amount).

The fair value of a CFD can be calculated as follows:

Long CFD position:

$$V(t) = L \cdot (S_t - S_0 - AI)$$

Short CFD position:

$$V(t) = -L \cdot (S_t - S_0 - AI)$$

where

$V(t)$ = value of the instrument at the valuation point,

t = valuation point,

L = number of instruments referenced in the CFD contract,

S_t = spot price at the valuation point,

S_0 = spot price at inception of CFD,

AI = Accrued interest on the contract, determined in accordance with the contractual terms of the CFD.

Note that to the extent that dividends are relevant to the CFD contract being valued, the above formulae should be adjusted accordingly.

Example
A simplified example is provided below:

- Valuation of a long position
  Consider the following scenario:

  Party A buys a CFD contract from Party A referencing 10 000 (L) specified shares.

  The price of the share on specified dates is as follows:
  - Trade date (t_0): R20 (S_0)
  - Valuation point (t): R25 (S_t)

  Assume that the accrued interest is determined on the basis of the exposure value over the term of the CFD (i.e. accrued interest determined on the basis of the share price which changes over the term of the CFD). The accrued interest from trade date to valuation point is R0.0242 per share.

  The value of the long position at valuation point is (value to Party A):

$$V(t) = L \cdot (S_t - S_0 - AI)$$
$$V(t) = 10\,000 \cdot (R25 - R20 - R0.0242) = R49\,758$$

- Valuation of a short position
  Consider the following scenario:

  Party C sells a CFD contract to Party D referencing 1 000 (L) specified shares.

  The price of the share on specified dates is as follows:
  - Trade date (t_0): R50 (S_0)
  - Valuation point (t): R48 (S_t)

  Assume that the accrued interest is determined on the basis of the exposure value over the term of the CFD (i.e. accrued interest determined on the basis of the share price which changes over the term of the CFD). The accrued interest from trade date to valuation point is R0.0652 per share.

  The value of the short position at valuation point is (value to Party C):

  $$V(t) = -L \cdot (S_t - \ S_0 - AI)$$
  $$V(t) = 1\ 000 \cdot (R48 - \ R50 - R0.0652) = R2\ 065$$

Note the effect of dividends where the underlying instrument is an equity instrument:

- An investor holding a long CFD position on the ex-dividend date of the underlying share will receive the dividends on the share in the form of manufactured dividends.
- For an investor holding a short CFD position on the ex-dividend date of the underlying share, the dividends on the share will be debited from the account of the investor.

4.6 FORWARD RATE AGREEMENTS ("FRA")

DEFINITION

A Forward Rate Agreement ("FRA") is an OTC contract obligating two parties to exchange cash flows based on floating reference rate versus a fixed interest rate that applies to a principal amount over a future time period.

FEATURES OF INSTRUMENT

A FRA is used by investors to manage interest rate risk.

The parties to the contract will exchange a fixed interest rate for a variable one. The party paying the fixed rate is usually referred to as the buyer (the party that is long the FRA), whilst the party receiving the fixed rate is referred to as the seller (the party that is short the FRA).

FRAs are cash-settled with the settlement amount based on the net difference between the interest rate and the reference rate in the contract. The notional amount is not exchanged.

Practically, FRAs are used to lock in an interest rate for a specified future time period. FRAs can be based on different periods and are quoted in terms of months to settlement date and the months to completion of the interest period. For example, a 3x6 FRA refers to a FRA that will settle in three months and then there is an interest period of three months from the settlement date. The contract will complete after a total of 3+3 = 6 months.

FAIR VALUE MEASUREMENT

i) Key valuation inputs

In order to measure the fair value of a FRA using the methodology set out below, the following valuation inputs may be required:

- Contractual terms of instrument;
- Discount curve (risk-free curve); and
- Forward rate curve.

Refer to Appendix 2 of this document for guidance regarding the relevant considerations in developing the required market inputs.

ii) Risk-neutral valuation methodology

The value of a FRA is determined as the difference between the forward rate expected to apply over the future time period referenced by the FRA (as determined on the valuation point) and the strike rate under the FRA, applied to the notional amount. The result is then discounted to the valuation point by applying the discount factor corresponding to the expected timing of the cash flow, derived from the constructed discount curve.

Value of a FRA:

$$V(t) = N(f - K) \cdot \tau(s,T) \cdot \mathrm{df}(t,s)$$

where

$V(t)$ = value of instrument at the valuation point,

t = valuation point,

N = nominal amount,

$f = f(t;s,T)$ = simple forward rate at the valuation point, expected to apply over the specified future time period referenced in the FRA, starting on the settlement date,

s = settlement date of the FRA (e.g. for a 21x24 FRA, s is the end of the 21st month);,

T = Expiry of the contract (i.e. the end of the interest period - e.g. for a 21x24 FRA, T is the end of the 24th month);

K = FRA rate (strike rate),

$\tau(s, T)$ = day count fraction function over the interest period referenced in the FRA contract,

$\mathrm{df}(t, s)$ = discount factor from the settlement date to the valuation point, derived from the discount curve.

Note that there is no exchange of principal - the only cash flows are the interest payments on the specified notional principal amount.

Example
The valuation methodology is best explained by means of an example:

t = Trade Date
t + 15 = valuation point
t + 60 = Expiry date (assumed to be the same as the settlement date - in the South African market, FRA's referencing JIBAR fix and settle on the same day)
t + 150 = Maturity of "theoretical deposit" on which the FRA is based

On *t* we enter into a FRA agreement expiring in 60 days which is based on a period of 90 days (a 2x5 agreement) at a rate of 6% (annualised) in the market based on a notional principle principal of R1 000 000.

Assume a day count convention of Actual / 365 Fixed.

Calculation of value of FRA on day t + 15 is determined as follows:

Step 1 – Calculate receivable:
R1 000 000 x (6.895% - 6%) x 90/365 = R2 206.85 on day t + 150

However, we note that the FRA pays in advance, so that this is discounted back to the settlement day using the JIBAR fixing rate, to get the value on day t + 90:

$$\frac{R2\ 206{,}85}{1 + 6.895\% \cdot \left(\frac{90}{365}\right)} = R\ 2\ 169.96$$

Step 2 – Calculate value today:
R2 169,96 will be the "theoretical payoff" of the FRA on t+60 based on current rates. To determine the value today we need to discount the value at the current 45 day rates off the relevant yield curve. We will assume this to be a simple rate of 6.8%.

Therefore value today:

$$\frac{\text{R2 169.96}}{1 + 6{,}8\% \cdot \left(\frac{45}{365}\right)} = \text{R 2 151.92}$$

4.7 CAPLETS, FLOORLETS AND OPTIONS ON FORWARD RATE AGREEMENTS ("FRA")

DEFINITION

Interest rate caplets and floorlets are derivative contracts that are designed to provide protection against interest rate fluctuations. Exercise of these contracts is based on the level of a pre-defined reference rate on a pre-specified date. Caplets are constructed to provide a payment to the holder in the event of interest rates rising above a specified level (the cap rate) on a pre-determined fixing date. Similarly, floorlets are constructed to provide a payment to the holder in the event of interest rates falling below a specified level (the floor rate) on a pre-determined fixing date. These contracts can be used in isolation to either take a speculative position or alternatively to hedge interest rate risk on a single exposure.

These options are typically traded over-the-counter (OTC). They involve the payment of an upfront premium, which reflects the flexibility that it provides to the holder of the option.

FEATURES OF INSTRUMENT

- **Option Type**
  Caplets and floorlets are options on a pre-specified forward interest rate. A caplet is a call option, providing a payout if the pre-specified interest rate rises above a particular level (called the cap rate). A floorlet is the equivalent put option, providing a payout if the pre-specified interest rate falls below a particular level (called the floor rate).

- **Exercise Style**
  As caplets and floorlets provide a payment at a pre-specified time in the future based on a specific interest rate on that specific date, these types of options are European in style.

- **Exercise / strike price**
  The exercise price is the cap or floor rate above or below (depending on which type of option is purchased) which the purchaser of the option will be entitled to receive a payment. This payment is based on the difference between the actual reference rate (for example JIBAR 3-month) observed on a particular day and the strike rate specified on the contract.

- **Settlement**
  Both caplets and floorlets generally settle in advance (only if not part of a cap or floor – refer to section 4.8 of this appendix).

FAIR VALUE MEASUREMENT

i) Key valuation inputs

In order to measure the fair value of caplets and floorlets using the methodology set out below, the valuation inputs applicable to bonds and options are required:

- Contractual terms of the caplet / floorlet including the strike, settlement and maturity date;
- Discount curve;
- Forecast curve;
- The underlying forward interest rate (determined from the forecast and discount curve); and
- Interest rate volatility.

Refer to Appendix 2 of this document for guidance regarding the relevant considerations in developing the required market inputs.

ii) Risk-neutral valuation methodology

Interest rate caplets and floorlets are valued using the Black option pricing model.

The value of the option at a point in time is the difference between the strike and the forecast market interest rate at expiry, taking into account the time value of the option which is driven by interest rate volatility and time to maturity.

The valuation formula for a caplet is:

$$V(t) = A[f\Phi(d_1) - K\Phi(d_2)]$$

and the valuation formula for floorlet is:

$$V(t) = A[K\Phi(-d_2) - f\Phi(-d_1)]$$

where

$V(t)$ = value of instrument at valuation point,

t = valuation point,

$A = N \cdot \tau \cdot \mathrm{df}$,

N = nominal amount,

$\tau = \tau(t;\, t_m, t_n) =$ day count fraction at t, which starts at t_m and matures at t_n,

$\mathrm{df} = \mathrm{df}(t;\, t_m, t_n)$ = discount factor at t, which starts at t_m and matures at t_n,

$f = f(t; t_m, t_n)$ = forward interest rate at t, which starts at t_m and matures at t_n,

Φ = cumulative standard normal distribution function,

K = caplet / floorlet rate (i.e. strike price of option),

$$d_1 = \frac{\ln\left(\frac{f}{K}\right) + \frac{\sigma_k^2}{2}\tau}{\sigma_k\sqrt{\tau}},$$

$$d_2 = d_1 - \sigma_k\sqrt{\tau}$$

σ_k = volatility of the forward interest rate f.

4.8 CAPS AND FLOORS

DEFINITION

Interest rate caps and floors are a series of caplets and floorlets, respectively. Whilst a caplet provides a single call option on the level of a forward interest rate, a cap provide a series of such call options. Similarly, floorlets provide a series of put options on various forward interest rates. Both of these derivatives are generally used for hedging purposes. Specifically, corporates tend to use them to hedge interest rate risk on floating rate loans.

Interest rate caps and floors are typically traded over-the-counter (OTC). They involve the payment of an upfront premium, which reflects the flexibility that it provides to the holder of the option. The cap and floor premiums are simply the respective sums of the caplet and floorlet premiums for all sub-periods.

FEATURES OF INSTRUMENT

- **Option Type**
  Caps and floors are options on a series of pre-specified forward interest rate. A cap is a call option, providing a payout every period that the pre-specified interest rate rises above a particular level (called the cap rate). A floor is the equivalent put option, providing a payout every period that the pre-specified interest rate falls below a particular level (called the floor rate).

- **Exercise Style**
  As caps and floors provide payment(s) at pre-specified time(s) in the future based on a series of specific interest rates on pre-specified dates, these types of options are European in style.

- **Exercise / strike price**
  The exercise price is the cap or floor rate above or below (depending on which type of option is purchased) which the purchaser of the option will be entitled to receive a payment. This payment is based on the difference between the actual reference rate (for example JIBAR 3-month) observed on pre-specified day(s) and the strike rate specified on the contract.

- **Settlement**
  Both caps and floors generally settle in arrears.

FAIR VALUE MEASUREMENT

i) Key valuation inputs

In order to measure the fair value of caps and floors using the methodology set out below, the valuation inputs applicable to caplets and floorlets are required (as outlined in section 4.7 of this appendix).

However, the volatility input will be commensurate with the term of the cap / floor, taking into account the volatility skew.

ii) Risk-neutral valuation methodology

As caps and floors are a series of caplets and floorlets, they are valued by applying a similar methodology as described in section 4.7 of this appendix.

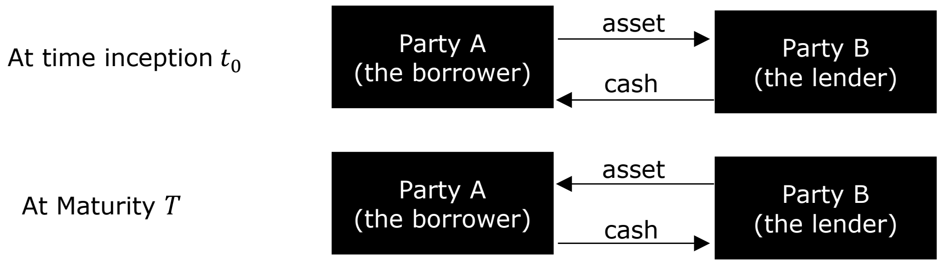
4.9 REPURCHASE AGREEMENTS

DEFINITION

Under a repurchase agreement, commonly referred to as a repo, one party agrees to sell an asset to another with the understanding that the selling party will buy it back later at a specified higher price. The interest rate implied by the price differential is the repo rate. Essentially, a repo is a securitised short-term borrowing transaction.

FEATURES OF INSTRUMENT

In simple terms, a repo functions as follows:



At inception (trade date), Party A (the borrower) places collateral (in the form of an instrument e.g. government bonds) with Party B (the lender) to securitise the transaction (the first leg of the repo transaction). This reduces the credit risk of the borrowing and therefore the lender charges a lower interest rate to the borrower. At the same time, Party A agrees to repurchase the asset at the maturity of the transaction (the second leg of the repo transaction).

The effective result of a repo is that Party B provides cash to Party A at inception and then at maturity, receives the cash provided plus a suitable return (determined on the basis of a rate of interest that is commensurate with the fact that collateral was placed by Party A).

In the case of a repo, the ownership of the collateral placed does pass temporarily from one party to the other. The effect of this is that if the borrower defaults on the cash repayment, the lender does not need to establish his or her right to the collateral.

In effect, a repo is a combination of two separate transactions: first, the purchase or sale of an instrument for immediate delivery and second, the reversal of the initial transaction, for settlement at a future date. Because it is understood from the outset that the first transaction will be reversed, the intention is that the transfer of instruments and cash is temporary rather than permanent.

The party seeking to borrow money is said to be transacting a repo whereas the party seeking to obtain securities is executing a reverse repo (i.e. for every transaction, one party's repo is another party's reverse repo).

Repos are generally considered money-market instruments because of their short-term nature.

The underlying asset in a repo is commonly a bond but may also be any other asset agreed by the parties.

A repo generally takes on of one of three forms (described by reference to the diagram above):

- **A standard repo (or classical repo)**
  A standard repo takes the general form described above. However, any cash flows on the underlying asset (e.g. dividends or coupon payments) received by Party B are paid over to Party A.

  Since ownership of the collateral passes to Party B for the period of the repo, Party B will receive the income (e.g. coupons, partial redemptions) due on the underlying instrument. However, Party B is holding the instrument as collateral only. The economic benefits of the repo to Party B originate from the interest earned on the cash amount lent to Party A, which Party B will receive through the difference in prices between the first and second legs of the repo. As a result, in a standard repo, the income received (e.g. coupon) by Party B is passed back to Party A (the original owner of the collateral).

- **Buy/sell-back**
  The first leg is executed at the price of the asset (e.g. bond) at that point in time (and may incorporate a haircut). The second leg, however, is executed at the forward price for the asset. Interest is calculated at the repo rate on the price of the first leg in the same manner as the future value of an NCD (however, adjustments might have to be made for the coupon) (refer to Appendix B).

  A buy/sell-back differs to a standard repo with respect to the treatment of income received or earned from the underlying collateral by Party B over the term of the repo. For a buy/sell-back, income on collateral is not passed on separately to Party A by Party B. As a result, income on collateral must be taken into account as part of the valuation of the second leg of the transaction, as agreed upfront. For example, in a buy/sell-back where a bond is transferred by Party A to Party B, Party B would return the bonds at maturity in return for the cash plus interest amount due under the terms of the repo, minus any coupons and interest that could have been earned on the bond by Party A over the term of the repo.

  With a buy/sell-back, the transfer of the asset from Party A to Party B is complete which means that over the term of the repo, any cash flows on the underlying asset are retained by Party B. Appropriate adjustments for the income are required when performing the valuation of a buy/sell-back.

- **Securities lending**
  Securities lending, like a repo, is a type of securities financing transaction. In a securities lending transaction, one party (the instrument lender) gives legal title to an instrument (or basket of instruments) to another party (the instrument borrower) for a limited period of time, in exchange for legal ownership of collateral.

  The collateral in securities lending can be either other instruments or cash (securities lending against cash collateral looks very much like repo). The instrument borrower pays a fee to the instrument lender for the use of the loaned instrument. However, if cash is given as collateral, the instrument lender is obliged to reinvest the cash and 'rebate' an agreed proportion of the reinvestment return back to the instrument borrower. In this case, the instrument lender usually deducts the borrowing fee owed from the rebate interest paid to the instrument borrower, rather than paying it separately, so the fee is implicit in the rebate rate.

  A key difference between repo and securities lending is that the repo market generally uses bonds and other fixed-income instruments as collateral, whereas an important segment of the securities lending market is in equities.

  Another difference between repo and securities lending is that most repo transactions are motivated by the need to borrow and lend cash, which means that provided the collateral is of adequate quality, the exact nature of the collateral is not critical. A securities lending transaction, on the other hand, is typically driven by the need to borrow specific instruments. However, there can be an overlap between securities lending and the repo market where a repo is driven by the need to borrow a particular instrument. A borrower in a repo transaction that is aware that the instrument being requested by the lender is in particularly short supply is able to negotiate a lower interest rate for the cash borrowed in the repo transaction.

