CIFA

ADVANCED LEVEL

DERIVATIVES ANALYSIS

STUDY TEXT

PAPER NO: 16

REVISED ON: OCTOBER 2021

INTRODUCTION

Following our continued effort to provide quality study and revision materials at an affordable price for the private students who study on their own, full time and part time students, we partnered with other team of professionals to make this possible.
This Study Text covers KASNEB syllabus and contains past examination past papers and our suggested answers as examples which are provided by a team of lecturers who are experts in their area of training. The book is intended to help the learner do enough study and practice on how to handle exam questions and this makes it easy to pass kasneb exams.
Special appreciation and recognition goes to FA Kegicha William Momanyi (MBA Accounting, CPA, CISA and CCP), Johnmark Mwangi (MSc Finance, CPAK, BCom Finance), and FA Bramwel Omogo (B.sc Actuarial Science, CIFA, CIIA final level and ICIFA member)

UNIT DESCRIPTION

This paper is intended to equip the candidate with the knowledge and skills that will enable him/her to analyse and trade in the various types of derivative investments.

LEARNING OUTCOMES

- Demonstrate an understanding of the features, structure and operations of derivatives markets
- Develop a framework for pricing various types of derivatives
- Value derivative instruments using discrete time and continuous time valuation principles.
- Price and hedge interest rate swaps
- Use financial derivative instruments for managing and hedging portfolio risk.
- Apply the framework for risk management so as to enable identification, assessment and control of numerous sources of risk

CONTENT

1. Introduction to Derivative Markets and Instruments

1.1. Introduction to Derivatives
1.2. Derivative specific definitions and terminologies
1.3. Types of Derivatives: forward commitments, contingent claims, financial futures, forward contracts, options, swaps, Exotic Derivatives, Forwards: Range forward contract, break forward contract; Options: Asian or average-rate options, Look back options, Barrier options, Rainbow options, Compound options, Chooser options; Swaps: Interest rate swap variants, Currency swap variants, Equity swap variants
1.4. Overview of derivative markets; regulation, players, Trading of financial derivatives, Trading of commodities derivatives, Buying and shorting financial assets
1.5. The Structure and purpose of derivative markets
1.6. Users and uses of financial derivatives
1.7. Criticisms of derivative markets
1.8. Elementary principles of derivative pricing
1.9. Size and Scope of derivatives markets; Global and regional derivatives markets

2. Forward Markets and Contracts

2.1 Introduction to forward markets and contracts
2.2 The structure and role of forward markets
2.3 Types of forward contracts: equity forwards contracts; bond and interest rate forward contracts; currency forward contracts; other types of forward contracts
2.4 Mechanics of Forward Markets and Contracts; Delivery and settlement of a forward contract; default risk and forward contracts; termination of a forward contract; cost of carry and

transaction costs

2.5 Pricing and valuation of forward contracts: generic pricing and valuation of forward contracts; pricing and valuation of equity forward contracts; pricing and valuation of fixed-income and interest rate forward contracts; pricing and valuation of currency forward contracts

2.6 Credit risk and forward contracts

3. Futures Markets and Contracts

3.1 Introduction: Definition of Futures, Brief history of futures markets;

3.2 Types of futures contracts: short-term interest rate futures contracts; intermediate- and long-term interest rate futures contracts; Bond futures contracts; stock index futures contracts; currency futures contracts; Commodities futures contracts – Agricultural, Energy, Precious and Industrial metal futures

3.3 Characteristics of Futures markets: Public standardized transactions; homogenisation and liquidity; the clearinghouse; daily settlement; and performance guarantee; regulation

3.4 Futures trading: the clearinghouse, margins, and price limits; delivery and cash settlement; futures exchanges. Mechanics of trading in futures markets; Long and short positions, Profit and loss at expiration, Closing of positions, Delivery procedures, marking to market of futures contracts, leverage effect, futures quotes

3.5 Pricing and valuation of futures contracts: generic pricing and valuation of a futures contract; pricing interest rate futures, stock index futures, and currency futures; Factors determining contract price - CAPM, hedging pressure theory and cost of carry model; Theoretical and Reality price of futures; Comparing the calculated value of the future vs the market

