

UNDERSTANDING THE PRICING & TRADING OF TREASURY BILLS, COMMERCIAL PAPERS AND TREASURY BONDS

TREASURY BILLS

Treasury bills are short-term Government debt securities with maturity of a period less than one year. They are the most well known of all Government securities. Treasury bills are designated by the number of days to their maturity¹. The ones that have been issued in the market include the following:

1. 30 days
2. 60 days
3. 91 days
4. 182 days
5. 270 days

The Government discontinued the issuance of the 30, 60 and 270 days bills and only the 91-day and 182 day bills are currently being offered to investors.

Treasury bills are sold on a discounted basis, which in simple terms means that you pay for the bills less the interest receivable during the term of the bill and receive the face value of the bill at the end of the period.

The following formula is used to compute the discounted amount one has to pay for a treasury bill of a desired amount:

$$P = \frac{1}{100 \{1 + (R/100)(D/365)\}}$$

Where:

P = the price per 100

R = the desired return as interest rate per year

D = Days to maturity of the bill being purchased

Example:

If you wanted to buy a Treasury Bill worth Kshs. 1 million to give you a return of 25% for 91 days to determine how much you have to pay, you proceed as follows:

$$P = \left\{ \frac{1}{\{1 + (13/100)(91/364)\}} \right\} \times 100,000,000$$

Therefore, **P = Kshs. 968,606.50**

To simplify computation of the amounts payable, CBK has published discount tables, which are available on request.

Tax paying clients should add to the amount payable withholding tax at the appropriate rate of 15% for locals or 12.5% for foreigners.

Treasury bills are not listed at the Stock Exchange. If one wanted to exit before maturity, re-discounting is possible at the Central Bank, but this carries a penalty of 3% above the current Treasury bill rate.

COMMERCIAL PAPER

Commercial papers are similar to treasury bills but are issued by companies and institutions. The treatment of commercial papers is the same as Treasury Bills. Like Treasury bills they are listed for periods below one year normally from 7 days to 220 days.

TREASURY BONDS

For ease of reference the following is some arithmetic that one might come across while trading in bonds.

If you had some surplus funds, that you wanted to put aside for a while, you might decide to visit your bank manager for advice. Since you do not know how soon you are likely to need the funds, you however may wish to know what the rates are in the market. The manager tells you that the rate for one month is 10%, for 2 months 10.19; for three months 10.33; 6 months 10.85; 9 months 11.38 and twelve months 11.94. You happen to know that a 1-year treasury bond listed at the NSE will earn you a rate of 13% and you tell the manager that if he wants your

money he has to improve the rate. The manager agrees to give you 13% per annum and quickly hastens to tell you that for 9 months the rate would be 12.80, for six months 12.60; 3 months; two months 12.41; and 30 days 12.35.

At this point you start telling the manager that although you are not sure how long you will keep the money with him, the money could stay for a year. You argue that he should still allow a rate of 13% for one month because you will keep on rolling over the deposit. The manager hastens to say that he cannot offer 13% because the realized rate would actually be much higher.

You do not understand what he is telling you, so he proceeds to explain:

If he offers you a rate of 13% per month and at the end of each month you roll over the deposit plus the interest earned during the month, the total yield that you would realize at the end of the year (the actual yield) would be 13.8041%.

The conversation detailed above summarizes in a simplified form how listed bonds are traded on the Nairobi Stock Exchange. The formulae that bond traders frequently use are the compounding and the annualizing ones.

Decompounding

If a bond offers an annual interest rate of 13% and you wanted to invest in the bond for, let's say 50 days you would want to know what is the equivalent to the 13% annual rate. To get that rate you decompound the annual rate as follows:

$$R_t = \left\{ (1 + R_{365})^{(t/365)} - 1 \right\} \times 365/t$$

Where:

R_t is the rate for the t days

R is the annual rate

Annualizing

On the other hand if a bond that has got 40 days remaining to maturity is being sold at a yield rate of 11%, you would want to know the annual equivalent of the 11%. The formulae you use is called annualizing as follows:

$$R_{365} = (1 + R_t \times t/365)^{(365/t)} - 1$$

Where:

R_{365} is the annual rate

t is the number of days

With the above two formulae you should be able to handle most of the pricing problems involving bonds. If you know the annual interest offered by a bond during the interest payment period and the days that the bond has to run to interest payment date you can compute the price that will give you the desired return.

Net Present Value

A lot of people may not be familiar with the floating rate bonds that are listed at the NSE but have heard about bonds that offer fixed interest rates for one or more years and which pay interest either quarterly, half yearly or even yearly.

However, with fixed interest bonds of various maturities offering different rates of interest and with varying payment terms, one may wish to know which of the two or three bonds is better than the others. The formula you use for this is the one that helps you to determine the net present value of each of the bonds so that you are able to compare them.

To be able to work out the net present value of a bond that is on offer you go through the following procedure:

1. Since you know the principal and the time it will be paid, you work out the net present value of the principal as follows:

$$P.V. = F \{1/(1+r)^n\}$$

2. Since the bond has been on for some days and you know the interest rate, you can work out the accrued interest.

$$P.V. = A \{1 - d\} \{1/(1 + rd)\}$$

3. Lastly there is payment of interest expected during the life of the bond, i.e., the balance on the first interest payment period and the payment for the remaining periods. The present value for these payment is worked as follows:

$$P.V. = A \{ 1 - 1 (1 + r)^n \} / r$$

Hence the net present value of each bond is expressed as follows:

$$P.V. = F \{ 1 / (1 + r)^n \} + A \{ 1 - d \} \{ 1 / (1 + rd) \} + A \{ 1 - 1 (1 + r)^n \} / r$$

If you work out the net present values of various bonds you then determine which is offering you better terms.

