MAKERERE UNIVERSITY BUSINESS SCHOOL

PROGRAM: BSF

COURSE UNIT: COMPUTERIZED FINANCIAL ANALYSIS

YEAR OF STUDY: TWO

SEMESTER: ONE

FACILITATOR: ROBERT OBELE

Topic one: Time Value of Money

- **Learning outcomes**
- By the end of this topic, students should be to;
- Explain the concept of Time value of money
- Apply future value and present value to solve TVM problems
- Amortize loans

The Hook

- “A bird in the hand is worth more than two in the bush”
- The gift with two options

Introduction

- One of the single most important concepts in the study of finance is the time value of money (TVM). This concept puts forward the idea that a dollar received today is worth more than, and therefore preferable to, a dollar received at some point in the future.
- The three primary reasons for this are that
- (1) money received now can be saved or invested now and earn interest or a return, resulting in more money in the future;
- (2) any promise of future payments of cash will always carry the risk of default; and
- (3) it is simple human nature for people to prefer making their purchases of goods and services in the present rather than waiting to make them at some future time

Introduction

- The entire concept of the time value of money is particularly important because it allows savers and investors to make better-informed decisions about what to do with their money. TVM can help a person understand which option may be best based on the critical factors of overall risk, rates of interest, inflation, and return.
- TVM is the key underlying principle of such important financial analytical activities as retirement planning, corporate capital project evaluation, and even deciding on your own personal investments and bank accounts.

Future value

- To derive the future value of an investment or asset, compounding is done.
- Sample scenario
- Melissa recently learned about the Sanlam income fund offered by Sanlam Uganda unit trust. The fund pays an interest rate of 14% p.a. Melissa has therefore, decided to invest shs. 10,000,000 into the unit trust.
- a) Assuming Melissa invests for 1 year, how much will she receive upon maturity if interest is compounded annually. = USh11,400,000.00
- Formula for calculation;
- FV = PV(1+i)^n
- Then use Excel
- **Interpretation after calculation;**
- **Melissa will receive shs. Xxxx at the end of 1 year, based on interest compounded annually. The difference between the FV (shs. XXM) and the PV (shs. 10M) is the amount of compound interest earned on the money invested.**

Future value

- b) Assuming Melissa invests for 1 year, how much will she receive upon maturity if interest is compounded quarterly. =
- Formula for calculation; USh11,475,230.01
- FV = PV(1+i/k)^n*k
- Then use Excel

- c) Assuming Melissa invests for 3 years, how much will she receive upon maturity if interest is compounded annually. USh14,815,440.00
- d) Assuming Melissa invests for 3 years, how much will she receive upon maturity if interest is compounded semi-annually. USh15,007,303.52

Present Value

- To find the present value of an investment or asset, we simply discount it’s future value.
- Formula;
- Re-arrange the FV formula
- FV = PV(1+i)^n
- PV = FV/(1+i)^n

Present Value

- Sample scenario
- Antony plans to start up a business in exactly 3 years from today. The estimated capital he will need is shs. 14,815,440.
- How much must he deposit today in an interest earning account that pays 14% compounded annually, to reach his target?

Annuities

- An annuity refers to a stream/series of fixed payments received or paid at regular intervals over a given period of time
- When a lump sum of money is borrowed and then repaid over time (such as a property mortgage), or lump sums are invested and then withdrawn in fixed amounts at regular intervals (such as a retirement annuity), interest is constantly being charged or earned.
- Annuity calculations therefore involve an interest factor compounded at regular intervals.
- These series of equal payments could be made yearly, half-yearly, quarterly, monthly, weekly or even daily

Annuities

- **These are some common examples of annuities:**
- regular monthly contributions into a pension fund (or provident fund)
- regular monthly contributions to a retirement annuity monthly
- insurance premiums on an endowment (or life) policy motor vehicle

Classification of annuities

- Annuities differ according to when the series of regular payments begin.
- **Ordinary annuity**
- An ordinary annuity is an annuity for which the series of regular payments take place at the end of each payment period for a fixed number of periods. These periods can be monthly, quarterly or annually, depending on the specific annuity contract.
- **Annuity due**
- Annuity due is an annuity for which the series of regular payments take place at the beginning of each payment period for a fixed number of periods.