  The treatment of any income payments on the underlying instruments in a securities lending transaction may mirror those of a standard repo or a buy/sell-back, depending on the terms of the transaction.

FAIR VALUE MEASUREMENT

i) Key valuation inputs

In order to measure the fair value of the money market instrument employing a present value technique, the following valuation inputs are required:

- Contractual terms of instrument;
- Forward price or rate of the underlying asset (refer to section 4.3 of this appendix for guidance of the determination of forward prices); and
- Discount curve (specific to the repo contract and consistent with the mitigated credit risk associated with these trades).

Refer to Appendix 2 for guidance regarding the relevant considerations in developing the required market inputs.

ii) Risk-neutral valuation methodology

Regardless of the form of the repo, the basic valuation methodology consists of the discounting of future expected cash flows.

In the case of a buy/sell-back, the transaction consists of a purchase of a bond at inception and the sale of the bond at a later stage. The reader is therefore referred to the sections relating to the pricing of bonds (refer to Appendix 3) and bond forwards (refer to section 4.4.3 of this appendix).

At inception, the total value of this transaction is the sum of the buy and sell components. If valuation is past the inception date, then the value of the instrument should only consider the far leg of the transaction (i.e. the sale of the bond at a later stage). At inception, the total value of the transaction is the sum of the buy and sell components. If valuation point occurs after the inception date, then the value of the instrument should only consider the far leg of the transaction (i.e. the sale of the bond).

For classic repos and securities lending, the contractual cash flows need to be determined and then discounted off the applicable repo rate.

4.10 EQUITY LINKED NOTES ("ELN") / CONVERTIBLE BONDS

DEFINITION

- **Equity Linked Notes ("ELN")**

Equity linked notes combine a fixed income investment with additional potential returns that are tied to the performance of underlying equity instruments. Equity linked notes are usually structured to return the principal with a variable interest portion that depends on the performance of the linked equity (index, portfolio or individual instrument). ELNs can be structured in many different ways, but the most common ELN is structured by combining a long call option on equity with a long zero coupon bond.

- **Convertible bonds**

A convertible bond is a type of bond issued by a company that can be converted into equity at certain times using a predetermined exchange ratio. They are therefore bonds with an embedded call option on the company' equity instruments.

Due to the similarity in the pay-offs of convertible bonds and equity linked notes we consider both in this section.

FEATURES OF INSTRUMENT

- **Equity Linked Notes ("ELN")**

  Equity linked notes provide a way for investors to protect their capital while also getting the potential for an above average return compared to regular bonds. In theory, the upside potential for returns in an equity linked note is unlimited, whereas the downside risk is capped.

  Equity linked notes are typically privately placed debt instruments.

- **Convertible bonds**

  A convertible bond can either be convertible at the option of the bondholder or at the option of the issuer:

  - A bond convertible at the option of the holder has a coupon rate that is typically lower than a similar bond without the conversion feature. This is due to the additional value attributable to the embedded option to convert the bond into equity of the issuer. The bondholder therefore has an option to participate in the upside of the issuer while remaining protected from the downside risk by the capital and / or coupon payments arising from the bond.
  - A bond convertible at the option of the issuer has a coupon rate that is typically higher than a similar bond without the conversion feature.
  - Different conversion options are available such as limits on conversion rights (e.g. Bermudan option that may only be exercised at certain predetermined dates versus American option that may be exercised at any point).

FAIR VALUE MEASUREMENT

i) Key valuation inputs

In order to measure the fair value of an ELN or convertible bond using the methodology set out below, the valuation inputs applicable to bonds and options are required:

- Contractual terms of the instrument;
- Appropriate discount curve taking into consideration the contractual terms and risks of the instrument;
- Spot price of underlying equity instrument at valuation point;

- Volatility measure (of the underlying equity instrument);
- Refer to Appendix 3 for further information regarding valuation inputs applicable to bond valuations; and
- Refer to section 4.4 of this appendix for further information regarding valuation inputs applicable to option valuations.

Refer to Appendix 2 for guidance regarding the relevant considerations in developing the required market inputs.

ii) Valuation methodology

Intuitively, the fair value of an ELN is determined as the value of the bond component and the value of the equity linked to the bond. Similarly, the fair value of a convertible bond is determined as the value of the bond component and the value of the conversion feature.

The value of the linked equity and the value of the conversion behaves as an option on the underlying equity, therefore the value of a convertible bond or ELN is the value of the vanilla bond and the value of the embedded option.

Specifically, the value of an ELN or convertible bond (that is convertible at the option of holder) is given by:

$$V(t) = B(t) + Q(t)$$

The value of a convertible bond that is convertible at the option of the issuer is given by:

$$V(t) = B(t) - Q(t),$$

where

$V(t)$ = fair value of instrument,

$B(t)$ = fair value of bond component as at valuation point (clean price - refer to Appendix 3 for further guidance),

$Q(t)$ = value of option as at valuation point (refer to section 4.4 of this appendix for further guidance),

t = valuation point.

Note that the above formulae represent a generic simplification. The specific terms and conditions of the instrument being valued need to be considered and the valuation approach adapted accordingly to appropriately measure fair value at the valuation point.

The downside of the method above is that it ignores any correlation between the bond and equity components, whereas in reality the correlation is typically not negligible. Additionally, it is only suitable if the option / conversion right is European, whereas in practice it is typically Bermudan.

The hybrid nature of convertible bonds and equity linked notes make it difficult to value these instruments, and various models exist for more accurate pricing. The choice of model should be informed by the complexity of the valuation.

The valuations of convertible bonds are typically done using either tree models (such as binomial trees), Monte Carlo simulations, or Partial Differential Equations (PDEs). We list some approaches.

Refer to section 3.6 of Appendix 3 for guidance on the valuation of callable bonds.

Specific considerations relevant to convertible bond valuations:

- The model proposed by Tsiveriotis and Fernandes (1998), models convertible bonds as a structural "open-form" solution. It considers the impact of credit risk (specifically default risk) on the convertible bond. Under this method, the value of the convertible bond is determined by splitting it two components. A cash-only part which is subject to credit risk and is discounted at the risky rate; and an equity part which is not affected by credit risk and is discounted at the risk-free rate. This approach is often used as a base model, but has various limitations that have to be considered before employing it.

- There are various approaches that employ tree valuations (e.g. binomial models), and these are quite popular due to their ease of implementation. See Hull (2003) and Chambers et al. (2007) for more information.

- There are complex models that can capture various factors. The approach proposed by Ayache et al. (2003) is a popular PDE approach to valuing convertible bonds and can handle many different assumptions about conversion rights and recovery on default.

4.11 SWAPS

DEFINITION

A swap is a derivative contract. The specific terms differ across instruments but effectively result in the exchange of cash flows between two parties. Each leg comprises of one or more cash flows. One cash flow leg may be fixed while the other variable, or both cash flow legs may be variable. Variable cash flows are based on a benchmark interest rate, floating currency exchange rate or index price.

Swaps cash flows are either based on a notional amount which does not change hands or on a principal amount which is exchanged by the parties to the swap.

FEATURES OF INSTRUMENT

The most common example of a swap is an interest rate swap. However, a large number of variations of swaps have emerged, based on variables other than interest rates. The subsection to follow provide further insight into the valuation principles relevant to a selection of swaps, including cross-currency swaps and inflation-linked swaps.

Trading in standardised swaps can take place on an exchange. However, the vast majority of swaps are transacted OTC.

FAIR VALUE MEASUREMENT

For exchange-traded swaps, price information for the instrument will be provided by the exchange. Provided the price is sourced from an active market at the valuation point and is based on actual transaction data, the exchange price may be used as a measure of the risk-neutral fair value of the instrument, subject to the consideration of relevant valuation adjustments (refer to section 3.3 of Chapter 3).

However, for the vast majority of swap transactions, the selection and application of a suitable valuation techniques, along with relevant inputs is required. It is recommended that consideration should be afforded to the fair value measurement principles set out in Chapter 3, in conjunction with the guidance in this appendix.

4.11.1 INTEREST RATE SWAPS

DEFINITION

An interest rate swap is a forward contract in which one stream of future interest payments is exchanged for another based on a specified notional amount. The notional amount referenced in an interest rate swap is generally not exchanged by the counterparties to the agreement.

FEATURES OF INSTRUMENT

Interest rate swaps are the exchange of one set of cash flows for another. Interest rate swaps may be traded on an exchange or OTC. OTC contracts in particular may be structured to the desired specifications of the parties to the contract.

Interest rate swaps involving an exchange of fixed and floating interest rates are generally employed to hedge interest rate risk.

A floating-for-floating swap is referred to as a tenor basis swap tenor basis swap as the resetting frequency of the reference indices are typically different (e.g. exchanging cash flows linked to 3 month JIBAR for cash flows linked to 6 month JIBAR).

FAIR VALUE MEASUREMENT

i) Key valuation inputs

In order to measure the fair value of an interest rate swap using the methodology set out below, the following valuation inputs may be required:

- Contractual terms of instrument;
- Discount curve (risk-free curve);
- Forward rate curve; and
- Historical floating rate (to the extent that the swap references a floating rate – for the purposes of calculating accrued interest at the valuation point).

Refer to Appendix 2 of this document for guidance regarding the relevant considerations in developing the required market inputs.

ii) Risk-neutral valuation methodology

The contractually specified future cash flows (floating and fixed) and the timing thereof arising from the interest rate swap are determined.

Specifically in relation to the floating leg, the forward rates used in the quantification of the expected future cash flows are obtained from the relevant forward rate curve constructed. To the extent that the rate applicable to the first cash flow after the valuation point is known, the actual rate is used in the calculation of the first floating cash flow, rather than the rate implied per the constructed forward rate curve. (It is important to note that this approach is derived through arbitrage arguments (refer to section 2.2 of Appendix 2) and not due to the fact that the forward curve is the market's prediction of future levels of the reference index. The forward rates only reflect the expected levels of the reference index under a risk-neutral probability measure.)

The related discount factor applicable to the date of each cash flow is obtained from the constructed discount curve. Each future cash flow is discounted using the corresponding discount factor. The sum of the discounted receiving leg cash flows is the present value of the receiver leg and the sum of the discounted paying leg cash flows is the present value of the payer leg.

An all-in price for the interest rate swap is formulated as the present value of the receiving leg less present value of the paying leg.

Once the all-in price has been calculated, the accrued interest on the interest rate swap (difference between floating and fixed rate, applied to the notional for the period of accrual) at the valuation point is determined. Finally, the clean fair value is calculated as the difference between the all-in price and the accrued interest.

Value of a payer interest rate swap:

$$V(t) = PV_{receive}(t) - PV_{pay}(t)$$

- Present value of a floating leg:

$$PV_{float}(t) = \sum_{i=1}^{n} N \cdot (f_{i-1} + s) \cdot \tau(t_{i-1}, t_i) \cdot \mathrm{df}(t, T_i)$$

- Present value of a fixed leg:

$$PV_{fixed}(t) = \sum_{i=1}^{n} N \cdot K \cdot \tau(t_{i-1}, t_i) \cdot \mathrm{df}(t, T_i)$$

Accrued interest (if $t > t_0$ and $t < t_1$):

$$AI = N \cdot \left((r_0 + s) - K\right) \cdot \tau(t_0, t)$$

where

$V(t)$ = value of instrument (all-in price) at the valuation point,

t = valuation point,

$PV_{receive}$ = present value of cash flows received,

PV_{pay} = present value of cash flows paid,

PV_{float} = present value of floating leg (cash flows determined with reference to a floating rate),

PV_{fixed} = present value of fixed leg (cash flows determined with reference to a fixed rate),

N = notional amount,

$f_{i-1} = f(t; \tilde{t}_{i-1}, \tilde{t}_{i-1} + tenor)$ = the forward rate for the reference index that resets at time $\tilde{t}_{i-1}$,

$\{\tilde{t}_0, \tilde{t}_1, \ldots, \tilde{t}_{n-1}\}$ = reset dates,

$tenor$ = floating rate period of the reference index,

s = contractually specified fixed spread over the benchmark rate,

$\{t_0, t_1, \ldots, t_n\}$ = accrual dates,

$\tau(t_{i-1}, t_i)$ = day count fraction function over the relevant period,

$\{T_1, T_2, \ldots, T_n\}$ = payment dates,

$\mathrm{df}(t, T_i)$ = discount factor from the relevant payment date to the valuation point, derived from discount curve,

K = Contractually specified fixed interest rate,

AI = accrued interest on instrument,

r_0 = fixing value of the reference index at $\tilde{t}_0$.

Note: The formulae above can be adapted for other types of swaps, as necessary. The notional is generally not exchanged under an interest rate swap – to the extent that this assumption is not relevant – the formulae above can be adapted, as necessary.

Important to note that this approach is derived through arbitrage arguments and not due to the fact that the forward curve is the market's prediction of future levels of the reference index. The forward rates only reflect the expected levels of the reference index under a risk neutral probability measure.

4.11.2 CROSS-CURRENCY SWAPS

DEFINITION

A cross-currency swap is a forward contract in the form of an agreement between two parties to exchange one stream of future interest payments and principal for another, with each stream denominated in a different currency.

FEATURES OF INSTRUMENT

A typical currency swap involves three sets of cash flows:

- The initial exchange of the principal amounts at inception of the agreement;
- The exchange of interest payments during the swap period; and
- The final exchange of principal amounts upon termination of the swap.

FAIR VALUE MEASUREMENT

i) Key valuation inputs

In order to measure the fair value of a currency swap using the methodology set out below, the following valuation inputs may be required:

- Contractual terms of instrument;
- Discount curve (basis-adjusted) per referenced currency;
- Forward rate curve(s)
- Spot exchange rate as at valuation point (amount of local currency per unit of foreign currency) or forward exchange rates (amount of local currency per unit of foreign currency).

Refer to Appendix 2 of this document for guidance regarding the relevant considerations in developing the required market inputs.

ii) Risk-neutral valuation methodology

The contractually specified future cash flows (floating and fixed interest payments as well as principal amounts) and the timing thereof arising from the currency swap, in each respective currency are determined.

One of two approaches may be applied to the valuation:

Valuation in terms of bond prices (specifically floating rate notes)

Under this method, the value of the currency swap in the domestic currency is determined as the difference between:

- The value of the bond defined by the domestic cash flows; and
- The value of the bond defined by the foreign cash flows, translated to the domestic currency using the spot exchange rate (subject to the relevant market settlement convention) at the valuation point.

This method is practically implemented as follows:

A stream of cash flows in local currency and a stream of cash flows in foreign currency are determined.

The related discount factor applicable to each cash flow is obtained from the constructed discount curve for the relevant currency.

Each future cash flow is discounted using the corresponding discount factor, per the relevant discount curve.

The sum of the discounted domestic cash flows is the present value of the domestic leg and the sum of the discounted foreign cash flows is the present value of the foreign leg.

The present value of the foreign leg is translated into domestic currency using the spot exchange rate (subject to the relevant market settlement convention) at the valuation point.

An all-in price for the interest rate swap is formulated as the present value of the receiver leg in domestic currency less present value of the payer leg in domestic currency.

Value of a payer-for-receiver currency swap (the assumption in the formulae below is that the receive leg is in the foreign currency):

$$V(t) = \left(PV_{receive}(t) \cdot S_t^{\mathrm{dom}}\right) - PV_{pay}(t)$$

- Present value of floating leg (foreign currency):

$$PV_{float}(t) = \left(\sum_{i=1}^{n} N_{\mathrm{for}} \cdot \left(f_{\mathrm{for}}(t_{i-1}) + s_{\mathrm{for}}\right) \cdot \tau(t_{i-1}, t_i) \cdot \mathrm{df}_{\mathrm{for}}(t, T_i)\right) + N_{\mathrm{for}} \cdot \mathrm{df}_{\mathrm{for}}(t, T_n)$$

- Present value of fixed leg (domestic currency):

$$PV_{fixed}(t) = \left(\sum_{i=1}^{n} N_{\mathrm{dom}} \cdot K_{\mathrm{dom}} \cdot \tau(t_{i-1}, t_i) \cdot \mathrm{df}_{\mathrm{dom}}(t, T_i)\right) + N_{\mathrm{dom}} \cdot \mathrm{df}_{\mathrm{dom}}(t, T_n)$$

Accrued interest (if $t > t_0$ and $t < t_1$):

$$AI = \left(N_{\mathrm{for}} \cdot r_{0(\mathrm{for})} \cdot \tau(t_0, t)\right) \cdot S_t^{dom} - \left(N_{\mathrm{dom}} \cdot K_{\mathrm{dom}} \cdot \tau(t_0, t)\right)$$

Valuation as a portfolio of forward contracts

Each exchange of payments under the currency swap is a forward foreign exchange contract. This method is practically implemented as follows:

A stream of cash flows in local currency and a stream of cash flows in foreign currency are determined.

The cash flows in foreign currency are translated to domestic currency by using forward exchange rates.

The related discount factor applicable to each cash flow is obtained from the constructed discount curve for domestic currency.

Each future cash flow is discounted using the corresponding discount factor.

The sum of the discounted floating cash flows is the present value of the domestic leg in domestic currency and the sum of the discounted foreign cash flows is the present value of the foreign leg in domestic currency.

An all-in price for the currency swap is formulated as the present value of the receiver leg less present value of the payer leg.

Once the all-in price has been calculated, the accrued interest on the currency swap at the valuation point is determined. Finally, the clean fair value is calculated as the difference between the all-in price and the accrued interest.