P.V. Present Value

F Bond Face Value

r Desired rate of return

n Number of interest calculations period

A Amount of each periodic interest payment

d Remaining portion of current payment period.

The decomposing and annualizing formulae help you to determine the yield you get from listed bonds for specific periods. The net present value helps you compare a number of bonds with different interest rates and payment terms. It is important to have these issues clear in your mind to avoid confusion.

Before the launching of the East African Development Bank floating rate corporate bonds at the Nairobi Stock Exchange, we can say that with the exception of the call deposits, there were no other money market instruments in the market that could have been termed as being liquid.

By having the bonds listed at the Nairobi Stock Exchange, it meant that instead of placing money in a call deposit, one had an alternative of buying the bonds and whenever one needed the funds back, the bond could be offered for sale in the market.

The trading of the bonds ensures that those people who hold these bonds share the coupon² as equitably as possible. The pricing mechanisms should therefore be capable of distributing the coupon to all the persons who hold the bonds during each interest payment period.

In saying this, one is however aware that the price of the bonds is affected by other factors as detailed elsewhere in this paper.

PRICING CORPORATE BONDS IN THE SECONDARY MARKET

After the issuer sells the bond to investors, they may in turn resell them to other investors. Secondary market bond transactions can take place either on the stock exchange or in the over-the-counter market (OTC). All bonds listed at the NSE can only be sold through the Exchange.

These transactions may take place at a price that is either substantially below or above the bonds original issue price. Five principal factors determine the resale value of a bond:

- I. The accrued interest
- II. The relative change in market interest rates
- III. The change in the credit quality of the bond
- IV. The relative supply and demand for the bonds
- V. Availability of credit in the market.

Accrued Interest

When bonds trade, the buyer must usually pay the seller "accrued interest" in addition to the purchase or sale price. Accrued interest is the interest that the buyer must pay the seller in compensation for the time the seller owned the bond since the last payment date.

Changes in Interest Rates

- a. If, after a bond is issued, interest rates should rise, then the market value of the bond falls.

- b. If, on the other hand, interest rates go down, the market value of the bond rises.

Fluctuation of the market interest rates is the most important factor in determining the market value of a bond. Unfortunately, since no one can accurately predict future interest rates, no one can predict with certainty future bond prices.

If after the bond issue, the issuer's credit quality improves or declines, the market value of the bond will be adjusted accordingly by the market.

Supply and Demand

Investors wishing to sell bonds get a better price during a period when bonds are in relatively short supply, than when there is a surplus of bonds in the market.

Availability of credit

In times of tight credit when people do not have adequate funds, demand for bonds can come down forcing sellers to lower prices to attract buyers.

Yields

Three most commonly used bond yields are:

- a. **Coupon yield:** This is the yield expressed as a percentage that the issuer pays on the bond's face value.
- b. **Current yield:** This is the yield, expressed as a percentage of number of shillings of interest that a bond pays by its current market value. This yield represents the annualized cash-on-cash return of a bond.
- c. **Yield to maturity:** If a bond is purchased in the secondary market for a price that is higher or lower than the bond's face value, and if the investor holds this bond until maturity, then the investor will have to gain or lose on the face value in addition to the interest earned.

DIRTY OR CLEAN PRICES

The prices quoted at our markets are referred to as dirty prices. This is mainly because the daily increase in price influenced by the accrued interest does not allow

the impact of the other forces that influence the rates to be determined. Prices that exclude accrued interest are referred to as clean prices.

It is useful for an investor to appreciate that the above forces do not operate in isolation but are always all at play. The price that is quoted in the market each day is arrived at after taking into account the combined influence of all the above factors. Since other than accrued interest and current treasury bill rates, all the other factors are subjective in nature, it is difficult for two people to arrive at the same rate which creates the need for arbitration and this is what spurs trading.

BONDS

Currently bonds are settled on a T + 3 basis. However, there is need to further modify the current system to facilitate other means of settlement as follows:

Same Day Settlement

For those clients who need money urgently, our trading system of settlement should allow the possibility of bonds being settled the same day. When the registration of the bonds is transferred to the Central Depository same day settlement should be easy to process.

Settlement after a day trade

Many markets provide this facility where bonds traded are settled on the following day to facilitate fast movement of funds.

RE-PURCHASE AGREEMENT (REPOS)

The launching of the listed bonds in the market was a major step in the merging of the money market and the capital markets.

For those clients who would like to utilize their bonds to secure funds in the money market they use the bonds as security for short-term advance but undertake to buy back the bonds from the lender at an agreed time. This is what is referred to as a REPO.

Less credit worthy clients can raise short-term funds in the money market by providing their bonds as security. Such bonds are effectively transferred to the

lender for one or more days and then transferred back to the borrower, once the funds have been repaid.

Trading REPOS will provide an alternative to the inter-bank lending.

TRADING BONDS

Since pricing of bonds is a bit involving investors are advised to consult their bond dealers (stockbrokers) for guidance.

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