Classification of annuities

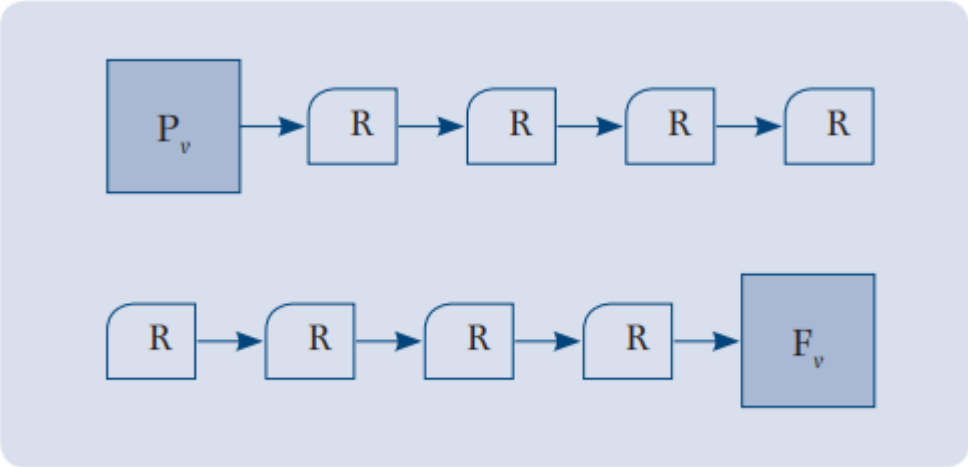
- **Deferred Annuities**
- Where the first of the series of regular payments only begins at some future period, and not immediately, during the term of the annuity, the annuity is known as a deferred annuity.

Computations of Annuities

- Present or future values of these streams of payments in annuities can be calculated by applying time value of money formulas to each of these payments
- Annuity calculations require finding one of the following:
- the future value of an annuity, Fv
- the present value of an annuity, Pv
- the regular payments, R.

Annuities

- Illustration of the concepts of annuities



Terminology in Annuities

- The following terminology is used in all annuity calculations:
- **The future value of an annuity, FV.**
- This is the amount of money that has accumulated by the maturity (or expiry) date of an annuity (i.e. when payments/contributions cease). It is equivalent to the sum of all regular payments, plus accumulated interest.(E.g., the retirement payout by NSSF).
- **The present value of an annuity, PV.**
- This is an initial lump sum of money that is either deposited or borrowed, and which will result in a series of equal payments at regular intervals for a period of time into the future.

Terminology in Annuities

- The term, n, is called the **duration** of an annuity
- The **payment period** is the time interval between successive regular payments of equal amounts. The payment period must always coincide with the period over which interest is compounded.
- The **regular payments**, **R**. This is the amount of money that must be deposited or paid at each payment period over the duration of the annuity.
- The **rate of interest, i**, which must coincide with the conversion (or compounding) period.
- NOTE: we can compute for each of these

Ordinary annuity

- **Present value of an ordinary annuity**
- Case 1:
- Mr. Peterson, who has just retired, would like to receive UGX 1,000,000 at the end of every month for 10 years. If this money can be invested at 9% p.a. compounded monthly, how much money should he deposit today?

- Mr Peterson will have to deposit a lump sum of UGX xxxx today to ensure a retirement income of UGX 1,000,000 month for the next 10 years, payable at the end of each month.

Ordinary annuity

- **Future value of an ordinary annuity**
- A father decides to invest UGX 1,000,000 at the end of each year for five years at 9% p.a. compounded semi- annually to pay for his son's university education in five years' time. What amount of money will be available at the end of five years?

- The father will have UGX xxxx available to pay for his son's university education in five years' time.

Ordinary annuity

- Assume that you have a chance to invest $15,000 per year at the end of each year for 10 years, earning 8% compounded annually. What amount would you have after the 10 years?

Annuity due

- **Present Value of Annuity due**
- An investor would like to invest in an S&P 100 index fund from which he wishes to withdraw $25,000 each year for five years. He expects to make the first withdrawal immediately at the beginning of the investment term. Assuming the index fund pays 9% p.a, how much should be deposited in the fund today?

Annuity due

- **Future value of annuity due**
- A father decides to invest UGX 1,000,000 at the beginning of each year for five years at 9% p.a. compounded semi- annually to pay for his son's university education in five years' time. What amount of money will be available at the end of five years?