3.6 Uses of financial and non-financial futures

3.7 The role of futures markets and exchanges

4. Risk Management applications of Forward and Futures strategies

4.1 Introduction to risk exposures managed by Forwards and Futures

4.2 Strategies and applications for managing interest rate risk: managing the interest rate risk of a loan using a forward contract; strategies and applications for managing bond portfolio risk

4.3 Strategies and applications for managing equity market risk: measuring and managing the risk of equities; managing the risk of an equity portfolio; creating equity out of cash; creating cash out of equity

4.4 Asset allocation with futures: adjusting the allocation among asset classes; pre- investing in an asset class

4.5 Strategies and applications for managing foreign currency risk: managing the risk of a foreign currency receipt; managing the risk of a foreign currency payment; managing the risk of a foreign-market asset portfolio

4.6 Hedging strategies using futures: hedge ratio, perfect hedge, basis risk and correlation

risk, minimum variance hedge ratio and hedging with several futures contracts.

5. Swap Markets and Contracts

5.1 Introduction: Definition of Swap contracts, Types of swaps: currency swaps; interest rate swaps; equity swaps; commodity and other types of swaps

5.2 Characteristics of swap contracts

5.3 The structure of global swap markets

5.4 Pricing and valuation of swaps; pricing and valuation of swaps

5.5 Swaptions: basic characteristics of swaptions; uses of swaptions; swaption payoffs; pricing and valuation of swaptions

5.6 Termination of a swap

5.7 Forward swaps

5.8 The role of swap markets

5.9 Uses of Swap Contracts: Credit risks and swaps

6. Risk management application of swap strategies

6.1 Introduction to risk exposures managed by Swaps

6.2 Strategies and applications for managing interest rate risk: using interest rate swaps to convert a floating-rate loan to a fixed-rate loan (and vice versa); using swaps to adjust the duration of a fixed-income portfolio; using swaps to create and manage the risk of structured notes, reducing the cost of debt

6.3 Strategies and applications for managing exchange rate risk: converting a loan in one currency into a loan in another currency; converting foreign cash receipts into domestic currency; using currency swaps to create and manage the risk of a dual-currency bond

6.4 Strategies and applications for managing equity market risk; diversifying a concentrated portfolio; achieving international diversification; changing an asset allocation between stocks and bonds; reducing insider exposure

6.5 Strategies and applications using swaptions; using an interest rate swaption in anticipation of a future borrowing; using an interest rate swaption to terminate a swap

7. Option markets and contracts

7.1 Introduction: Basic definitions and illustrations of options contracts:

7.2 Types of options: Financial options; options on futures; commodity options; other types of options

7.3 Characteristics of Options Contracts: some examples of options;

7.4 The concept of moneyness of an option

7.5 The structure of global options markets: over-the-counter options markets; exchange-listed option markets

7.6 Options Valuation: Determinants of option price, Option pricing models, sensitivity

analysis options premiums

7.7 Principles of option pricing; payoff values: Boundary conditions; the effect of a difference in exercise price; the effect of a difference in time to expiration; put-call parity; American options, lower bounds, and early exercise; the effect of cash flows on the underlying asset; the effect of interest rates and volatility; option price sensitivities

7.6 Discrete-time option pricing: The binomial model; the one-period binomial model; the two-period binomial model; binomial put option pricing; binomial interest rate option pricing; American options: extending the binomial model

7.7 Continuous-time option pricing: The Black-Scholes-Merton model; assumptions of the model; the black-Scholes-Merton formula; inputs to the black-Scholes- Merton model; the effect of cash flows on the underlying; the critical role of volatility

7.8 Pricing options on forward and futures contracts and an application to interest rate option pricing: Put-call parity for options on forwards; early exercise of American options on forward and futures contracts; the black model; application of the black model to interest rate options

7.9 The role of options markets;

7.10 Uses of Options

8. Risk management applications of option strategies

8.1 Introduction to risk exposures managed by options

8.2 Option strategies for equity portfolios: standard long and short positions; risk management strategies with options and the underlying; money spreads; combinations of calls and puts

8.3 Interest rate option strategies using: interest rate calls with borrowing; interest rate puts with lending; an interest rate cap with a floating-rate loan; an interest rate floor with a floating-rate loan; an interest rate collar with a floating-rate loan

8.4 Option portfolio risk management strategies: delta hedging an option over time; gamma and the risk of delta; vega and volatility risk; the Greeks.