Value of a payer-for-receiver currency swap (the assumption in the formulae below is that the receive leg is in the foreign currency):

$$V(t) = PV_{receive}(t) - PV_{pay}(t)$$

- Present value of floating leg (foreign currency):

$$PV_{float}(t) = \left(\sum_{i=1}^{n} N_{for} \cdot (f_{\text{for}}(t_{i-1}) + s_{\text{for}}) \cdot \tau(t_{i-1}, t_i) \cdot F_{\text{dom}}(t_i) \cdot \text{df}_{\text{dom}}(t, T_i) \right) + N_{\text{for}} \cdot F_{\text{dom}}(t_n) \cdot \text{df}_{\text{dom}}(t, T_n),$$

- Present value of fixed leg (domestic currency):

$$PV_{fixed}(t) = \left(\sum_{i=1}^{n} N_{\text{dom}} \cdot K_{\text{dom}} \cdot \tau(t_{i-1}, t_i) \cdot \text{df}_{\text{dom}}(t, T_i) \right) + N_{\text{dom}} \cdot \text{df}_{\text{dom}}(t, T_n)$$

Accrued interest (if $t > t_0$ and $t < t_1$):

$$AI = \left(N_{\text{for}} \cdot r_{0(\text{for})} \cdot \tau(t_0, t) \right) \cdot S_t^{\text{dom}} - (N_{\text{dom}} \cdot K_{\text{dom}} \cdot \tau(t_0, t)),$$

where

$V(t)$ = value of instrument (all-in price) at valuation point,

t = valuation point,

$PV_{receive}$ = present value of cash flows received,

PV_{pay} = present value of cash flows paid,

PV_{float} = present value of floating leg (cash flows determined with reference to a floating rate),

PV_{fixed} = present value of fixed leg (cash flows determined with reference to a fixed rate),

S_t^{dom} = Spot exchange rate at time t (amount of domestic currency per unit of foreign currency),

$F_{\text{dom}}(t)$ = forward exchange rate (amount of domestic currency per unit of foreign currency),

N_{for} = nominal amount for foreign currency,

N_{dom} = nominal amount for domestic currency,

$f_{\text{for}}(t_{i-1}) = f(t; \tilde{t}_{i-1}, \tilde{t}_{i-1} + tenor)$ = forward rate for foreign currency benchmark rate,

$\{\tilde{t}_0, \tilde{t}_1, \ldots, \tilde{t}_{n-1}\}$ = reset dates,

$tenor$ = floating rate period of the reference index,

s_{for} = contractually specified fixed spread over the foreign currency benchmark rate,

$\{t_0, t_1, \ldots, t_n\}$ = accrual dates,

$\tau(t_{i-1}, t_i)$ = day count fraction function over the relevant period,

$\{T_1, T_2, \ldots, T_n\}$ = payment dates,

$\text{df}_{for}(t, T_i)$ = discount factor derived from foreign currency discount curve,

$\mathrm{df}_{dom}(t, T_i)$ = discount factor derived from domestic currency discount curve,

T_n = maturity date of contract,

$\mathrm{df}_{for}(t, T_n)$ = discount factor from maturity date to valuation point, derived from foreign currency discount curve,

$\mathrm{df}_{dom}(t, T_n)$ = discount factor derived from maturity date to valuation point, domestic currency discount curve,

K_{dom} = contractually specified fixed interest rate (to which the domestic leg is referenced),

AI = accrued interest on instrument,

$r_{0\,(for)}$ = fixing value of the reference index at $\tilde{t}_0$.

Note: The formulae above can be adapted for other types of swaps (floating-for-fixed, floating-for-floating), as necessary. In addition, the formulae above assume a final exchange of the principal amount. However, to the extent that the cross-currency swap contract terms require interim exchanges of principal, the valuation formulae applied should be adjusted accordingly.

It is important to note that on each leg of the swap may be subject to specific conventions applicable to the relevant market. For example, the interest reset date may differ to the interest period start date. The reader is referred to the section 2.9 of Appendix 2 for more information regarding market conventions. A brief illustrative example to illustrate is provided below:

USD Leg			
Start Date	**End Date**	**Payment Date**	**Reset Date**
23-Jun-15	23-Sep-15	23-Sep-15	19-Jun-15
ZAR Leg			
Start Date	**End Date**	**Payment Date**	**Reset Date**
23-Jun-15	23-Sep-15	23-Sep-15	23-Jun-15

4.11.3 INFLATION-LINKED SWAPS

DEFINITION

An inflation-linked swap is a forward contract in the form of an agreement between two parties to exchange one stream of cash flows based on an inflation index, such as the Consumer Price Index ("CPI"), in exchange for cash flows based on a fixed or floating rate of interest.

It should be noted that an inflation-linked swap differs to that of a vanilla interest rate swap in that the principal amount generally differs between the two legs and is exchanged at maturity.

An inflation-linked swap is a derivative instrument used to transfer inflation risk from one party to another.

Inflation-linked instruments generally depend on lagged values of an inflation index (refer to section 2.4.9 of Appendix 2).

FEATURES OF INSTRUMENT

Inflation-linked swaps are customisable and can take on various cash flow profiles in order to meet the objectives of the parties to the contract.

Inflation-linked swaps may be structured in the form of a:

- **Real swap**
  These are swaps involving the exchange of cash flows based on a real fixed rate (agreed at the outset) and nominal cash flows based on a specified floating rate. Interest is compounded and the payment is made at the maturity date of the swap;

- **Coupon swap**
  Like vanilla interest rate swaps, these swaps involve the periodic exchange of cash flows based on a real fixed rate (agreed at the outset) and cash flows based on a specified floating rate;

- **Break-even swap**
  This swap involves the exchange of cash flows based on a fixed rate for cash flows linked to the realised break-even rate over the term of the swap.

There are multiple variations for structuring inflation-linked swaps. The period-on-period inflation-linked swap may, for example, have the CPI leg structured to have a based fixed return on a period-by-period basis (base cash flow) which is adjusted for changes in the CPI index.

An overview of key valuation principles have been described below but these should be adapted according to the specific terms of the instruments being valued.

FAIR VALUE MEASUREMENT

i) Key valuation inputs

In order to measure the fair value of an inflation-linked swap using the methodology set out below, the following valuation inputs may be required:

- Contractual terms of instrument;
- Nominal discount curve (if a real discount curve is used, the forecast of the future cash flows per the formulae below should be adjusted accordingly);
- Forward rate curve(s);
- Inflation curve; and
- Historical floating rate (to the extent that the swap references a floating rate – for the purposes of calculating accrued interest at the valuation point).

Refer to Appendix 2 of this document for guidance regarding the relevant considerations in developing the required inputs.

ii) Risk-neutral valuation methodology

We have considered the valuation of a non-CPI-for-CPI inflation-linked swap below.

To value an inflation-linked swap, the instrument is separated into the non-CPI and CPI legs in order to take into account the different rates and notional amounts specific to each of the legs.

The contractually specified future cash flows (for both the non-CPI and CPI legs) and the timing thereof arising from the inflation-linked swap are determined.

For the CPI leg, cash flows may either be inflation-adjusted (using the ratio of forecast CPI (obtained from the constructed inflation curve) to the contractually stipulated base CPI) or forecasted on a real (i.e. not adjusted for inflation) basis.

The non-CPI leg may be linked to a fixed or floating rate. If the non-CPI leg of the inflation-linked swap references a floating rate, the forward rates used in the quantification of the expected future cash flows are obtained from the relevant forward rate curve constructed. To the extent that the rate applicable to the first cash flow after the valuation point is known, the actual rate is used in the calculation of the first floating cash flow, rather than the rate implied per the constructed forward rate curve.

The related discount factor applicable to each cash flow is obtained from the constructed discount curve. The discount curve must correspond to the nature of the related cash flows (i.e. for the CPI leg, if real cash flows have been forecast, a real discount curve is required and similarly, if nominal cash flows have been forecast, a nominal discount curve is required).

Each future cash flow (for both the non-CPI and CPI leg) is discounted using the corresponding discount factor. The sum of the discounted non-CPI cash flows is the present value of the non-CPI leg and the sum of the discounted CPI cash flows is the present value of the CPI leg. (Note that the notional amount on each respective leg of the swap can differ due to the highly customisable nature of inflation-linked swaps.)

An all-in price for the inflation-linked swap is formulated as the present value of the CPI leg less present value of the non-CPI leg.

Once the all-in price has been calculated, the accrued interest on the inflation-linked swap (difference between rate on each respective leg of the swap, applied to the notional for the period of accrual) at the valuation point is determined. Finally, the clean fair value is calculated as the difference between the all-in price and the accrued interest.

Value of a non-CPI-for-CPI inflation-linked swap (assuming notional is exchanged):

$$V(t) = PV_{receive}(t) - PV_{pay}(t)$$

- Present value of CPI leg
  Nominal discount curve (if nominal cash flows have been determined):

$$PV_{CPI}(t) = \sum_{i=1}^{n} N \cdot r_e \cdot \tau(t_{i-1}, t_i) \, . \frac{CPI_{t_i}}{Base\ CPI} \cdot \mathrm{df}(t, T_i) + N \, . \frac{CPI_{T_n}}{Base\ CPI} \cdot \mathrm{df}(t, T_n)$$

- Present value of non-CPI leg:

$$PV_{non-CPI}(t) = \sum_{i=1}^{n} N \cdot (f_{i-1} + s) \cdot \tau(t_{i-1}, t_i) \cdot \mathrm{df}(t, T_i) + N \cdot \mathrm{df}(t, T_n)$$

Accrued interest (if $t > t_0$ and $t < t_1$):

$$AI = \left(N \cdot r_e \cdot \tau(t_0, t) \cdot \frac{CPI_{t_1}}{Base\ CPI}\right) - (N \cdot (r_0 + s) \cdot \tau(t_0, t))$$

where

$V(t)$ = value of instrument (all-in price) at valuation point,

t = valuation point,

$PV_{receive}$ = present value of cash flows received,

PV_{pay} = present value of cash flows paid,

PV_{CPI} = present value of CPI leg,

$PV_{non-CPI}$ = present value of non-CPI leg,

N = nominal / principal amount,

r_e = real interest rate (contractually specified and assumed to be fixed),

$\{t_0, t_1, \ldots, t_n\}$ = accrual dates,

$\tau(t_{i-1}, t_i)$ = day count fraction function over the relevant period,

CPI_{t_i} = reference CPI applicable in order to determine the amount payable in relation to the interest period ended t_i, determined in accordance with the contractual terms of the instrument and projected off the inflation curve,

$Base\ CPI$ = specific to a particular inflation-linked swap and is equal to the CPI Index (adjusted for the appropriate lag),

$\{T_1, T_2, \ldots, T_n\}$ = payment dates,

$\mathrm{df}(t, T_i)$ = discount factor derived from nominal discount curve, from the relevant payment date to the valuation point,

CPI_{T_n} = reference CPI applicable in order to determine the amount payable upon maturity T_n in relation to the exchange of the notional amount under the contract, determined in accordance with the contractual terms of the instrument and projected off the inflation curve,

T_n = maturity date,

$\mathrm{df}(t, T_n)$ = discount factor derived from nominal discount curve, from maturity date to the valuation point,

$f_{i-1} = f(t; \tilde{t}_{i-1}, \tilde{t}_{i-1} + tenor)$ = the forward rate for the reference index that resets at time $\tilde{t}_{i-1}$ (which may be a fixed rate depending on the terms of the instrument),

$\{\tilde{t}_0, \tilde{t}_1, \ldots, \tilde{t}_{n-1}\}$ = reset dates,

$tenor$ = floating rate period of the reference index,

s = contractually specified fixed spread over the benchmark rate,

AI = accrued interest on instrument,

r_0 = fixing value of the reference index at $\tilde{t}_0$.

Note: To the extent that the notional is not exchanged under the inflation-linked swap – the formulae above can be adapted, as necessary.

Recall that the CPI referenced in the formulae above will generally be based on lagged values.

Given the extensive variety of inflation-linked swaps, the formulae above should be amended as appropriate to reflect the specific contractual terms of the instrument being valued. For instance, the formulae above assume a fixed real interest rate but to the extent that this is not reflective of the contractual terms of the instrument being valued, the formulae should be adjusted accordingly.

Example
Below is an example of a year-on-year inflation linked swap valuation. It is important to note that, in South Africa, the cash flows on inflation-linked swaps depend on lagged values – refer to section 2.4.9 of Appendix 2 for further details.

The details for valuation purposes being as follows:
Notional amount: ZAR 100 000 000
Trade date: 24 April 2010
Effective date: 24 April 2010
Termination date: 23 April 2011
Contract Specified Fixed Interest Rate: 5.2%
Ref $CPI_{initiation}$: 109.42
Number of payments: 1
Frequency of payments: Annual
Valuation point: 30 April 2010

Table of current and forecasted CPI levels:

The forward inflation index values below have been calculated by building the reference CPI rate forward using a CPI yield curve. These have been calculated based on a three month lag.

Date	CPI
12/31/2009	109.2
1/31/2010	109.5
2/28/2010	110.2
3/31/2010	111.1
4/30/2010	111.3
5/31/2010	111.5
6/30/2010	111.5
7/31/2010	112.2
8/31/2010	112.3
9/30/2010	112.4
10/31/2010	112.6
11/30/2010	112.8
12/31/2010	113.0
1/31/2011	113.5

Calculate cash flows:
Ref $CPI_{initiation}$ = 113 + (23-1)/30 x (113.5 -113)
= 113.37

Cash flow for the inflation leg at the end of year 1:
= [(113.37/109.42 - 1) x 100 000 000] x 364/365
= 3 597 015,06

Cash flow for the fixed leg:
= 5.2% x 100,000,000 x 364/365
= 5 185 753.42

In order to calculate the valuation, the net of the above which is 1,588,738.36 should be discounted to valuation point (30 April 2010) based on the applicable discount rate.

Note:
In South Africa, CPI rebases to 100 every four years (last rebasement occurred December 2016). This needs to be considered when valuing contracts that extend over a rebasement date (adjust contracted / initial CPI rate).

4.11.4 TOTAL RETURN SWAPS

DEFINITION

A total return swap is a bilateral financial transaction where the counterparties swap the total return of a single instrument or basket of instruments in exchange for periodic cash flows, typically a floating rate plus a fixed spread.

A key feature of a total return swap is that the parties do not transfer actual ownership of the instruments, as occurs in a repo transaction.

FEATURES OF INSTRUMENT

The two parties involved in a total return swap are known as the total return payer and the total return receiver.

A total return swap is a means to transfer the total economic exposure, including both market and credit risk, of the underlying instrument. The payer of a total return swap can transfer all the economic exposure of the underlying instrument without having to sell it. The total return receiver can access the economic exposure of the underlying instrument without having to buy the instrument.

In a total return swap, the receiver is exposed to instrument return risk, interest rate risk and credit risk. The payer, on the other hand, forfeits the risk associated with the performance of the reference instrument, but takes on interest rate risk and the credit exposure to which the receiver may be subject.

FAIR VALUE MEASUREMENT

i) Key valuation inputs

In order to measure the fair value of a total return swap using the methodology set out below, the following valuation inputs may be required:

- Contractual terms of instrument;
- A risk-free discount curve;
- Forecast / expected price of reference instrument;
- Forward rate curve (if total return payer leg references a floating rate);
- Expected income generated by underlying reference instrument; and
- Previous interest rate fixing (to the extent that the swap references a floating rate).

Refer to Appendix 2 of this document for guidance regarding the relevant considerations in developing the required market inputs.

ii) Risk-neutral valuation methodology

The contractually specified future cash flows (total return receiver leg and total return payer leg) and the timing thereof arising from the total return swap are determined.

Specifically, where the total return payer leg references a floating rate, the forward rates used in the quantification of the expected future cash flows are obtained from the relevant forward rate curve constructed. To the extent that the rate applicable to the first cash flow after the valuation point is known, the actual rate is used in the calculation of the first floating cash flow, rather than the rate implied per the constructed forward rate curve.

With respect to the total return receiver leg, future cash flows comprise of both the income generated by the underlying reference instrument and the change in value of the underlying reference instrument between inception date and maturity date of the swap. The income generated over the life of the swap is determined by the nature of the underlying reference instrument (for example expected coupon payments in the case of a bond, or expected dividends in the case of an equity instrument / index).

The final cash flow under the total return receiver leg should reflect the change in the value of the underlying reference instrument. Appropriate techniques are used to determine the forecast / expected fair value of the underlying instrument upon termination of the swap which is compared to the contractual strike price of the underlying instrument as at inception of the swap. This percentage change in value is applied to the notional amount per the swap agreement to determine the final cash flow under the total return receiver leg.

The related discount factor applicable to each cash flow is obtained from the constructed discount curve. Each future cash flow (both the total return receiver cash flows and the total return payer cash flows) is discounted using the corresponding discount factor. The sum of the discounted total return receiver cash flows is the present value of the total return receiver leg and the sum of the discounted total return payer cash flows is the present value of the total return payer leg.

An all-in price for the total return swap (from the perspective of the total return payer) is formulated as the present value of the total return receiver leg less present value of the total return payer leg.

Once the all-in price has been calculated, the accrued interest on the total return swap at the valuation point is determined. The quantification of the all-in price is subject to the specific terms and conditions of the total return swap contract (and as a result no generalised valuation formulae for its determination is provided below).

Finally, the clean fair value is calculated as the difference between the all-in price and the accrued interest.