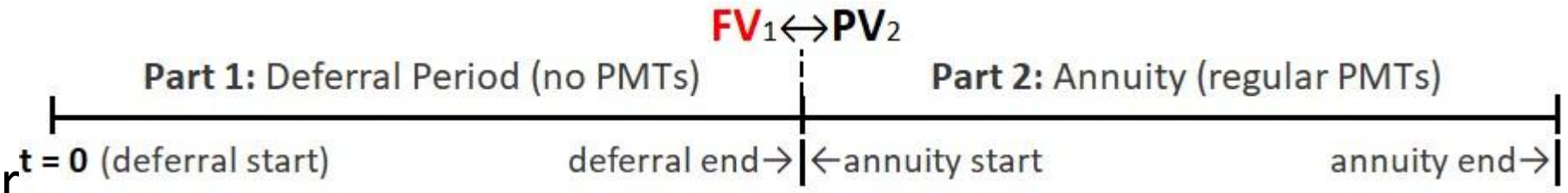
- The father will have UGX xxxx available to pay for his son's university education in five years' time.

Deferred Annuities

- To understand deferred annuities, let us first go back and examine the definition of an annuity.
- An annuity is **“a series of equal-sized payments, at regular intervals, over a fixed period of time.”**
- What then does it mean to defer this annuity? It means to delay (or defer) the regular payments for a period of time.
- The most common example of a deferred annuity is a retirement fund where the investor is not yet ready to retire. They defer their withdrawals (payments) until they retire. In the mean time, the fund earns interest. The fund continues to earn interest as the investor withdraws money from the fund.

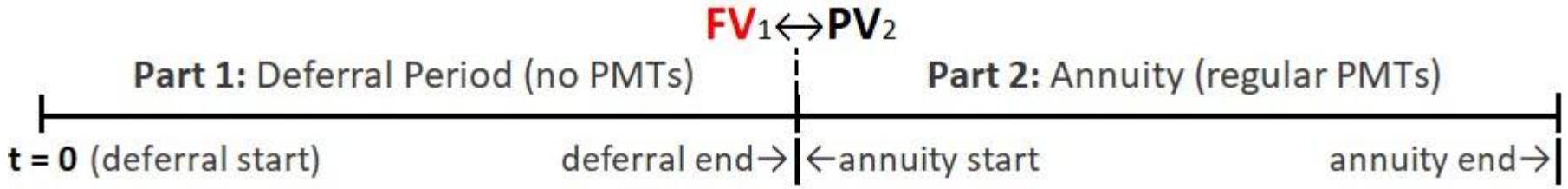
Deferred Annuities

- Because there is a deferral period and a payment (annuity) period, there are actually two parts to the problem:



- Par
- There are no payments in part 1 (PMT1 = 0).
- The only money being added to the initial balance (PV1) is the interest being earned (or charged).
- The ending balance from the deferral period (FV1) equals the starting balance for the annuity (PV2).

Deferred Annuities



- Part 2: Annuity with Regular Payments
- Payments are being made or withdrawn (PMT2).
- Assume the final future value (FV2) equals 0 unless told otherwise.

Deferred Annuities

- Mr. Othieno recently sold off one of his properties for UGX 245M. Upon the sale, he immediately deposited the money into a retirement fund. The fund earns 2.45%, compounded monthly, for the entire time. Mr Othieno expects to retire in 10 years time. He would like to make withdrawals from his account starting one month after he retires, for a period lasting 5 years. How much can Mr. Othieno withdraw per month from the retirement fund?

Loan amortization

- Amortization is the process of paying off debt over time with regular installments of interest and principal sufficient to repay the loan in full by its maturity date.
- We can create an amortization table (or schedule) to show the amount of principal and interest that make up each payment. The table also shows the balance owing after each payment. The table can run until the loan (or mortgage) if fully paid off or to the end of the term.

Loan amortization

- JP business ventures owned by Marvin has borrowed a business loan of 50M from Equity bank to increase his stock. The loan attracts 17.5% interest p.a and is to be repaid within 5 years.
- Compute the monthly loan installment for Marvin’s loan.
- Amortize the loan monthly and annually
- *cell referencing is key*

Loan amortization

- George has decided to purchase a new Mercedes AMG G63 valued at $200,000. Goerge's plan is to pay $ 60,000 cash for the car from his savings and finance the balance using a car loan from ABSA bank.
- Assuming the banks offers him the loan of $140,000 for a 10 years, at 9% p.a. for the first 4 years and 11% for the remaining period, to be repaid on a monthly basis.
- Calculate George's monthly loan installment payment
- Show how George's loan will be repaid.