9. Contemporary issues and emerging trends in derivatives Contracts

9.1 Numerical methods of Pricing Options: binomial model, finite difference method and Monte Carlo method.

9.2 Credit derivatives: Credit default swaps (CDS), Credit linked notes (CLN), role of credit derivatives, market participants, Valuation of credit derivatives, credit derivatives institutional framework, spread volatility of credit default swaps

9.3 Financial Engineering; Construction, Uses and Abuses of Derivatives

9.4 Applications of Artificial intelligence and financial technology in derivatives markets

9.5 Benefits and Indispensability of derivatives

9.6 Trends and future of derivatives market globally

9.7 Effects of Crises and Pandemic on global derivatives market

CHAPTER **PAGE NO**

CHAPTER ONE

INTRODUCTION TO DERIVATIVE MARKETS AND INSTRUMENTS

Derivatives markets and instruments

Derivatives - is a financial instrument that offers a return based on the returns of some other underlying assets i.e. its return is derived from another instrument hence the name. Derivative performance is based on the performance of an underlying instrument.

The underlying asset is often referred to the underlying and it trades in the market where buyers and sellers meet and decide on the price then the seller delivers the asset to the buyer and receives payment.

A Cash price or spot price-refers to the price you immediate purchase of the asset.

A derivative has a defined and limited life which means a derivative contract initiates on a certain date and terminates on a later date. A derivative payoff is determined and /or made or the expiration date in most cases.

A derivative contract is an agreement between two parties in which each party does something for the other e.g an insurance contract where one party pays the other and in return receives coverage against potential losses.

Derivatives trade in the following markets;

Exchange Traded Market

They have standard terms and features and they have organized derivative trading facilities e.g. a future exchange as an option exchange.

Over the counter markets

In these markets derivative contracts refers to any transaction created by two parties anywhere else. Such contracts are highly customized and not regulated.

Types of Derivatives

Derivatives can be classified into two major classifications

1. Forward commitment
2. Contingent claims

Forward Commitment

These are contracts in which two parties enter into an agreement to engage in a transaction at later date at a price mentioned at start date

Under these types of commitments, we have

i. The exchange traded futures
ii. Over the counter contracts.

Characteristics of forward commitment

i. Are agreement between two parties in which one party agrees to buy from the other party an underlying asset(stocks, bonds, interest rates, currency exchange rate and commodities like food, gold at a future date at a price established at start)
ii. Parties specify all the forward contract terms and conditions hence it is highly customized.
iii. Each party is subject to the possibility that the other party will default
iv. They are largely unregulated and operate in a private market. They are private because parties want to keep them private and not because they are illegal or corrupt.
v. Are (forward, future and swaps) firm and binding agreement to engage in a transaction in a future date.

They obligate each party to complete their transaction or to offset the same by engaging in another transaction that settles each party's financial obligation to the other.

CONTIGENT CLAIMS

These are contracts in which payoff occurs if a specific event happens. They are generally referred to as option.

An option is a financial instrument that gives one party the right but not the obligation to buy or sell an underlying asset from one to another party at a fixed price over a specified period of time. An option that gives the right to buy is a call option while one that give the right to sell is a put option.

