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Derivatives 101

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"Derivatives Pricing"

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Executive Summary

- The last six issues of our **Derivatives 101** series detailed the derivatives instruments, the trading process, derivatives strategies and the key differences between stocks and derivatives trading.
- This 7th issue gives an in-depth explanation of **"Derivatives pricing"** and specifically futures contracts traded at the Nairobi Securities Exchange (NSE).
- The report begins with a brief explanation about futures pricing in relation to the price of the asset (stock) at the spot market.
- We also discuss fair value, marking to market and cost of carry model used in pricing of futures contracts.
- To conclude, we give two examples to demonstrate pricing of futures contracts with zero dividends and when dividend are expected during the life of the contract.

Pricing of Futures

- **Futures contracts** are financial contracts to buy or sell an underlying asset at a certain price in the future.
- Therefore, the futures contract's value is based on the asset's cash price.
- The futures price moves in relation to the spot price for the asset based on its supply and demand.

What is fair value?

- Fair value refers to the actual value of a security that is agreed upon by both the seller and the buyer.
- Pricing of futures contract is very simple and the fair value of a futures contract is calculated using the **cost-of carry** logic.
- Every time the observed price deviates from the fair value, arbitrageurs would enter into trades to capture the arbitrage profit.
- This in turn would push the futures price back to its fair value.
- Stock index futures at **NSE Derivatives Market (NEXT)** are cash settled, there is no delivery of the underlying stocks.

Marking to market

- Mark-to-market (MTM) is an accounting method that records the value of an asset according to its current market price.
- All futures contracts at NSE Derivatives Market (NEXT) are marked to market based on the daily settlement price of the futures contracts at the end of each trading day.
- The futures price at any point in time is the price that makes the value of a new contract equal to zero.
- If the futures price increases, the value of the long position increases while the value of the short position decreases.

Cost of Carry

- Cost of carry is a cost associated with holding the underlying asset.
- The pricing of single stock futures is based on the cost-of-carry model, where the carrying cost is the cost of financing the purchase of the stock, minus the present value (PV) of dividends obtained from the stock.
- Cost of carry = Financing cost – PV (Dividends)
- The main differences between commodity and equity futures are:
    a) There are no costs of storage involved in holding equity.
    b) Equity comes with a dividend stream, which is a negative cost if an investor is long the stock and positive if the investor is short the stock.
- A crucial aspect of dealing with equity futures as opposed to commodity futures is accurate forecasting of dividends.
- The better the forecast of dividends offered by a stock, the better is the estimate of the futures price.
- The cost of carry model used for pricing futures is given as;

$$F = S - PVD \times (1+r)^{\wedge}T$$

or

$$F = S \times (1+r)^{\wedge}T - FVD$$

- Where; F = Futures Price
  S = Spot Price
  PVD = Present Value of Dividends
  FVD = Future Value of Dividends
  r = Interest Rate
  T = (Days to expiry/365); (Months to expiry/12)

Pricing of Futures with zero dividends and when dividends are expected

1) Pricing Single Stock Futures when no dividend is expected (PVD = 0)

- If no dividends are expected during the life of the contract, pricing futures on that stock is very simple.

Example 1

- Safaricom futures trade on Nairobi Securities Exchange (NSE) as 3-months contract.
- Assume Safaricom share price in the spot market is KES.28.00.
- Also assume that the 3-month (91days) Treasury bill rate is 8.0%.
- **T (Months to expiry/12) = 3/12 = 0.25** and **Present Value of Dividends (PVD) =0**

$$F = S - PVD \times (1+r)^{\wedge}T = 28 - 0 \times (1 + 0.08)^{\wedge}0.25 = \text{KES.28.54}$$

2) Pricing Single Stock Futures when dividends are expected

- When dividends are expected during the life of the futures contract, pricing involves reducing the cost of carry to the extent of the dividends.
- The next carrying cost is the cost of financing the purchase of the stock, minus the present value of dividends obtained from the stock.

Example 2

- KCB trades on NSE as a 3-months contract.
- Assume that KCB will be declaring a dividend of KES.3.00 per share after 2-months (60-days) of purchasing the contract.
- Also assume the market price of KCB is KES.40.00 and the 3-month (91days) Treasury bill rate is 8.0%.
- To calculate the futures price of KCB contract, we need to reduce the cost-of-carry to the extent of dividend to be received.
- The dividend received is KES.3.00 and hence will be discounted for 2-months (60-days).
- **T (Months to expiry/12) = 3/12 = 0.25** and **Present Value of Dividends (PVD) = 3 / (1.08^0.17) = 2.96**

$$F = S - PVD \times (1+r)^{\wedge}T = 40 - 2.96 \times (1 + 0.08)^{\wedge}0.25 = \text{KES.37.76}$$

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