Value of a total return swap from the perspective of the total return payer (assuming notional is not exchanged):

$$V(t) = PV_{receiver}(t) - PV_{payer}(t)$$

- Present value of total return receiver leg:

$$PV_{receiver}(t) = \left(\sum_{i=1}^{n} m_i \cdot \mathrm{df}(t, T_i)\right) + N \cdot \mathrm{df}(t, T_n) . \frac{S_{T_n} - S_0}{S_0}$$

- Present value of total return payer leg:

$$PV_{payer}(t) = \sum_{i=1}^{n} N \cdot (f_{i-1} + s) \cdot \tau(t_{i-1}, t_i) \cdot \mathrm{df}(t, T_i)$$

where

$V(t)$ = value of instrument (all-in price) at the valuation point,

t = valuation point,

$PV_{receiver}$ = present value of total return receiver leg,

PV_{payer} = present value of total return payer leg,

m_i = income payment earned on reference instrument (eg. coupons where underlying instrument is a bond, expected dividends where underlying instrument is an equity instrument),

$\{T_1, T_2, \dots, T_n\}$ = payment dates,

$\mathrm{df}(t, T_i)$ = discount factor from the relevant payment date to the valuation point, derived from discount curve,

T_n = maturity date,

$\mathrm{df}(t, T_n)$ = discount factor derived from nominal discount curve, from maturity date to the valuation point,

S_{T_n} = spot price at maturity of the swap,

S_0 = spot price as at inception of swap,

N = notional amount,

$f_{i-1} = f(t; \tilde{t}_{i-1}, \tilde{t}_{i-1} + tenor)$ = the forward rate for the reference index that resets at time $\tilde{t}_{i-1}$ (which may be a fixed rate depending on the terms of the instrument),

$\{\tilde{t}_0, \tilde{t}_1, \ldots, \tilde{t}_{n-1}\}$ = reset dates,

$tenor$ = floating rate period of the reference index,

s = contractually specified fixed spread over the benchmark rate,

$\{t_0, t_1, \ldots, t_n\}$ = accrual dates,

$\tau(t_{i-1}, t_i)$ = day count fraction function over the relevant period.

Note:
The notional is generally not exchanged under a total return swap – to the extent that this assumption is not relevant – the formulae above can be adapted, as necessary.

4.11.5 ASSET SWAPS

DEFINITION

There are various types of asset swaps, but generally asset swaps can be used to transform the cash flow characteristics of the underlying asset in order to hedge currency, credit and/or interest rate risks.

FEATURES OF INSTRUMENT

An asset swap effectively comprises of two trades:

- The swap buyer purchases a bond from the swap seller in return for a full price of par plus accrued interest (called the dirty price and denoted by P in this section);
- The two parties create a contract where the buyer agrees to pay fixed coupons to the swap seller equal to the fixed rate coupons received from the bond. In return, the swap buyer receives interest payments based on a variable benchmark rate plus (or minus) a contractually agreed spread. The maturity of this swap is the same as the maturity of the asset.

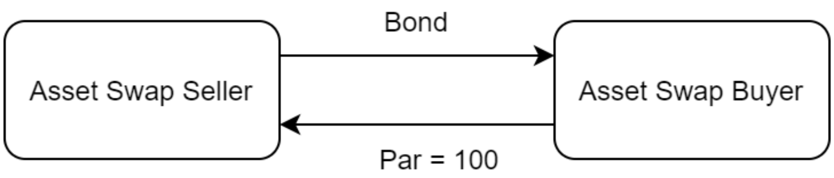
In the case of a an investor seeking to transform its risk profile, as before, the swap seller (protection seller) pays the swap buyer (protection buyer) interest payments based on a variable benchmark rate plus (or minus) a contractually agreed spread. In the event of default, the swap buyer will continue to receive the variable interest payments from the swap seller. In this way, the swap buyer has transformed its original risk profile by changing both its interest rate (fixed to floating plus a spread) and credit risk exposure (credit risk associated with coupon payments were transformed from the issuer of the bond to the counterparty of the interest rate swap). There are a number of variations of asset swaps. The most common types have been identified below:

There are a number of variations of asset swaps. The most common types have been identified below:

- **Par asset swap**
  The key characteristics of a par asset swap are as follows:
  - The notional amount of the swap is the same as the bond notional;
  - The buyer pays the fixed coupon amount and receives a variable amount based on the benchmark rate plus a spread;
  - The maturity of the swap is the same as that of the underlying bond;
  - An upfront premium equal to the difference between the bond's dirty price and the par price is exchanged between the buyer and the seller; and
  - The fixed spread above the benchmark rate (par asset swap spread) paid by the asset swap seller is set so that the net value of the sale of the bond and the swap transaction is zero at inception of the par asset swap.

We illustrate the asset and cash flow exchanges below.

At trade inception the bond is sold to the asset swap buyer (assume sold by the asset swap seller) for its dirty price P. The asset swap buyer pays an additional upfront premium of $(100 - P)$ to enter into the swap. The exchanges at inception are given below:



At subsequent coupon / interest exchange dates, the asset swap buyer receives the coupons from the bond, which are then transferred to the seller. In exchange for this the buyer receives a floating rate plus a spread.

In the case of a default event on the bond, the swap buyer will still be obliged to pay the seller the coupon.

The par asset swap spread is calculated as follows:

Assume it is constructed that the relevant swap curve discount factors where $\mathrm{df}(T)$) is the price today of R1 to be paid at time T. The net upfront premium has a value $(100 - P)$ where P is the dirty price of the bond in the market. The principal payments of par cancel each other out.

For simplicity it is assumed that all payments are annual and are made on the same dates. For the asset swap seller the present value at inception is:

$$\underbrace{(100 - P)}_{\text{Upfront premium}} + \underbrace{\underbrace{c\sum_{i=1}^{n} \mathrm{df}(t,T_i)}_{\text{Fixed payments}} - \underbrace{\sum_{i=1}^{n}(f_{i-1} + s)\cdot\tau(t_{i-1},t_i)\cdot \mathrm{df}(t,T_i)}_{\text{Floating payments}}}_{\text{Interest rate swap}}$$

where

P = dirty price of the bond,

c = annual paid coupon,

t = valuation point,

$\{T_1, T_2, \ldots, T_n\}$ = payment dates,

$\mathrm{df}(t,T_i)$ = discount factor from the relevant payment date to the valuation point, derived from the discount curve,

$f_{i-1} = f(t; \tilde{t}_{i-1}, \tilde{t}_{i-1} + tenor)$ = the forward rate for the reference index that resets at time $\tilde{t}_{i-1}$ (which may be a fixed rate depending on the terms of the instrument),

$\{\tilde{t}_0, \tilde{t}_1, \ldots, \tilde{t}_{n-1}\}$ = reset dates,

$tenor$ = floating rate period of the reference index,

s = contractually specified fixed spread over the benchmark rate,

$\tau(t_{i-1}, t_i)$ = day count fraction function over the relevant period.

- **Market asset swap**
Under a market asset swap the investor swaps the bond price P into a floating rate plus spread. To account for this, the notional of the floating leg is scaled by the dirty price. The fixed leg of the swap remains the same as the bond. The floating rate is therefore paid on a notional that is different from the notional of the fixed leg. This is different to the par asset swap, where the notionals of both legs of the interest rate swap are the notional of the bond. This structure requires an additional premium payment at the maturity of the asset swap (vs. at inception for the par asset swap). The market asset swap spread for a market asset swap is therefore different to that of a par asset swap.

  The market asset swap spread is calculated as follows:

  Using the same notation as above, the present value of all the cash flows to the asset swap seller is

$$\underbrace{c\sum_{i=1}^{n}\mathrm{df}(t,T_i)}_{\text{Fixed payments}} \underbrace{\underbrace{-\frac{P}{100}\sum_{i=1}^{n}(f_{i-1}+s)\cdot\tau(t_{i-1},t_i)\cdot\mathrm{df}(t,T_i)}_{\text{Floating payments}} + \underbrace{(100-P)\cdot\mathrm{df}(t,T_n)}_{\text{Exchange of notional at maturity}}}_{\text{Interest rate swap}}$$

  where

  P = dirty price of the bond,

  c = annual paid coupon,

  t = valuation point,

  $\{T_1, T_2, \ldots, T_n\}$ = payment dates,

  $\mathrm{df}(t, T_i)$ = discount factor from the relevant payment date to the valuation point, derived from the discount curve,

  $f_{i-1} = f(t; \tilde{t}_{i-1}, \tilde{t}_{i-1} + tenor)$ = the forward rate for the reference index that resets at time $\tilde{t}_{i-1}$ (which may be a fixed rate depending on the terms of the instrument),

  $\{\tilde{t}_0, \tilde{t}_1, \ldots, \tilde{t}_{n-1}\}$ = reset dates,

  $tenor$ = floating rate period of the reference index,

  s = contractually specified fixed spread over the benchmark rate,

  $\tau(t_{i-1}, t_i)$ = day count fraction function over the relevant period,

  T_n = maturity date,

  $\mathrm{df}(t, T_n)$ = discount factor derived from nominal discount curve, from maturity date to the valuation point.

- **Cross-currency asset swap**
The cross-currency asset swap enables the investor to purchase a bond denominated in one currency and exchange the coupons and principal for equally valued payments in a different currency.

- **Inflation-linked asset swap**
The inflation-linked asset swap enables the investor to purchase an inflation-linked bond and exchange the inflation-linked payments for fixed or floating rate payments. The notional amount of the inflation-linked leg of the swap is also linked to inflation, while the notional amount of the other leg is fixed. Therefore, there is an exchange of principal at maturity.

FAIR VALUE MEASUREMENT

i) Key valuation inputs

In order to measure the fair value of an asset swap using the methodology set out below, the valuation inputs applicable to bonds and options are required:

- Contractual terms of instrument;
- Discount curve;
- Refer to Appendix 3 for the valuation inputs applicable to bond valuations;
- Refer to section 4.11 of this appendix for the valuation inputs applicable to swap valuations.

Refer to Appendix 2 for guidance regarding the relevant considerations in developing the required market inputs.

ii) Risk-neutral valuation methodology

This section focuses on the basic valuation principles for the most common types of assets swaps and the calculation of breakeven spreads.

From the perspective of the asset swap seller, the fair value of the asset swap at the valuation point is equivalent to the clean price of a fixed-for-floating interest rate swap (assuming any upfront premiums are incorporated into the value of the interest rate swap).

From the perspective of the asset swap buyer, the value of the asset swap at the valuation point is equivalent to the value of the abovementioned interest rate swap (from the buyer perspective) plus the value of the underlying bond.

It is important to note that asset swaps are customisable OTC instruments and can take on various cash flow profiles in order to meet the objectives of the parties to the contract. The most common examples have been discussed above. In general, it is important to ensure that the discount factors used in the valuation are appropriate and that any premiums or exchange of principal are taken into account in the valuation approach adopted.

The detailed valuation methodologies of the individual components that make up asset swaps (i.e. bonds and swaps) are referenced below:

- Appendix 3 for guidance with respect to the valuation of fixed income notes;
- Section 4.11.1 of this appendix for guidance with respect to the valuation of an interest rate swap;
- Section 4.11.2 of this appendix for guidance with respect to the valuation of a cross-currency swap; and
- Section 4.11.3 of this appendix for guidance with respect to the valuation of an inflation-linked swap.

4.12 SWAPTIONS

DEFINITION

Swaptions are derivative contracts that grant the purchaser the right, but not the obligation, to enter into an interest rate swap as from a predetermined date in the future. These contracts can be used to manage interest rate risk, typically for loan exposures that will only be drawn down in a future date.

Swaptions are typically traded over-the-counter (OTC), exposing the respective counterparties to the contract to each other's credit risk, depending on the forecasted mark-to-market value at any point in time. For the right to enter into an interest rate swap at a future date, the purchaser of the swaption usually pays an upfront premium to the writer of the swaption. The contracts are quoted similar to forward rate agreements (for example, a swaption expiring in three years which gives the purchaser the right to enter into a five year interest rate swap from that date forward would be quoted as a 3y5y swaption).

A swaption contract provides a useful alternative to forward-starting swaps. Although a swaption involves the payment of an upfront premium, it provides flexibility to the purchaser. Unlike a forward-starting swap, a swaption does not need to be exercised if it is out of the money at expiry date.

FEATURES OF INSTRUMENT

- **Types of swaption contracts**
  - **Receiver swaption** - grants the purchaser the right but not the obligation to enter into an interest rate swap on a pre-determined future date, where the purchaser receives a fixed interest rate (i.e. swap rate) and pays a floating interest rate. A receiver swaption is in the money if the market swap rate is lower than the strike which is required to be paid by the swaption holder; and
  - **Payer swaption** - grants the purchaser the right but not the obligation to enter into an interest rate swap on a pre-determined future date, where the purchaser pays the fixed interest rate (i.e. swap rate) and receives a floating interest rate. A payer swaption is in the money if the market swap rate is higher than the strike which is required to be paid by the swaption holder.
- **Styles of swaption contracts**
  Swaptions could have various expiry dates depending on whether the swaption style is:
  - American - can be exercised at any point until the expiry date;
  - European - can only be exercised at a specific date; or
  - Bermudan - can be exercised at numerous predetermined dates.
- **Swaption exercise / strike price**
  As the underlying in a swaption is a forward starting swap interest rate, the exercise price is the fixed swap rate that the purchaser of the swaption will be entitled to pay or receive (depending on which type of swaption is purchased) in terms of the interest rate swap agreement which will be become effective as from the date that the swaption is exercised.
- **Settlement**
  There are two ways in which a swaption can be settled:
  - Physical settlement **–** holder of the swaption enters into the underlying interest rate swap at expiry of the swaption.
  - Cash settlement **–** The interest rate swap present value is settled in cash. This present value is calculated based on market swap rates at expiry of the swaption contract. Swaption contracts of this type do not generally trade in South Africa.

FAIR VALUE MEASUREMENT

i) Key valuation inputs

In order to measure the fair value of a swaption using the methodology set out below, the valuation inputs applicable to bonds and options are required:

- Contractual terms of the swaption including the strike, maturity date, payment dates;
- Discount curve;
- Forecast curve;
- The underlying forward starting swap par rate (determined from the forecast and discount curve); and
- Interest rate volatility (related to the underlying reference rate).

Refer to Appendix 2 of this document for guidance regarding the relevant considerations in developing the required market inputs.

ii) Risk-neutral valuation methodology

As a swaption represents an option to enter into an interest rate swap at a future predetermined date, it is valued using an option pricing model (Black Scholes model for European options and the binomial model can be used for American or Bermudan options).

The value of the option at a point in time is the difference between the strike (as specified in the swaption contract as the fixed swap rate for the interest rate swap that will be entered into if the option is exercised) and the forecast market swap rate at expiry, taking into account the time value of the option which is driven by interest rate volatility and time to maturity.

The valuation formula for a European payer swaption is:

$$V(t) = N \cdot A[f\Phi(d_1) - K\Phi(d_2)]$$

and the valuation formula for a European receiver swaption is:

$$V(t) = N \cdot A[K\Phi(-d_2) - f\Phi(-d_1)]$$

where

$V(t)$ = value of swaption at the valuation point,

t = valuation point,

N = nominal amount,

A = the annuity factor, and is given by:

$$\sum_{i=m}^{n-1} \tau(t_i, t_{i+1}) \cdot \mathrm{df}(t, t_{i+1})$$

$\tau(t_i, t_{i+1})$ = day count fraction between consecutive swap pay dates,

$\mathrm{df}(t, t_{i+1})$ = discount factor over the relevant period,

K = strike price of the option,

$f = f(t; t_m, t_n)$ = par rate at t for the underlying forward starting swap, which starts at t_m and matures at t_n,

Φ = cumulative standard normal distribution function,

$$d_1 = \frac{\ln\left(\frac{f}{K}\right) + \frac{\sigma^2}{2}\tau(t, t_m)}{\sigma\sqrt{\tau(t, t_m)}},$$

$$d_2 = d_1 - \sigma\sqrt{\tau(t, t_m)},$$

$\sigma = \sigma(f, K; t_m, t_n)$ = swaption volatility,

$\{t_m, t_{m+1}, \dots, t_n\}$ = underlying swap dates, with t_m the swap start date, also equal to the expiry of the swaption, and t_n the swap maturity date.

4.13 CREDIT DEFAULT SWAPS ("CDS") / CREDIT DEFAULT OPTIONS

DEFINITION

A CDS is a bilateral agreement with two legs; a premium leg in which the seller makes periodic coupon payments to the buyer, and a protection leg in which the buyer will compensate the seller in the case of a credit event relating to a specific reference entity. Please note that for the purposes of this section, the protection buyer is the seller of the CDS.

As an example, if an entity owns corporate bonds and is concerned that the obligor will default, a CDS contract can be used to mitigate or reduce the credit risk. The entity transfers the credit risk to the counterparty of the CDS, who in turns gets an ongoing premium payment.

There are different credit events that could be applicable for a CDS, and these are contractually specified in the trade contract. The most common credit events include bankruptcy, failure to pay, debt restructuring, repudiation/moratorium, obligation default, and obligation acceleration. Upon a credit event, settlement of the CDS is triggered, where upon the seller (i.e. protection buyer) is compensated in the form of a payment.

FEATURES OF INSTRUMENT

- **Overview**
  At inception of a CDS contract the coupon is calculated such that the CDS prices to par, i.e. such that the CDS has a mark-to-market (MtM) of zero. The coupon which prices the CDS to par is known as the CDS spread. The MtM of the CDS could vary between positive and negative throughout the life of the contract, depending on changes in the obligor's credit quality.

  A key difference between a CDS and an insurance contract is that an insurance contract provides protection against losses on an instrument that is owned. In the case of a CDS, the underlying instrument does not have to be owned.