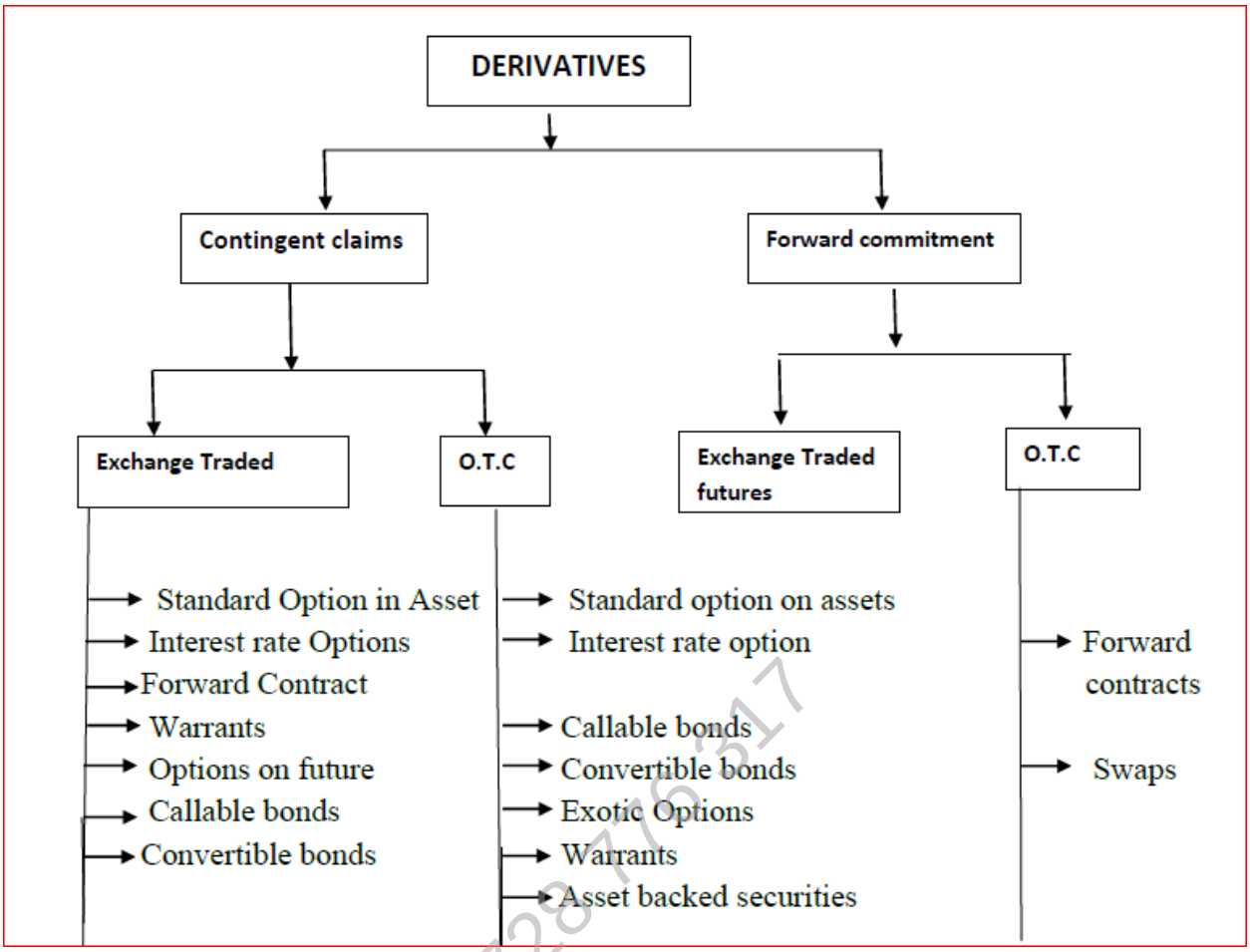
Characteristics of contingent claims

i. They give to only one party a right to buy or sell the underlying and not a commitment to do so.
ii. To acquire this right the buyer pays premium or the option price
iii. The payoff of an option is contingent upon an event taking place

iv. Options can either be customized (OTC)/ contracts or exchange listed standardized contracts that are traded in the option exchange.