  As a result of the credit crisis in 2007/2008, the liquidity in the CDS market dried up; in order to aggregate the available liquidity in market, the International Swaps and Derivatives Association (ISDA) drew up standardised terms for CDS contracts (we will refer to these as standard CDS). Standard CDS contracts are the most liquid ones in the market. In South Africa the CDS market is very illiquid, and CDS are often structured with bespoke terms.

  Standard CDS have a fixed coupon / spread (e.g. 100bp, 200bp and 500bp) and a corresponding initial cost termed points-up-front (PUF) (reflects the differential between the obligor's credit quality and the fixed coupon). Thus, the PUF can be positive or negative and is either paid or received by the protection buyer. In addition, all CDS contracts with a specified counterparty, tenor and issue date now have the same fixed coupon and maturity dates. For example, a 1Y CDS on HSBC issued on 20-Jun-2013 (with a coupon of 100bps), will be identical to every other 1Y CDS on HSBC (with 100bps coupon) issued up to 19-Sep-2013, i.e. they will have identical premium payments and a maturity of 20-Sep-2014 - this is known as *on-the-run*. After 19-Sep-2013, new 1Y CDSs will have a maturity of 20-Dec-2014, so the 'old' 1Y CDSs (which are now effectively 9M CDSs) will be less liquid, and are now known as being *off-the-run*.

  It should be noted that in the South African market CDS contracts are highly illiquid and the above mentioned standardization does not usually apply.

- **Dates**
  Before moving on to the critical dates of a CDS contract it is important to define the International Monetary Market ("IMM") dates. These are the four quarterly dates of each year, defined as the third Wednesday of March, June, September and December. By abuse of language, CDS contracts are based on IMM dates, however they refer specifically to 20 March, 20 June, 20 September and 20 December each year – note that these may fall on a weekend.

  There are several dates which are defined in a typical CDS contract, these include:

  - Trade Date - the date when the trade is executed, denoted as t_0;
  - Step-in (Protection Effective) Date – the date from which the issuer is deemed to be risky;

- Cash-settle Date - the date that any upfront fees are paid;
- Start (Accrual Begin) Date - this is the prior coupon date and is the IMM date before the trade date;
- End (Maturity) Date - this is the CDS contract expiry date and the point in time at which and the protection ends – note that this is an unadjusted IMM date;
- Payment Dates - these are IMM dates adjusted according the relevant day count convention;
- Accrual Start and End Dates **-** these dates are used in the calculation of each premium payment. Apart from the final accrual end date, these are adjusted according the relevant day count convention.

- **Payment and settlement**
  Note that the buyer of a CDS contract will still have to pay the full coupon amount at the next payment date, which has accrued from the previous IMM date. They will however be compensated for a portion of this amount on the cash settlement date – this does not factor in the points up-front ("PUF") calculation discussed below.

  The premium paid on each payment date under the CDS contract is: $\text{Notional} \times \tau(t_{i-1}, t_i) \times s$,

  where

  s is the coupon (expressed in decimal format), and

  $\tau(t_{i-1}, t_i)$ = day count fraction function over the relevant period (per the contractual terms),

  $\{t_0, t_1, \ldots, t_n\}$ = accrual dates.

  Note that for most CDS contracts, on default, the protection buyer must pay any accrued premium to the protection seller. In return, the protection seller usually settles in one of two ways:

  - Cash settlement – a dealer poll is conducted to establish the value of the reference obligation such as x% of par. The protection seller then pays $(100 - x)$% of the notional to the protection buyer; or
  - Physical settlement – the protection buyer sells an acceptable obligation to the protection seller for par.

  For the purpose of CDS valuation, it is assumed that the protection seller pays the protection buyer an amount of $\text{Notional} \times LGD$, where $LGD = 1 - RR$. The percentage LGD is the Loss Given Default, while RR is the associated Recovery Rate (which is assumed to be known at inception). In pricing a CDS contract a standard recovery rate of 40% is assumed for senior, while 20% is assumed for subordinated is generally used. In the case of emerging markets 25% is used in both cases. This however may differ and should be determined based on the CDS contract terms.

- **Independent amounts and trigger events**
  To protect the buyer against the credit risk of the seller, non-standardised CDS contracts often require the posting of an Independent Amount ("IA"). An IA is a predetermined cash amount or equivalent instruments that the seller posts to the buyer as collateral. There are often either upfront IA that are required and/or or trigger-based IA's. The holder of the collateral amount typically pays interest on this determined by a contractually specified reference rate plus spread.

  Trigger events can take on different forms, but often include rating based conditions, e.g. credit downgrades or upgrades, or par spread of the specified obligation of the entity exceeding contractual thresholds.

  Contractually specified IA's and trigger events can have a substantial impact on the valuation of the CDS – both in terms of the complexity of the valuation and on the fair value - and need to be adequately taken into account when valuing a CDS; e.g. the interest that is accrued on the IA is typically below the funding rate of the seller, thus resulting in a funding cost.

- **Terms of prior CDS Contracts**
  Prior to 2003, the maturity date of a CDS contract was not fixed to the IMM dates, i.e. a six month (6M) CDS would have a maturity exactly six months after the step-in date. The maturity date has subsequently changed to the IMM dates of 20 March, June, September and December of each year.

  Currently, a 6M CDS refers to a CDS which has a duration of six months after the next IMM date from the trade date. The table below details the maturity of newly issued 6M and 1Y CDSs as one moves from 18 June to 21 June.

Trade Date	6M	1Y
18-Jun-15	20-Dec-15	20-Jun-16
19-Jun-15	20-Dec-15	20-Jun-16
20-Jun-15	20-Mar-16	20-Sep-16
21-Jun-15	20-Mar-16	20-Sep-16

- **CDS Options**
  A CDS option or credit swaption provides the investor with the right, but not the obligation, to buy (call option) or sell (put option) on a CDS. In South Africa, the CDS market is generally illiquid. Consequently, these derivatives are subjected to a lack of observable market data, e.g. volatilities, and are notoriously difficult to value. An appropriate valuation approach for a CDS option would include deciding on a suitable underlying CDS price process, e.g. using a Cox–Ingersoll–Ross (CIR) model for the hazard rate, and then calibrating this to available data (in an illiquid market this would relate to proxy data with certain relevant assumptions), and then to employ a Monte Carlo simulation for the valuation. Valuing these options lies outside the scope of this Guideline, however disregarding the aforementioned issues, a BS model is described in Brigo & Mecurio (2007).

FAIR VALUE MEASUREMENT

i) Key valuation inputs

In order to measure the fair value of a CDS using the methodology set out below, the valuation inputs applicable to bonds and options are required:

- Contractual terms of the CDS including the CDS spread, maturity date, premium payment dates;
- Discount curve;
- Loss Given Default ("LGD") and Recovery Rate ("RR") parameters; and
- Survival probability curve.

Refer to Appendix 2 for guidance regarding the relevant considerations in developing the required market inputs.

ii) Risk-neutral valuation methodology

The value of owning a CDS is given by (i.e. the value to the seller of protection):

$$V(t)_{CDS} = PV_{Premium} - \mathrm{PV}_{Protection}$$

Where $PV_{Protection}$ is the expected discounted payment that the seller will receive due to the credit event, and $\mathrm{PV}_{Premium}$ is the discounted accrual payment made by the seller. Recall that the seller of a CDS is the protection buyer.

The derivation formulae for the approximate value of the protection and premium legs of a standard CDS (i.e. one without trigger events, IA clauses, early settlement clauses or funding considerations), assuming that any payment resulting from default is made on the next scheduled payment date can be found in Brigo and Mecurio (2007). The results are

$$PV_{Protection} \approx LGD \sum_{i=1}^{n} [Q(T_{i-1}) - Q(T_i)]\mathrm{df}(t, T_i)$$

where T_i is the i^{th} payment date. In addition, if it is assumed that on average default happens mid-way through the period, one can approximate the accrued interest paid on default as:

$$AI \approx \frac{1}{2} s \sum_{i=1}^{n} \tau(t_{i-1}, t_i)\,[Q(T_{i-1}) - Q(T_i)]\,\mathrm{df}(t, T_i)$$

where τ_i is the year fraction between payment dates. Therefore:

$$\mathrm{PV}_{Premium} = s\left[\frac{1}{2}\sum_{i=1}^{n} \tau(t_{i-1}, t_i)\,[Q(T_{i-1}) - Q(T_i)]\,\mathrm{df}(t, T_i) + \sum_{i=1}^{n} \tau(t_{i-1}, t_i) \cdot Q(T_i) \cdot \mathrm{df}(t, T_i)\right]$$

The spread that solves the CDS to a zero initial value is:

$$s = \frac{LGD \sum_{i=1}^{n} \mathrm{df}(t, T_i)[Q(T_{i-1}) - Q(T_i)]}{\frac{1}{2}\sum_{i=1}^{n} \tau(t_{i-1}, t_i) \cdot \mathrm{df}(t, T_i)[Q(T_{i-1}) - Q(T_i)] + \sum_{i=1}^{n} \tau(t_{i-1}, t_i) \cdot \mathrm{df}(t, T_i) \cdot Q(T_i)}$$

where

$V(t)_{CDS}$ = value of the CDS at the valuation point,

t = valuation point,

$PV_{Protection}$ = expected discounted payment that the buyer will receive due to the credit event,

$\mathrm{PV}_{Premium}$ = discounted accrual payment received by the seller,

LGD = Loss Given Default,

Q = Survival probability,

$\{T_1, T_2, \ldots, T_n\}$ = payment dates,

$\mathrm{df}(t, T_i)$ = discount factor from the relevant payment date to the valuation point, derived from discount curve,

s = CDS premiums payable by the holder,

$\{t_0, t_1, \ldots, t_n\}$ = accrual dates,

$\tau(t_{i-1}, t_i)$ = day count fraction function over the relevant period,

AI = Accrued interest on CDS.

Non-standardised CDS contracts need to be valued on a bespoke basis, typically by setting up an appropriate Monte Carlo method taking the contract features into account.

Example

Suppose that today is 1 June 2016 and that one wishes to trade a one year standard CDS. Since the next IMM date is 20 June 2016, the maturity of the CDS is 20 June 2017, with payments dates of 20 June 2016, 20 September 2016, 20 December 2016, 20 March 2017 and 20 June 2017. Note that we have not applied any modified following convention to these dates. Assume that the relevant discount factors and survival probabilities are given, with $LGD = 40\%$. One then have the following table:

Dates	τ_i	$df(0,T_i)$	$PD(T_i)$	$df(0,T_i)\,[PD(T_{i-1}) - PD(T_i)]$	$\tau_i df(0,T_i)[PD(T_{i-1}) - PD(T_i)]$	$df(0,T_i)\tau_i PD(T_i)$
01-Jun-16	0.00	1	1			
20-Jun-16	0.05	0.99	0.995	0.005	0.000	0.052
20-Sep-16	0.26	0.97	0.98	0.015	0.004	0.243
20-Dec-16	0.25	0.96	0.97	0.010	0.002	0.235
20-Mar-17	0.25	0.95	0.95	0.019	0.005	0.226
20-Jun-17	0.26	0.94	0.93	0.019	0.005	0.223
			Total	0.067	0.016	0.979

Therefore the spread that solves the CDS to a zero initial value is:

$$s = \frac{0.4(0.067)}{0.5(0.016)+0.979} = 2.72\%$$

4.14 CREDIT LINKED NOTES

DEFINITION

A Credit Linked Note ("CLN") is a funded credit derivative which offers the buyer of the CLN higher returns than a typical bond would in exchange for credit risk exposure. The CLN is issued on a reference entity, with respect to a particular credit event. There are thus two sources of credit risk; namely, risk to the issuer defaulting, and risk to the reference entity defaulting. A CLN is typically issued under a medium term note programme.

The buyer of the CLN deposits a principal amount with the issuer for a predefined tenor, for which it receives coupon payments from the issuer. Typically, a CLN is equivalent to buying a Credit Default Swap ("CDS") as well as a Floating Rate Note (which extinguishes on a credit event). If the specified credit event does not occur, the principal is returned on maturity. However, if the credit event does occur, the issuer will only return a recovery amount, and not the full nominal. Moreover, no further coupon payments would be made.

Issuers of CLNs usually sell them in order to hedge credit risk, and buyers usually buy them to achieve higher returns than those typically associated with bonds.

FEATURES OF INSTRUMENT

- **Cash flows**
  A vanilla CLN usually involves 4 sets of cash flows:
  - The buyer deposits a nominal amount with the issuer.
  - The seller pays out a series of cash flows to the issuer until either maturity is reached or the referenced credit event occurs; these cash flows are determined by a reference rate (e.g. 3-month JIBAR) plus a funding spread plus a coupon from the CDS.
  - If the credit event does not occur, the nominal is returned to the buyer at maturity.
  - If the credit event occurs, a recovery amount is paid out to the buyer.

  Exotic OTC CLNs might have drastically different cash flow structures, which would need be valued on a bespoke basis, but exposing the buyer of the CLN to the default risk of the CDS reference entity in exchange for greater returns remains the same.

- **Liquidity**
  Even though the market for CLNs are typically a lot higher than that of the CDS market, the liquidity of CLNs remains low; especially in South Africa. This leads to significant liquidity risks if the CLNs are not held up to unwinding or maturity.

- **Correlation risk**
  The buyer of a CLN is exposed to two forms of credit risk; the buyer is exposed to obligator risk, i.e. the risk that the credit event relating to the reference party comes to fruition, as well as counterparty risk in the form of issuer default.

  The obligator and counterparty often have correlated credit risks, e.g. either being subjected to the same socio-economic climate; or doing business the in same industry.

- **Inward listing**
  In the case where the reference entity is not a local entity, it can be inward listed on the JSE, meaning the underlying bond and CDS are USD denominated, but settled in ZAR. This effectively strips the inherent FX exposure from the obligator risk that the CLN buyer would have been exposed to if they were to buy the same CLN on the international market. In this case, the underlying CDS is thus a quanto CDS. These CLNs are typically listed on the JSE.

FAIR VALUE MEASUREMENT

i) Key valuation inputs

In order to measure the fair value of a CLN using the methodology set out below, the valuation inputs applicable to bonds and CDSs are required:

- Contractual terms of the CLN including the coupon rates, payment frequency, principal amount, recovery rate and maturity date;
- A suitable discount curve , typically being a funding curve; and
- Survival probability curve of the reference entity.

Refer to Appendix 2 of this document for guidance regarding the relevant considerations in developing the required market inputs.

b) Risk-neutral valuation methodology

The cash flows generated by owning a CLN are approximately identical to that of owning a bond of the issuer, and a CDS on the reference entity.

The fair value of the CLN is thus approximately equal to:

$$V(t)_{CLN} = V(t)_{Bond} + V(t)_{CDS}$$

where

$V(t)_{CLN}$ = value of the CLN at the valuation point,

$V(t)_{Bond}$ = value of the bond component at the valuation point,

$V(t)_{CDS}$ = value of the CDS component at the valuation point.

For guidance relating to the valuation of the bond component – refer to Appendix 3.
For guidance relating to the valuation of the CDS component – refer to 4.13 of this Appendix.

If market quotes for the bond and / or CDS are available and liquid, these may be sourced directly and applied in the above formula. Alternatively, each component must be separately valued to determine the fair value of the CLN.

As CLNs are uncollateralised, the appropriate discount curve to use in the valuation of the bond component above is typically a market related funding curve.

The formula mentioned above does not take the correlation risks between the issuer and reference entity into account. This would introduce a discount correction (i.e. manipulate discount factors in order to determine fair value).

APPENDIX 5:
EQUITY INSTRUMENTS

5.1 INTRODUCTION

An equity instrument represents an ownership claim on the net instruments of an entity (business).

In the absence of a quoted price in an active market for an equity instrument, an alternative valuation technique should be identified and applied to measure fair value. This would apply to unlisted equity instruments or where the price of an equity instrument that is traded on an exchange becomes unavailable or is no longer considered to be representative of fair value due to low trading activity, suspension or delisting.

The fair value measurement principles (set out in section 3.2 of Chapter 3) should be considered in developing a suitable valuation technique that appropriately reflects the risks and characteristics inherent in the equity instrument that a market participant would consider.

This chapter provides broad considerations to be applied in the development and application of suitable valuation techniques. The content is intended only as an introductory overview and it is recommended that the following publications should be consulted for further specific guidance:

- International Private Equity and Venture Capital Valuation Guidelines ("IPEV Guidelines"); and
- International Valuation Standards Council – International Valuation Standards ("IVSC Guidelines").

5.2 DISTINGUISHING CHARACTERISTICS OF EQUITY INSTRUMENTS

An entity may finance its operations through a combination of debt (e.g. taking out a loan from a bank), equity (e.g. issuing ordinary shares to the public) or hybrid instruments (i.e. instruments with both debt and equity features). In general, while debt issued by an entity represents a contractual obligation that must be repaid (along with interest charges), the issuance of equity poses no obligation on the issuer. When an entity issues equity instruments, it is not contractually obligated to repay the amount received or to make periodic payments for the use of the funds invested. Instead, acquirers of an equity instrument have a claim on the entity's instruments, after all liabilities have been paid (i.e. a residual claim on the instruments of the entity) and are therefore considered owners of the entity. Equity holders are, in effect, afforded a claim on the net earnings of the entity for their ownership stake (after all other obligations and claims are taken into account).

For an investor in a debt instrument, the return expected is the interest on the outstanding principal until maturity of the instrument (along with the repayment of the principal amount). On the other hand, the return expected by a holder of an equity instrument is dividends and / or capital appreciation (which is realised on the sale of the instrument).

In general, the cost of debt to the issuer is lower than the cost of equity owing to the certainty of returns as well as the preferential claim on the instruments of the entity afforded to the holder of a debt instrument.

The categorisation of debt or equity should always be based on the substance of the instrument rather than its legal form. It is commonplace for structured products to present the legal form of an equity instrument but, in substance, the risks and characteristics of the product are akin to a debt instrument, and vice versa. For example, consider a preference share that imposes an obligation on the issuer to make periodic dividend payments (representing interest) and to repay the principal amount at pre-determined dates. Although the instrument may present the legal form of an equity instrument, the instrument displays the characteristics of a debt instrument and should be valued as such (refer to the guidance relating to fixed-income instruments set out in Appendix 3).

In some cases, a single instrument may contain both a debt and an equity component. In such instances, it is important to give specific consideration to the manner in which the debt component and the equity component will be treated in the valuation technique applied.

This appendix specifically focuses on valuation considerations specific to equity instruments.

5.3 TYPES OF EQUITY INSTRUMENTS

Equity instruments may be issued and traded in the public market (e.g. on an exchange) or in the private equity market.

Types and characteristics of some common equity instruments are provided below:

- **Ordinary shares**
  Ordinary shares represent an ownership interest in an entity and are the predominant type of equity instrument. As a result, the holders of an equity instrument share in the net earnings of the entity, participate in the governance process through voting rights and have a claim on the entity's net instruments in the case of liquidation. An entity may choose to pay out some, or all, of its net income (net income remaining after the fulfilment of all debt obligations) in the form of dividends to ordinary shareholders, but is generally not obligated to do so.

- **Preference shares**
  Preference shares normally rank above ordinary shares with respect to the payment of dividends and the distribution of the entity's net instruments on liquidation.

  The specific terms of preference shares vary in practice (with respect to voting rights, dividend rights and preferential claims). As a result, preference shares may display characteristics of a debt instrument, an equity instrument or both.

  Similar to the interest payments on a debt instrument, the preference dividend amount is specified upfront. A preference dividend may be a fixed amount but it can also be determined by reference to other indicators (e.g. a lending rate, an inflation measure or a proportion of the entity's income).

  Preference shares can have a fixed maturity date or no specified maturity.

  Dividend features on preference shares can take on many different forms:

  - **Cumulative**
    Dividends on cumulative preference shares accrue so that if the entity does not pay a dividend in one or more periods, the unpaid dividends accrue and must be paid in full before dividends on ordinary shares can be declared.
  - **Non-cumulative**
    Any dividends on the preference share that are not paid in the current or subsequent periods are forfeited and are not accrued over time to be paid at a later date. However, the entity is still not permitted to pay any dividends to ordinary shareholders in the current period unless the preferred dividends have been paid.
  - **Participating**
    Participating preference shares entitle the holder to receive the standard preferred dividend plus the opportunity to receive an additional dividend if the entity's profits exceed a pre-specified level. In addition, participating preference shares can also contain provisions that entitle holders to an additional distribution of the entity's net instruments upon liquidation, above the face value of the preference shares.
  - **Non-participating**
    Non-participating preference shares do not allow the holder to share in the profits of the entity. Instead, the holder is entitled to receive only the specified preference dividend amount and the par value of the shares on maturity (or upon liquidation in the case of perpetual preference shares).
  - **Some combination of the above**
    It is common for the dividend terms of preference shares to display a combination of the forms described above. For example, dividends on a preference share may be cumulative participating, cumulative non-participating, non-cumulative participating, non-cumulative non-participating.

- **Convertible preference shares**
  Convertible preference shares entitle the holder to convert their preference shares into a specified number of ordinary shares. The conversion ratio and other conversion terms (e.g. timing) are normally determined upon issuance of the preference shares.

  In effect, holders of a convertible preference share earn the preferred dividend and are allowed to benefit from a rise in the price of the ordinary shares through the conversion option.

  Refer to section 4.10 of Appendix 4 for guidance relevant to the valuation of convertible instruments.

- **Callable or puttable shares**
  Callable ordinary shares or callable preference shares give the issuing entity the right, but not the obligation, to buy back the shares from investors at a pre-determined call price, at a specified point in time or over a specified period of time. An entity would generally call the shares when the market price is above the pre-determined call price.

  Puttable ordinary shares or puttable preference shares give investors the right, but not the obligation, to sell their shares back to the issuer at a pre-determined put price, at a specified point in time or over a specified period of time. An investor would generally sell their shares back to the issuer when the market price is below the pre-determined put price.

  Refer to section 4.4 of Appendix 4 for considerations relevant to the valuation of options.

- **Shares in entities domiciled in a foreign jurisdiction**
  An increasing number of entities are dual listed, which means that their shares are simultaneously issued and traded in two or more markets. However, where shares of a foreign entity are not traded in the local market, alternative investment mechanisms may be considered such as:

  - ***Direct investing***
    An investor may gain exposure to foreign equity by directly buying and selling equity instruments in foreign markets. However, this may pose a number of challenges for an investor, including exposure to currency conversions (price quotations and dividend payments), unfamiliar market practices and differences in regulatory and accounting standards.

  - ***Depository receipts***
    As an alternative to direct investment in a foreign market, a depository receipt is an instrument that trades like an ordinary share on a local exchange and represents an economic interest in a foreign entity. A depository receipt is effectively a mechanism that allows the publicly listed shares of a foreign entity to be traded on an exchange outside its domestic market.

  The valuation techniques applicable to foreign shares are similar to those applied to the valuation or ordinary, preference and other equity instruments. An exception may arise where a valuation adjustment is required to take into account a characteristic specific to the foreign share itself.

5.4 RISK AND RETURN CHARACTERISTICS OF EQUITY INSTRUMENTS

Different types of equity instruments have different risk and return characteristics, driven by the nature of the instrument.

There are two main sources of return for an equity instrument: capital gain (difference between purchase price and sale price) and / or dividend income. For investors in depository receipts or foreign shares, there is a third source of return, namely foreign exchange gains or losses (related to the exchange rate differential between the investor's currency and the currency of the foreign shares).

The risk of any instrument, on the other hand, is based on the uncertainty of its future cash flows (which in the case of an equity instrument, relates to capital gain and / or dividend income). The greater the uncertainty, the greater the risk and the more volatile the value of the equity instrument.

The characteristics of certain preference shares and ordinary shares can make them riskier than others. For example, from an investor's perspective (and assuming all else equal), puttable ordinary or preference shares are less risky than their callable or non-callable counterparts because a minimum price is established that investors will receive. The uncertainty of the instrument's future cash flow is reduced and as a result, puttable instruments generally pay a lower dividend than non-puttable instruments. Similarly, callable ordinary or preference shares are riskier than their non-callable counterparts because the issuer has the option to redeem the instruments at a pre-determined price, limiting an investor's potential future return. For this reason, callable ordinary or preference shares generally pay a higher dividend to compensate investors for the risk that the instruments may be called in the future.

5.5 OVERVIEW OF VALUATION CONSIDERATIONS

Equity instruments traded in an active market for which price information is available may be valued by reference to the quoted price. However, in the absence of a market mechanism to provide reliable pricing information, the application of a valuation technique to measure fair value is generally required (refer to Chapter 3 for an overview of fair value measurement principles and guidelines for the sourcing of price or market data).

The valuation techniques applied to the valuation of equity instruments result in a measure of either the equity value or the enterprise value of an entity. It is important to understand the distinction between these two interrelated concepts:

- Equity value is the residual claim on the instruments of an entity after subtracting its liabilities;
- Enterprise value is a measure of an entity's total market value, regardless of the manner in which the entity is funded.

The book value of equity is the amount reflected in the accounting records of the entity but is not equal to the fair value of the entity's equity.

5.6 VALUATION TECHNIQUES

It is generally considered best practice to use a variety of techniques. If multiple valuation techniques are employed, the range of values determined should be critically assessed for reasonableness. The fair value of the equity instrument is the point within the range that is most representative of fair value, given the surrounding facts and circumstances.

Three major categories of equity valuation models are considered in practice:

5.6.1 INCOME APPROACH

Techniques under this approach estimate the fair value of an equity instrument as the present value of the future benefits expected to be received. In present value models, benefits may be defined in terms of:

- Cash expected to be distributed to shareholders (dividend discount models);
- Cash flows available for distribution to the providers of debt and equity capital (free cash flow to the firm); or
- Cash flows available for distribution to equity shareholders (free cash flow to equity).

Ordinary shareholders have a residual interest in an entity. As a result, the determination of the fair value of an ordinary share cannot be performed in isolation. Consideration must be afforded to the operating performance of the issuer of the ordinary share as this will be the predominant driver of the estimate of future benefits arising from the ordinary share.

A brief description of a selection of the most common valuation models applied in practice is presented below (the list is not exhaustive). The key inputs required in the application of the following models is discussed in the following section of this appendix.

- **Dividend discount model**
  The dividend discount model focuses on the benefits to be generated by the ordinary share to the holder. The benefits equate to the cash flows generated on the equity share (i.e. dividends)

  The applicable discount rate is based on the investor's required rate of return, which is generally equal to the entity's cost of equity.

If the issuing entity is assumed to be a going concern, the fair value of an ordinary share is equal to the present value of forecast dividends.

The dividend discount model is generally used as a sense check for other valuation techniques in practice (principally the discounted cash flow techniques considered below). The dividend discount model is rarely used as the sole source to estimate the fair value of an ordinary share.

The dividend discount method poses a challenge in trying to forecast dividend amounts into the future. To simplify this process in practice, assumptions are made about how dividend will grow or change over time. The Gordon (constant) Growth Model is a simple application of a dividend discount model. The model assumes dividends grow indefinitely at a constant rate.

Because of its assumption of a constant growth rate, the Gordon growth model is particularly appropriate for valuing the ordinary share of a dividend-paying entity that is relatively insensitive to the business cycle, has reached a mature growth phase (e.g. the producer of a staple food product) and has a history of increasing the dividend at a stable growth rate (which is expected to continue into the future).

- **Discounted cash flows**
  Generally, the most widely applied technique to estimate the fair value of an ordinary share is discounted cash flows. Under this technique, value is determined based on projections of cash flows that the underlying entity is forecast to generate in the future, discounted back to the valuation point. The application of this technique requires the performance of robust, detailed analyses of revenue, expenses, capital investments, capital structure decisions.

  The starting point for the application of the discounted cash flow technique is the estimation of the forecast free cash flows. Free Cash Flow is the amount of surplus cash flow an entity generates from its operation activities, after taking into account cash outflows to support operations and maintain capital instruments. Unlike other accounting measures of profitability (such as EBITDA), free cash flow excludes non-cash expenses (in the income statement) and includes capital expenditure spending (both tangible and intangible) as well as cash inflows or outflows arising from changes in working capital requirements.

  Generally, two distinct forecast periods are identified:

  - Explicit forecast period – during this period, the cash flows are explicitly defined, assessed and forecast (represented by the first term in the formulae set out below); and
  - Terminal growth period – during this period, a constant growth of the cash flow occurring at the end of the explicit forecast period is assumed, into perpetuity (represented by the second term in the formulae set out below).

  Note that the forecast periods identified above will not be relevant in all cases and will be driven by the nature and characteristics of the instrument being valued. For example, a terminal growth period would be relevant for indefinite-life instruments, such as a business that is a going concern. The explicit forecast period may be used to define the future cash flows until a stabilised level of growth is reached, after which a terminal growth period is assumed. However, if the business is already considered to be in a stable state, the valuation may take into account only a terminal value. On the other hand, for an instrument with a finite life (e.g. a mine), it is likely that the valuation will only comprise of an explicit forecast period extending to the termination of the instrument. It is important to note that the intentions of any single investor with respect to the instrument is not relevant when performing a fair value measurement – the only assumptions that are relevant are those that a market participant would take into consideration.

Once determined, the forecast cash flows are discounted to the valuation point at an appropriate discount rate. The appropriate discount rate and the result obtained will depend on the definition applied in estimating the free cash flow estimates. There are two key methods of defining free cash flow estimates:

- **Free cash flow to the firm**
  The cash flows estimates used is the free cash flow that is available to all providers of capital including ordinary shareholders, preference shareholders and lenders.
  The appropriate discount rate to determine the present value of the free cash flows to the firm is the WACC.
  The resulting present value is equal to the enterprise value of the entity at the valuation point.

  Once the enterprise value of the entity at the valuation point has been determined, the equity value per share can be determined by subtracting the value of the entity's liabilities (that do not form part of working capital) at the valuation point from the enterprise value (including any adjustments for cash). The result obtained is then divided across the number of outstanding shares at the valuation point to estimate the fair value per ordinary share.
  Note that it is the fair value of the liabilities that should be subtracted from the enterprise value and not the book value of the liabilities.

- **Free cash flow to equity** –
  The cash flows estimates used is free cash flow available to the equity providers of capital only (i.e. cash flows to debt obligations have already been excluded).
  The appropriate discount rate to determine the present value of the free cash flows to equity is the cost of equity.
  The resulting present value is equal to the equity value of the entity at the valuation point.

  Once the equity value of the entity at the valuation point has been determined, the equity value per share can be determined by dividing the total equity value across the number of outstanding shares at the valuation point.

The following points should be considered when considering the application of a discounted cash flow technique:

- The free cash flow estimates should exclude any non-cash items that are generally included as part of accounting profit, Examples include depreciation and impairment.
- The cash flows from non-operating or non-core instruments or liabilities should be excluded from free cash flow estimates. For example, the interest income earned on passive investments in money market funds should be excluded from free cash flow. The risks and characteristics applicable to these instruments are separate from those that are applicable to the operating entity. As a result, these instruments should be valued separately, through the application of valuation models and inputs developed in accordance with best practice valuation principles for the instrument type in question. The fair value of the instrument can then be added to the present value of the free cash flows (as determined in accordance with the above formulae) as an additional, non-operating instrument that increases the value of the entity.
- The free cash flow estimate must be adjusted for any non-market aspects applicable to the entity that a market participant would consider. For example, a main shareholder runs the day-to-day operations of the entity but does not take a salary. A market-related salary should be estimated and deducted from the estimate of free cash flow.
- The treatment of deferred tax instruments require careful consideration in order to avoid overstating the entity's instruments. It is critical to assess whether the benefits implied in the deferred tax instrument are expected to be received by the entity. To the extent that the benefits are considered highly probable, these can be explicitly forecast as part of the free cash flow estimates (provided the cash flows are post-tax). Alternatively, the fair value of the deferred tax instrument can be determined separately and added to the present value of the free cash flows (as determined in accordance with the above formulae) as an additional, non-operating instrument that increases the value of the entity.
- In order to ensure that the value attributed to the terminal growth period is not overstated, it is important to ensure that the growth rate inherent in the final cash flow in the explicit forecast period is equal to the long-term growth rate expected to apply over the duration of the terminal growth period. In other words, all cash flows (including capital expenditures and working capital levels) making up the final cash flow of the explicit forecast period should reflect normalised levels expected to apply in the long-term.

- Where free cash flow to the firm estimates are used, the valuation of equity requires the quantification of the fair value of the debt of the entity. In addition, where liabilities are considered to be understated, relevant adjustments should be made to ensure that the enterprise value is reduced by the correct amount in determining the equity value of the entity. For example, where an entity has an employee pension liability that is underfunded, the liability amount should be adjusted to reflect the amount the entity will be required to expend in meeting its obligations to employees.
- The fair value per equity share is determined by dividing the total equity value of the entity by the number of shares outstanding at the valuation point. Careful consideration should be afforded to instances where an entity has issued warrants or other options that may increase the number of shares outstanding (e.g. share options issued to employees). In determining fair value, the same assumptions a market participant would use should be applied.
- As with any valuation technique, it is important to ensure that all assumptions employed are internally consistent. If a tax has been taken into account in the discount rate, this should be mirrored in the free cash flow estimates. The same applies to assumptions regarding inflation.
- The choice of currency used for the valuation should be considered in relation to the assumptions relating to risk and inflation incorporated in the valuation model. In addition, where the valuation of an entity located in a foreign jurisdiction is contemplated, one of two translation methods may be considered:

- Cash flows are forecast in the foreign currency and translated to the CIS valuation currency using estimates of forward exchange rates. The cash flows are then discounted at the discount rate (appropriate for the valuation currency) to determine the present value at the valuation point; or
- Cash flows are forecast in the foreign currency and discounted at the discount rate (appropriate for the foreign currency) to determine the present value at the valuation point. The present value is converted to the currency of the CIS using the spot exchange rate at the valuation point.
- Ownership rights, including for example the limited liability protection generally offered by a company structure, should be considered in determining the fair value of an equity instrument.

5.6.2 MARKET APPROACH

Techniques under this approach draw on the information relating to capital market activities of comparable listed entities. Two key applications of this approach include:

- **Market multiples**
  Multiples are used in relative valuation techniques. The rationale underlying the technique is the law of one price: identical instruments should sell for the same price.

  There are two key main types of multiples:

  - Equity multiples are used to estimate the fair value of an ordinary share, on the basis of a specified fundamental variable, such as revenue, earnings, cash flows or book value. Examples of common multiples include:
    - Price to earnings (referred to as the P/E ratio and calculated as the share price divided by earnings per share);
    - Price to book (calculated as the share price divided by book value per share); and
    - Price to sales (calculated as the share price divided by annual sales per share).
  - Enterprise value multiples express the ratio of an entity's enterprise value to the value of a fundamental variable. An estimate of equity value can be determined by subtracting the value of non-operating liabilities (i.e. not part of working capital) and any preference shares from enterprise value. Examples of common multiples include:
    - Enterprise value to EBITDA (calculated as the enterprise value divided by annual EBITDA);
    - Enterprise value to sales (calculated as the enterprise value divided by annual sales).