Examples of option include:

i. The standard options(calls and puts)
ii. Convertible bonds
iii. Callable bonds
iv. Asset backed securities (they give the pre-payment option)



Purpose of Derivative Markets

1. **Price Discovering.** Future markets provide valuable information about the prices of the underlying asset on which futures are based.
   In the future market, the price of the contract with the shortest time to expiration often serves as a proxy for the price of the underlying asset. Price of all future contracts serve as prices that can be accepted by those who trade contracts in place facing uncertain future prices.
   Forward and swap allow users to substitute a sign locked in price for the uncertainty of the future spot prices and thereby permit the same form of price discovery as do future.
2. **They reveal volatility of the underlying asset price - T**his is revealed by option since volatility of underlying is a critical factor in the pricing of the options. It's therefore possible to infer what investors feel about volatility for the price options.
3. **Risk management (Hedging)** - Is the process of identifying desired level of risk, identifying the actual level of risk and altering the actual level of risk to equal the desired level of risk.

4. **Hedging-** is the reduction and elimination of the risk while speculation is the assumption of risk by a given party. Since derivatives lock in the price at the beginning of the contracts they play a role in risk management by eliminating uncertainties.
5. **To improve the market efficiency for the underlying-**Efficient markets are fair and competitive and they do not allow one party to easily take money from the other.
   In derivative market, prices are set in such a way that the party makes extra gains without consuming extra risks i.e. no arbitrage opportunities
6. **Relatively low transaction costs of derivative contracts-**derivatives are designed to provide a means of managing risk e .g an insurance cannot be viable if its cost is too high to the value of the insured asset thus derivatives must have low transaction cost otherwise they won't exist.
7. Catalyze growth of financial markets

Criticism of derivative market

1. Complexity - derivatives are found by most investors to be complicated and for this reason they are used improperly thereby delivering undesirable results
2. Lack of understanding by the users which leads to losses incurred by these users.
3. Derivatives are mistakenly characterized as a form of legalized gambling yet the benefits of derivatives extend much further a cross society while organized gambling incurs social costs such as addition and irresponsibility.

Elementary pricing of derivatives.

- **Arbitrage:** it occurs when equivalent assets or combination of assets sell for two different prices.
- This situation creates an opportunity to profit at no risk with no commitment of money.
- Derivative market operates on the principle that there should be no arbitrage opportunity i.e law of one price.
- Prices are set to eliminate profits at no risk i. e no money commitment
- If the same equivalent asset is selling at different prices in different geographical markets then this is not arbitrage because of transportation and handling costs between the two markets.
- The forward price should always be the spot price increased by the interest rates.
- Markets where arbitrage opportunities are either none existing or are quickly eliminated are relatively efficient markets.

CHAPTER TWO

FORWARD MARKETS AND CONTRACTS

A forward contract - is agreement between two parties in which one party the buyer agrees to buy from another party the seller an underlying asset or other derivatives at a future date at a price established at the start of the contract.
Therefore it is a commitment by two parties to engage in a transaction at a later date with the price set in advance.
The buyer in the forward contract is often called the long and the seller is called the short.

FEATURES OF FORWARDS

1. Forward contracts lock in the price and if by the time the seller is supposed to deliver and the price goes lower than the set price, he will still receive the set price and benefit from having locked in the price. However, if prices went up he will lose the chance of enjoying high prices in the marked since he will have to pay the set forward price.
2. Neither party pays any money at the start. No money changes hand at the start.
3. Delivery and settlement of cash-when forward contract expires, it can either be settled through delivery or cash settlement.
4. A deliverable forward contract stipulates that the long will pay the agreed upset price to the short who will in turn deliver the underlying asset to the long in a process called **delivery** .Cash settlement on the other hand, permits the long and the short to pay the set cash value of the position on the delivery date I .e the party that owes the other will pay the amount owed after calculating the value of the forward contract for both parties.
5. **Default risk**. Forwards are subjected to default
6. **Termination of forward contracts**. Forward contracts can be terminated by expiration date by entering into a counter contract for the remaining contract period i.e. if he was the long he now becomes the short with the same underlying and forward price and with the same expiration date.
   Can also be terminated by offsetting i.e. the value of the forward contract is calculated and the part owing pays off the amount owed to the counter party.