  The fundamental variable referenced in equity or enterprise value multiples may be stated on a forward basis (e.g. forecasted earnings per share for the next year) or on a trailing basis (e.g. earnings per share for the past year). It is important to ensure that the usage and inputs employed in a market multiple valuation are consistent – for example, if a forward P/E is used to measure the fair value of an equity instrument, consistent input measures of forward earnings expected for the entity being valued should be determined.

The starting point for the application of this technique is the selection of a benchmark multiple. The benchmark multiple is the multiple that references a fundamental variable considered to be the key driver of value for the underlying issuer of the ordinary share. For example, for many entities, the key driver would be a profit measure whereas for a start-up entity that is still building capacity and therefore earning low profits, revenue may be considered to be the key driver of the value of the entity.

The next step is to identify a set of comparable entities to the issuer being considered and source the benchmark multiple for each comparable entity. The identification of comparable entities is a matter of professional judgement. Careful analysis is required to identify entities that are most similar to the issuer being considered in order to allow for meaningful comparison, on the basis of a number of dimensions (which may include, for example, industry, product line, size, geography, capital structure etc.). Comparable entities are those that, in essence, respond to the same economic variables as the entity being considered. Comparable entities will, in most cases, be listed entities for which price multiple information is observable (refer to section 3.5 of Chapter 3 for guidance on the sourcing of market data).

A robust analysis of the benchmark multiples sourced is then required. Although comparable entities are selected based on the existence of similar characteristics to the issuer being considered, some differences will remain. As a result, before a comparable benchmark multiple can be applied in the valuation technique, the benchmark multiple must be adjusted to ensure it takes into account the risk and return characteristics of the specific ordinary share being valued. The type and quantum of the adjustments applied is subject to professional judgement. Various market survey publications are available to provide guidance in the identification and quantification of adjustments to multiples. Examples of common adjustments include (note this list is not exhaustive):

- Listing status – Listed entities are generally considered to be less risky than unlisted entities owing to a number of factors including the ease of access to funding, scale of resources and increased regulatory requirements which promote transparency and sound governance practices;
- Size – Larger, established entities are generally assumed to have better access to resources (both financial and non-financial), economies of scale and other operational efficiencies that assist in overcoming operating challenges and other economic downturns more successfully when compared to smaller entities. As a result, larger entities are typically considered less risky than smaller entities;
- Country risk – In some instances comparable entities may be identified in foreign markets. The objective of this adjustment is to reflect the political, economic and financial risks of operating in a specified country. Ordinarily, entities operating in developed economies are generally considered to be less risky when compared to entities operating in emerging markets;
- Diversification – Diversified entities (for example, in terms of geography, product line or service offering) are generally considered less risky as the existence of diversified revenue streams may make them less susceptible to effects of economic downturns; and
- Net working capital and capital expenditure levels – A key differentiator between entities that contributes towards value are the levels of capital required to run the entity and the level of investment into maintaining or expanding operations;
- Growth – To the extent that the comparable entity has greater or lesser growth opportunities and prospects when compared to the issuer of the ordinary share being considered, appropriate adjustments should be applied.

The above factors may either increase or decrease the benchmark multiple for each comparable entity, depending on whether there is an increase or a decrease in the risk relating to the issuer of the ordinary share being valued, relative to the comparable entity.

In identifying the adjustments to the benchmark multiple, it is important to bear in mind that the valuation result from the application of a market multiple valuation approach is a minority valuation. This is because multiples are computed based on the individual traded share prices of listed entities which represent minority holdings (e.g. individual shares in a public company generally do not have the ability to make decisions related to the operations of the company).

As a final step, the fundamental variable referenced in the selected benchmark multiple (e.g. earnings per share, total sales) is then computed for the issuer being considered. A sustainable estimate of the fundamental variable must be developed, taking into account relevant characteristics and surrounding facts that a market participant would consider. A sustainable estimate reflects the forecast outcome for the issuer considered. Where historical outcomes for the fundamental variable are used as a starting point to develop the estimate to be input into the valuation model, any once-off or non-recurring items (e.g. once-off loss on the sale of equipment that occurs infrequently) should be disregarded and any non-market items should be adjusted to reflect current market conditions (e.g. if the main shareholder runs the operations of the entity but does not take a salary, a market-related salary should be estimated and taken into account).

Once the adjusted benchmark multiple for each comparable entity is determined, the result is applied to the sustainable fundamental variable estimate determined for the issuer of the ordinary share being valued. The resulting value obtained (for each comparable entity input used) is:

- An estimate of the fair value of the ordinary share at the valuation point (if an equity multiple was used as the benchmark multiple); or
- An estimate of the enterprise value of the issuer entity at the valuation point (if an enterprise multiple was used as the benchmark multiple). The fair value per share can be estimated by subtracting the value of any non-operating liabilities and preference shares of the entity from the enterprise value (including any required adjustments for cash) and dividing the result by the number of ordinary shares outstanding.

To illustrate the above, consider the following example:
A CIS has purchased an ordinary share in Entity X, an unlisted entity.
At the valuation point, a market multiple technique is determined as a suitable method to determine the fair value of the ordinary held by the CIS in Entity X. The appropriate multiple to be used is determined to be the P/E multiple.
One comparable entity is identified, Entity Y. Entity Y is similar to Entity X with the exception that Entity Y is listed and it is larger than Entity X.
The P/E ratio for Entity Y at the valuation point is 8. Taking into account the differences between Entity X and Entity Y, a 30% adjustment downwards to the P/E ratio is quantified. The resulting adjusted P/E ratio is 5.6.
The fundamental variable referenced in the selected multiple is earnings per share. A sustainable estimate for the earnings per share of Entity X at the valuation point is determined to be ZAR2.10per share (after tax).
The fair value estimate of the ordinary share held in Entity X is ZAR11.76 per share (ZAR2.10 per share multiplied by the adjusted P/E ratio of 5.6).

To the extent possible, the reasonability of multiples used should be compared to industry standards or norms in the market.

Note that the market multiple technique may also be applied to a benchmark yield sourced for comparable entities (e.g. the inverse of the P/E ratio is the earnings yield).

- **Consideration of recent arm's length transactions in identical or similar instruments**
  An alternative method falling under the market approach is the consideration of recent arm's length transactions in identical or similar instruments. This method may be considered appropriate when transaction data is available for an identical or similar equity instrument to the instrument being valued that was traded in an arms-length transaction between market participants at the valuation point.

  The determination of whether an instrument is "similar" requires careful scrutiny to ensure that relevant defining characteristics are selected to facilitate the analysis.

  In circumstances where the comparable transaction data is available for an equity instrument that is not identical to the instrument being valued, the identification and application of suitable adjustments may be required as part of the valuation process. The type and quantum of the adjustment is a matter of professional judgement and should be corroborated by relevant facts that are, as far as possible, observable. Differences between the comparable transaction data and the equity instrument being valued may include restrictions on the transfer of the instrument, marketability or other control characteristics.

Similarly where price data relates to transactions between related parties, an adjustment is required to ensure that the fair value attributed to the equity instrument is reflective of an orderly transaction (refer to section 3.2 of Chapter 3).

The use of price data from transactions that were not concluded at the valuation point should be carefully scrutinised to ensure that the surrounding facts and circumstances between the transaction date and the valuation point have not changed to an extent that would impact the appropriateness of the use of the transaction price to measure fair value.

- **Cost approach**
  Techniques falling under the approach estimate the fair value of an ordinary share from the estimated fair value of the instruments of an entity minus the estimated fair value of its liabilities and preference shares. This approach requires a discrete appraisal of each instrument and each liability.

In the subsections to follow, a selection of specific valuation models are considered, simplified to demonstrate the relevant principles. In practice, modifications to the valuation models presented below may be required to take into account specific facts and circumstances relevant to the instrument being valued.

The guidance set out in this appendix does not encapsulate all possible valuation models that may be considered and applied in practice. In varying circumstances, other valuation models may be developed and determined to be most appropriate in the calculation of fair value.

5.6.3 VALUATION OF PREFERENCE SHARES

A preference share, in its simplest form, is a form of equity (generally, non-voting) that has priority over ordinary shares in the receipt of dividends and on the issuer's net instruments in the event of liquidation. It may have a stated maturity date at which point payment of the preference share's principal (or par) is made or it may be perpetual with no maturity date.

In determining the fair value of a preference share, the estimation of forecast dividends should consider the entity's ability to pay the preference dividend at each dividend payment date. To the extent that an entity is not expected to pay a dividend on certain dividend payment dates, the valuation of the preference share should be adjusted accordingly – in the case of cumulative preference shares, an adjustment to the timing of cash flows is required while in the case of non-cumulative preference shares, the forecast of future cash flows is reduced.

In addition, preference dividends may reference a floating rate or index (for example, preference dividends may be based on prime, preference dividends may be inflation-adjusted or preference dividends may be based on a measure of the entity's profits for participating preference shares). In such instances, an estimate of forecast dividends based on the relevant floating rate or index must be developed. Reference may be made to Appendix 2 for guidance in developing forward curves relating to market variables (e.g. inflation curves, prime curves). In order to develop estimates of future earnings expected to be generated by an entity, a fundamental analysis of the entity, its performance and trends in the context of the industry and economic environment in which it operates is required.

Preference shares exhibit characteristics of both debt and equity instruments. The discount curve applied to the valuation of a preference share should reflect the return a market participant would require, taking into account the risk and return characteristics of the instrument. As a result, the discount curve (based on the investor's required rate of return) will generally lie between the cost of debt and the cost of equity for the entity.

Please refer to Appendix 2 for further detailed guidance relevant to the valuation of preference shares possessing characteristics similar to those of a debt instrument.

For preference shares with option-like features, refer to section 4.4 of Appendix 4 for relevant valuation considerations.

5.7 VALUATION INPUTS

Estimates of future cash flows

A number of valuation techniques require the estimation of future cash flows including for example, dividend discount models and discounted cash flow techniques.

An equity instrument, by definition, evidences a residual interest in the instruments of an entity, after the settlement of its liabilities. Although preference shares may have a priority over ordinary shareholders with respect to the payment of dividends (and return of capital on liquidation), debt holders are generally afforded highest ranking in terms of claims on the instruments of an entity. Even in the case of preference shareholders entitled to a fixed dividend, the entity is not obligated to make the dividend payment at each dividend payment date. Due to the characteristics of equity instruments, the estimate of forecast cash flows generally requires an analysis of the fundamentals of the underlying issuer entity of the equity instrument. Assessing the cash flow generating ability of the underlying entity as a whole will inform the returns expected on the equity instrument.

However, cash flow forecasts may also be developed directly in relation to a partial interest (e.g. the returns on an equity instrument in the form of dividends.

Cash flow estimates can either be determined as a single most likely amount or a probability-weighted estimate, each period. It is important to ensure that the estimate of future cash flows is appropriately compiled with the other inputs used in the valuation model (including the discount rate) in order to avoid double counting. For example, where estimates of future cash flows reflect most likely outcomes, the discount rate may be adjusted to take into account the uncertainty inherent in the realisation of the future cash flows. Similar considerations apply to the treatment of assumptions regarding tax and inflation.

- **Forecast of future cash flows**
  Valuation techniques falling within the income approach are based on the discounting of future amounts of cash flow to a present value.

  The forecast of future cash flows for an the underlying issuer of an equity instrument should take into account all relevant facts and circumstances relating to the entity and the broader operating and economic environment in which the entity operates (including seasonality and cyclicality aspects). In developing the estimates, the same assumptions a market participant would use should be taken into account.

  For an explicit forecast period, financial information for the entity should be forecast (projected inflows and outflows). The forecasts are generally based on historical financial information as well as expectations of future performance, of the entity and the broader economic environment, assessed at the valuation point.

  A key technique often used as a means to forecast or assess estimates of future cash flows is the calculation and interpretation of ratios for the entity being assessed as well as other competitors or similar entities. Ratios are based on information reported in financial statements and used to analyse business performance and financial condition. For example, the analysis of the gross profit margin (gross profit as a percentage of gross revenue) over time. In addition, many industries have specialised measures (e.g. in the hospitality industry, occupation rates is an important metric monitored).

  Where cash flows are expected to continue beyond an explicit forecast period, an estimate of the fair value at the end of the explicit period is required, which is discounted to the valuation point and added to the present value of the cash flows during the explicit forecast period.

  A number of methods may be used to estimate the terminal value. The most common methods include the application of the Gordon growth model or the use of an exit multiple (e.g. application of market multiples).

- **Consensus forecasts**
  In some instances, instead of performing a fundamental analysis on the issuer of the equity instrument being valued, estimates of future cash flows may be based on consensus forecast information (such as estimates developed by analysts). For example, a dividend discount model requires an estimate of benefits expected to be received by the holder of an equity instrument, including dividends. Dividend

forecasts are developed by a number of industry analysts and provided by various price and market data vendors or consensus pricing services.

Prior to making use of consensus forecast data, it is important to assess the source and the nature of the data for reasonability and appropriateness for fair value measurement purposes. Information sourced should be carefully analysed for consistency (e.g. through performing ratio analysis) and corroborated by other observable data (e.g. expected industry growth rates, competitor results).

It is generally considered best practice to source consensus forecast information from multiple sources.

Refer to section 3.5 of Chapter 3 for guidance with respect to the sourcing of price and market data.

Discount rate

The discount rate is used to determine the present value of forecast cash flows. The discount rate should reflect the time value of money as well as the risks inherent in the cash flow forecasts.

The discount rate used will be driven by the type of cash flow forecasts developed for the valuation. A number of methods may be considered when estimating the discount rate including the Capital Instrument Pricing Model ("CAPM"), Weighted Average Cost of Capital ("WACC") or a build-up approach (estimation of the risk-free rate including the addition of various components reflecting the underlying risk). Introductory guidance is provided below on selected approaches commonly considered in practice (the list is not exhaustive);

- **Cost of equity, cost of debt and the required rate of return to an investor**
  There is a cost to an entity associated with the raising of funds, either through debt or equity. When an entity raises capital using debt (e.g. from bondholders or a bank), the cost incurred for the use of these funds is called the cost of debt. The cost of debt is determined based on the periodic interest (or coupon) that the entity is contractually obligated to pay on the debt instrument. When an entity raises capital by issuing ordinary shares, the cost incurred is the cost of equity. Unlike debt, an entity is not contractually obligated to make payments to the holders of ordinary shares. As a result, the cost of equity must be estimated by the application of appropriate techniques.

  Investors require a return on the funds provided to an entity that reflects the perceived level of risk in the investment. This return is referred to as the investor's minimum required rate of return. For an investor in a debt instrument issued by an entity, the minimum required rate of return is equal to the cost of debt. For an investor in an equity instrument issued by an entity, the entity's cost of equity is often used as a proxy for the investors' minimum required rate of return because entity's try to raise capital at the lowest possible cost.

  A variety of methods can be applied to estimate an entity's cost of equity, including for example, the Capital Instrument Pricing Model ("CAPM").

  It is important to note that the cost of debt, cost of equity and required rate of return are continuously reassessed to take into account current facts and circumstances (at each valuation point). For example, the cost of debt is not the interest rate charged historically, but rather the cost that would be incurred by the entity to raise additional debt funding in the future.

- **Weighted Average Cost of Capital ("WACC")**
  WACC is a measure of an entity's total cost of funding in which the cost of debt and equity funding are proportionally weighted according to a target capital structure. All sources of capital, including ordinary shares, preference shares, bonds and any other long-term debt, are included in a WACC calculation.

  The cost of debt (after tax) and the cost of equity are integral components to estimate an entity's Weighted Average Cost of Capital ("WACC"). WACC represents the minimum required rate of return that an entity must earn on its long-term investments to meet the requirements of all capital providers.

  It is important to bear in mind that WACC is a forward-looking measure and should indicate the cost of funding forecast to apply in the future, assessed at the valuation point.

  The formula provided above is limited to two sources of funding: ordinary shares and debt. To the extent that it is forecast that an entity will employ additional sources of funding, this should be taken into account in the calculation of WACC.

Estimate of a long-term growth rate

Estimates of the long-term growth rate are used dividend discount models and discounted cash flow models.

A variety of methods are used to estimate the long-term growth rate. The method used is a matter of judgement and driven by a number of economic and operational factors relevant to the issuer of the ordinary share.

Examples of methods that may be considered include:

- Assessment of the growth in dividends or earnings of the issuer of the equity instrument over time, including any trends that emerge;
- Making use of the industry median growth rate, to the extent that it is available; or observable; or
- Using the expected long-term growth rate in the country in which the entity's operations are based (either Gross Domestic Product or inflationary growth rates, depending on the underlying entity's ability to pass on price increases to customers and structural ability to increase volumes).

5.8 VALUATION ADJUSTMENTS

In accordance with the fair value measurement principles described in Chapter 3, a measure of fair value should include the same assumptions a market participant would use when pricing the instrument, including assumptions about risk. These assumptions may either be incorporated as part of the inputs into a valuation model (e.g. reducing cash flow forecasts to take into account the uncertainty in whether the forecasts will be realised) or considered as direct adjustments to the output from a valuation technique.

Adjustments should not reflect the conditions or intentions of any specific market participant. Only considerations applicable to the characteristics of an instrument may be taken into account, provided it is consistent with aspects a market participant would take into account.

For example, any restrictions on the transfer of an instrument (that is not specific to any particular market participant) would likely be considered to impact the fair value of an instrument (e.g. lock-in periods).

In addition, the nature of the valuation technique used may produce results that are not aligned to the characteristics of the instrument being valued. For example, the discounted cash flow technique is generally used to determine the fair value of a controlling or majority stake in an entity. An adjustment to the valuation result obtained may be required where the fair value of a minority interest is being considered.

APPENDIX 6:
GLOSSARY OF TERMS

The following term descriptions are provided as guidance to aid in the understanding of the terms used and does not replace any term defined in the Act or regulations. It remains subject to any definitions in the Act or regulations.

Term	Description
accrued interest	Amount of interest that has been earned or incurred, as of a specific date, but has not yet been paid.
active market	Defined in IFRS as "a market in which transactions for the asset or liability take place with sufficient frequency and volume to provide pricing information on an ongoing basis."
all-in price	Price of an instrument including accrued interest.
amortised cost	Defined in IFRS as "the amount at which a financial asset or financial liability is measured at initial recognition minus the principal repayments, plus or minus the cumulative amortisation using the effective interest method of any difference between that initial amount and the maturity amount and, for financial assets, adjusted for any loss allowance."
arbitrage	A financial transaction that returns a risk-free profit.
ask price	The ask price (or offer price) is the lowest price at which an instrument is offered for sale. Typically the ask price displayed by most market data vendors is the lowest ask price in the market.
Authority	Consistent with the Conduct Standard, means the Financial Sector Conduct Authority established under section 56 of the Financial Sector Regulation Act, 2017 (Act No. 9 of 2017).
bid-ask spread	The bid-ask spread is the difference between the ask price and the bid price of an instrument.
bid price	The bid price is the highest price a buyer of an instrument is willing to pay. This is essentially the available price at which an instrument can be sold. The bid price displayed by most market data vendors is the highest bid price in the market.
bond	A debt instrument representing an amount owed (the principal amount) by the issuer to the holder. The issuer is obliged to pay the holder interest (coupon payments) at periodic intervals on the principal amount owed. The principal amount is repaid on maturity of the bond (or at specified dates during the term of the bond).
book-close date	The date at which a company's instrument ownership register is checked and dividend or coupon payments are allocated against that register.
call option	A call option gives its holder the right to buy a specified amount of the asset at the given strike price, within a pre-specified time period or at a point in time.
CIS	Collective Investment Scheme

CISCA	Collective Investment Schemes Control Act, 2002 (Act No. 45 of 2002), including any notices issued under the Act.
clean price	Price of an instrument excluding accrued interest or income.
closing price	The final price at which a security is traded on a given trading day. For securities traded on an exchange, the closing price is determined in accordance with the rules of the relevant exchange.
commercial paper	An unsecured, short-term debt instrument issued by a company, typically to finance immediate cash requirements. Commercial paper is usually issued at a discount to face value.
Conduct Standard	Conduct Standard 1 of 2020 on net asset valuation calculation and pricing for collective investment scheme portfolios, issued by the Financial Sector Conduct Authority.
cost approach	Defined in IFRS as "a valuation technique that reflects the amount that would be required currently to replace the service capacity of an asset (often referred to as current replacement cost)."
counterparty	The party to a financial transaction.
coupon	Interest payment amount on a debt instrument, as contractually stipulated.
coupon rate	The contractually stipulated interest rate applied to the face value of a debt instrument in order to determine the coupon payable.
credit risk	Defined in *International Financial Reporting Standard 7: Financial Instruments – Disclosures* ("IFRS 7") as "the risk that one party to a financial instrument will cause a financial loss for the other party by failing to discharge an obligation".
Certificate of Deposit ("CD")	A debt instrument issued by a bank with a fixed maturity date and a specified interest rate (interest payments may either occur periodically or at maturity). Early withdrawal from a CD will generally incur a penalty for the investor.
Consumer Price Index ("CPI")	CPI measures changes in the weighted average price level of a predetermined representative basket of consumer goods and services. CPI and CPI-based measures are frequently used as a measure of inflation.
Credit Valuation Adjustment ("CVA")	A valuation adjustment quantifying the price of the counterparty credit risk for a given asset or liability (refer to section 3.3 of Chapter 3 and section 2.8 of Appendix 2).
debenture	A long-term, unsecured debt instrument with a specified interest rate.. Debentures are issued by both governments and companies in order to raise capital. There are two types of debentures: convertible and non-convertible. Convertible debenture issuers offer investors the choice of converting the debentures into shares upon maturity or over certain predetermined periods of time. Nonconvertible debentures have a fixed maturity date and provide for the redemption of capital over the term of the debenture or at maturity.
Debit Valuation Adjustment ("DVA")	A valuation adjustment quantifying the price of an entity's own credit risk for a given asset or liability (refer to section 3.3 of Chapter 3 and section 2.8 of Appendix 2).

derivative	A financial instrument or other contract with all three of the following characteristics: • Its value changes in response to a specified underlying (e.g. interest rate, commodity price etc.); • It requires no initial net investment or an initial net investment that is smaller than would be required for other contracts that would be expected to have a similar response to changes in market factors; and • It is settled at a future date.
dividend yield	The ratio of the dividend earned on a share to the market price of the share at the date the measure is determined. The dividend yield is commonly expressed as a percentage.
EBITDA	Earnings before interest, taxation, depreciation and amortisation. This is the trading profit of an entity.
effective interest method	Defined in IFRS as "the method that is used in the calculation of the amortised cost of a financial asset or a financial liability and in the allocation and recognition of the interest revenue or interest expense in profit or loss over the relevant period."
effective interest	Defined in IFRS as "the rate that exactly discounts estimated future cash payments or receipts through the expected life of the financial asset or financial liability to the gross carrying amount of a financial asset or to the amortised cost of a financial liability."
equity instrument	Defined in IFRS as "any contract that evidences an ownership interest in an entity and may be represented by an ordinary share or a preference share".
enterprise value	Enterprise Value is a measure of an entity's total value, attributable to debt and equity providers of capital. Enterprise Value is calculated as the sum of the value of the entity's issued equity instruments, debt and minority interests, less cash and cash equivalents.
exchange traded	A financial instrument traded on recognised financial exchanges.
Exchange Traded Fund ("ETF")	An ETF is an investment product that tracks a pool of securities (equity instruments, bonds or commodities) and can be bought or sold on an exchange.
exit price	Defined in IFRS as "the price that would be received to sell an asset or paid to transfer a liability.
expiry date	The last date on which an option may be exercised. In valuing an instrument, the timing of future cash flows is a critical consideration and it is therefore important to take into account the settlement date conventions for the relevant market (refer to section 2.9 of Appendix 2). For example, the settlement date of a contract occurs after a pre-specified number of business days following the expiry date of the contract – as a result, the timing of the future cash flows under the contract should be determined accordingly when performing the valuation.
face value	Nominal value or par value of an instrument as stated by the issuer.
fair value	Defined in IFRS as "the price that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants at the measurement date."

forward contract	A forward contract specifies the price and / or quantity of an asset to be delivered on or before a future pre-specified date.
future	A futures contract is a legally binding agreement to buy or sell an asset in a designated future month at a previously agreed upon price.
highest and best use	Defined in IFRS as "the use of a non-financial asset by market participants that would maximise the value of the asset or the group of assets and liabilities (e.g. a business) within which the asset would be used."
IFRS	International Financial Reporting Standards issued by the International Accounting Standards Board.
IFRS 9	Accounting standard providing the classification and measurement requirements for financial assets, financial liabilities, and some contracts to buy or sell non-financial items, titled: *International Financial Reporting Standard 9: Financial Instruments.*
IFRS 13	Accounting standard specifically addressing fair value measurement principles, titled: *International Financial Reporting Standard 13: Fair Value Measurement.*
income approach	Defined in IFRS as "valuation techniques that convert future amounts (e.g. cash flows or income and expenses) to a single current (i.e. discounted) amount. The fair value measurement is determined on the basis of the value indicated by current market expectations about those future amounts."
index	A grouping of a set of financial instruments to give a performance measure of the collective (e.g. JSE ALSI is an example of an index that is a collective measure of the market of listed equities on the JSE).
inflation	Inflation is the increase in general price level in an economy. Inflation is measured by various statistics (such as CPI), in different economies.
inputs	Defined in IFRS as "the assumptions that market participants would use when pricing the asset or liability, including assumptions about risk, such as the following: a) The risk inherent in a particular valuation technique used to measure fair value (such as a pricing model); and b) The risk inherent in the inputs to the valuation technique. Inputs may be observable or unobservable."
instrument	Refers generally to investments held in a CIS portfolio. Unless otherwise specified in this Guideline, the term 'instruments' can be considered to include assets or liabilities.
interest rate parity	The basic theoretical identity that relates interest rates and exchange rates.
jurisdiction	The legal and regulatory environment in which a valuation engagement is performed.
last traded price	Last price at which a security trades on an exchange, even if more than one day ago.
Level 1 input	Defined in IFRS as "quoted prices (unadjusted) in active markets for identical assets or liabilities that the entity can access at the measurement date."

Level 2 input	Defined in IFRS as "inputs other than quoted prices included within Level 1 that are observable for the asset or liability, either directly or indirectly."
Level 3 input	Defined in IFRS as "unobservable inputs for the asset or liability."
listed equity	An instrument that is listed and traded on any exchange.
long position	A long position refers to actually owning an asset.
market approach	Defined in IFRS as "a valuation technique that uses prices and other relevant information generated by market transactions involving identical or comparable (i.e. similar) assets, liabilities or a group of assets and liabilities, such as a business."
market maker	Individual that makes a market in an asset. The market maker maintains bid and offer prices in a given asset and stands ready to buy or sell the asset, at publicly quoted prices.
market participant	Defined in IFRS as "buyers and sellers in the principal (or most advantageous) market for the asset or liability that have all of the following characteristics: a) They are independent of each other (although the price in a related party transaction may be used as an input to a fair value measurement if the entity has evidence that the transaction was entered into at market terms. b) They are knowledgeable, having a reasonable understanding about the asset or liability and the transaction using all available information, including information that might be obtained through due diligence efforts that are usual and customary. c) They are able to enter into a transaction for the asset or liability. d) They are willing to enter into a transaction for the asset or liability (i.e. motivated but not forced or otherwise compelled)."
mark-to-market	The process of recognising all instruments in a portfolio at their market value.
maturity date	The specified date at which a bond, loan or financial contract will terminate. In valuing an instrument, the timing of future cash flows is a critical consideration and it is therefore important to take into account the settlement date conventions for the relevant market (refer to section 2.9 of Appendix 2). For example, the settlement date of a contract occurs after a pre-specified number of business days following the maturity date of the contract – as a result, the timing of the future cash flows under the contract should be determined accordingly when performing the valuation.
moneyness	Moneyness is a description of a derivative relating its strike price to the price of its underlying asset.
most advantageous market	Defined in IFRS as "the market that maximises the amount that would be received to sell the asset or minimises the amount that would be paid to transfer the liability, after taking into account transaction costs and transport costs."
NAV	Consistent with the Conduct Standard, means Net Asset Value, which is the total market value of all assets in a portfolio including any income accruals and less any permissible deductions as contemplated in section 93 of the CISCA.

Negotiable Certificate of Deposit ("NCD")	A CD guaranteed by a bank that is negotiable in the secondary market for financial assets. Interest is paid either at maturity, or the instrument is purchased by an investor at a discount to its face value.
notional amount	The contractually stated amount used in the calculation of the cash flows arising from an instrument.
option	An option is a contract whereby one party, the holder or buyer, has the right but not the obligation to exercise a feature of the contract, the option, on or before a future date (the exercise date). The other party, the writer or seller, has the obligation to honour the specified feature of the contract on the date it is exercised.
ordinary shares	Also referred to as common stock, an ordinary share is a contract that evidences a residual interest in the net assets of a company. Ordinary shares generally carry voting rights but have no predetermined dividend amounts. Upon liquidation, ordinary shares entitle the holder to a share of the net assets of the company, after settlement of all outstanding debt and preference shares.
Over-The-Counter ("OTC")	OTC refers to securities that are not traded on a formal exchange.
participatory interest	Consistent with section 1 of the CISCA, means any interest, undivided share or share whether called a participatory interest, unit or by any other name, and whether the value of such interest, unit, undivided share or share remains constant over time or varies from time to time, which may be acquired by an investor in a portfolio.
preference shares	Also referred to as preferred stock, a preference share accords the holder preference over the ordinary shareholders with respect to the payment of dividends (when dividends are declared by the company) and the return of capital on liquidation. The preferential rights attributed to a preference share may vary and include features such as rights to participate in profits, conversion to ordinary equity and dividend accumulation rights. Accordingly, preference shares fall under four categories: cumulative, non-cumulative, participating and convertible. cumulative, non-cumulative, participating and convertible. Preference shares may be classified as either debt or equity.
principal amount	The contractually stated amount which is exchanged at maturity.
promissory note	A written commitment to pay another party a specific amount of money by a specific date.
put option	A put option gives the investor the right to sell a fixed number of a specified asset at a fixed price within a pre-specified time period or at a point in time.
reset dates	Also referred to as fixing dates, The contractually specified dates at which the specified rates are applied in order to calculate the applicable cash flows.
rights issue	An offer for subscription made to existing shareholders (referred to as "rights") to purchase additional shares to be issued by a company on a specified future date, at a discount to market price. Until the date the rights are exercised and the additional shares are issued, rights can be traded on an exchange.

short position	A short position arises when an investor sells an asset, with the intention of repurchasing the asset or covering it at later point. An investor taking a short position anticipates a drop in price of the security.
spot	Price for immediate delivery of an asset.
strike	The strike price, or exercise price, is the price at which the asset underlying an options contract may be bought or sold.
terminal value	The value of an asset at the end of the explicit projection period.
Treasury Bill	A short-term debt instrument bearing no coupons. A Treasury Bill is issued by a government to finance its debt.
trustee	Means the trustee or custodian appointed in terms of section 68 of the CISCA
unlisted equity	An instrument that is not listed or traded on any exchange.
Volume Weighted Average Price ("VWAP")	The average price at which the security traded over a predetermined time period, weighted by the volume of each trade.
valuation point	Consistent with the Conduct Standard, means the point in time on a pricing day at which the prices of participatory interests are calculated and shall be the time as determined in the deed.
warrants	The holder of a warrant has the right, but not the obligation, to buy new shares directly from the issuing entity at a fixed price over a given period of time.
working capital	The capital of a business which is used in its day-to-day trading operations, calculated as the current assets minus the current liabilities.
xVA	A suite of valuation adjustment specifically relevant to the determination of fair value of derivative instruments (refer to section 2.8 of Appendix 2).
yield curve	A yield curve shows the relationship between yields to maturity and times to maturity for securities with the same risk profile.
yield to maturity	It is the return an instrument is expected to generate if it is held to maturity. Essentially, it is the IRR of an instrument (i.e. the single discount rate at which the present value of the future cash flows expected to be generated by the instrument is equal to the instrument's current market price).

APPENDIX 7:
REFERENCES

Damiano Brigo and Fabio Mercurio. *Interest rate models-theory and practice: with smile, inflation and credit*. Springer Science & Business Media, 2007.]

Donald R Chambers and Qin Lu. A tree model for pricing convertible bonds with equity, interest rate, and default risk. *The Journal of Derivatives*, 14(4): 25–46, 2007.

Elie Ayache, Peter A Forsyth, and Kenneth R Vetzal. Valuation of convertible bonds with credit risk. *The journal of Derivatives*, 11(1):9–29, 2003.

Ferdinando Ametrano and Marco Bianchetti. Everything you always wanted to know about multiple interest rate curve bootstrapping but were afraid to ask. *SSRN Electronic Journal*, 2013. doi: 10.2139/ssrn.2219548.

Francis A Longstaff and Eduardo S Schwartz. Valuing american options by simulation: a simple least-squares approach. *The review of financial studies*, 14(1):113–147, 2001.

Graeme West. Interest rate derivatives in the south african market based on the prime rate. *Studies in Economics and Econometrics*, 32(1):77–87, 2008.

Iain J Clark. *Commodity option pricing: a practitioner's guide*. John Wiley & Sons, 2014.

John C Cox, Stephen A Ross, and Mark Rubinstein. Option pricing: A simplified approach. *Journal of financial Economics*, 7(3):229–263, 1979.

John C. Hull. *Options, Futures, and Other Derivatives*. PEARSON, 2017. ISBN 013447208X. URL https://www.ebook.de/de/product/28332421/john_c_hull_options_futures_and_other_derivatives.html.

John C Hull. *Options futures and other derivatives*. Pearson Education India, 2003.

John C Hull and Alan White. LIBOR vs. OIS: The derivatives discounting dilemma. *The Journal of Investment Management, Forthcoming*, 2013.

Kostas Tsiveriotis and Chris Fernandes. Valuing convertible bonds with credit risk. *The Journal of Fixed Income*, 8(2):95, 1998.

Patrick S. Hagan and Graeme West. Interpolation methods for curve construction. *Applied Mathematical Finance*, 13(2):89–129, jun 2006. doi: 10.1080/13504860500396032.

Paul Glasserman. *Monte Carlo Methods in Financial Engineering*. Springer New York, 2003. ISBN 0387004513.
URL https://www.ebook.de/de/product/3259168/paul_glasserman_monte_carlo_methods_in_financial_engineering.html.

Steven E. Shreve. *Stochastic Calculus for Finance II*. Springer New York, 2010. ISBN 0387401016. URL https://www.ebook.de/de/product/2835534/steven_e_shreve_stochastic_calculus_for_finance_ii.html.

Steven Wheelwright, Spyros Makridakis, and Rob J Hyndman. *Forecasting: methods and applications*. John Wiley & Sons, 1998.

Tomas Björk. *Arbitrage theory in continuous time*. Oxford university press, 2009.