TYPES OF FORWARDS

1. **Equity forwards**
   These are contracts calling for the purchase or sale of an individual stock, a stock portfolio or a stock index at a later date at a price set at the beginning of the contract.
2. **Bond contracts.**

These are contracts for the purchase or sale of an individual bond, a specific bond portfolio or a bond index. These bonds pay interest that affects the forward contracts on bond. A forward contract on a bond must expire prior to the maturity date of the bond.

3. **Currency forward**
   They are forward contracts based on foreign exchange rates whereby the future exchange rate is locked at the start of the contract hence the contract is based on the purchase or sale of a foreign currency at a later date at the greed upon by 2 parties at a contract initiation.
4. Commodity forwards

FORWARD RATE AGREEMENTS (FRA'S)/ FORWARD CONTRACTS ON INTEREST RATES

These are forward contracts on interest rates (that prevail on different bonds /instrument especially the short term ones such as the Euro dollar) but net forwards neither on bonds nor on euro dollar or euros.

AN OVERVIEW OF THE INSTRUMENTS ON WHICH INTEREST RATE FORWARD CONTRACTS ARE BASED

The primary time deposit (short term unsecured loan is called) the **euro dollar** which is a dollar from the other banks deposited outside the US but particularly in the London Banks borrow dollars from other banks by issuing a euro dollar time deposit. The rate of such dollar loans is called the lender interbank rate .The lending rate is called the Lender Interbank offer rate (LIBOR).The LIBOR is most commonly used in derivatives markets though there exists borrowing rates too.

LIBOR is the rate at which London Banks lend dollars to other London Banks
LIBOR is considered to be the best representative rate on dollar borrowed outside the US by a private non-government high quality borrower .Note that the London market includes many branches of banks from the outside the UK and these banks are still active participants in the euro dollar market.
Like the Treasury bill market, the convention in the euro-dollar market is to pre-rate the quoted interest over 360 days in a year. In contrast to the T-bill market interest in euro dollar market is added onto the face value a procedure known as **Add-On Interest**.
Euro-dollar rates are assembled by a central organization and quoted in financial newspapers.

Other time deposits include;

- Euro-dollar
- Euro sterling : trades in turkey (sterling pound)

- Euro yen: Yens traded in the lender market
- Euro libor: euros traded in London
- Eurobond :euro traded within Frankfurt market

The No-Arbitrage Principle

The price of a forward contract is *not* the price to purchase the contract because the parties to a forward contract typically pay nothing to enter into the contract at its inception. Here, *price refers to the contract price of the underlying asset under the terms of the forward contract*. This price may be a U.S. dollar or euro price but it is often expressed as an interest rate or currency exchange rate. For T-bills, the price will be expressed as an annualized percentage discount from face value; for coupon bonds, it will usually be expressed as a yield to maturity; for the implicit loan in a forward rate agreement (FRA), it will be expressed as annualized London Interbank Offered Rate (LIBOR); and for a currency forward, it is expressed as an exchange rate between the two currencies involved. However it is expressed, this rate, yield, discount, or dollar amount is the forward price in the contract.

The price that we wish to determine is the forward price that makes the *values* of both the long and the short positions zero at contract initiation. We will use the *no-arbitrage principle*: there should not be a riskless profit to be gained by a combination of a forward contract position with positions in other assets. This principle assumes that (1) transactions costs are zero, (2) there are no restrictions on short sales or on the use of short sale proceeds, and (3) both borrowing and lending can be done in unlimited amounts at the risk-free rate of interest. This concept is so important, we'll express it in a formula:

forward price = price that would not permit profitable riskless arbitrage in frictionless markets

A Simple Version of the Cost-of-Carry Model

In order to explain the no-arbitrage condition as it applies to the determination of forward prices, we will first consider a forward contract on an asset that costs nothing to store and makes no payments to its owner over the life of the forward contract. A zero-coupon (pure discount) bond meets these criteria. Unlike gold or wheat, it has no storage costs; unlike stocks, there are no dividend payments to consider; and unlike coupon bonds, it makes no periodic interest payments.