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### Theoretical Future Price

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Theoretical or fair value is the mathematical estimation of the price that a particular future contract should have. We know that future prices does not coincide with the spot prices before the expiration of the contract. This discrepancy is due to the basis. The theoretical value is trying to estimate the magnitude of the basis by taking into consideration all the factors. (i.e., storage costs, interest rates and more) that make the price of a contract to be different from the spot price.

Depending on the underlying asset a different formula can be applied. For example, if we want to price a commodity future, we have to take into consideration the storage cost, whereas a stock index future (i.e., S&P 500) does not have storage cost but it has dividends.

### Theoretical Value of Commodity Future Held for Consumption

Below, we can see the formula by which we can estimate the theoretical value of a commodity future which can be held for consumption. The symbol  $e$  denotes the natural logarithm and it is

used in order to incorporate in the formula the concept of continuous compounding.

$$F_t = S_t \times e^{(r_f + u - y) \times (T - t)}$$

where,

$F_t$  = Theoretical price of contract

$S_t$  = Spot price of underline asset

$r_f$  = Risk free rate

$u$  = Storage cost per annum as % of the commodity price

$y$  = Convenience yield

$T-t$  = Time until maturity of the contract

Notice that the future price is positively related to interest rates and storage cost (positive signs) and negatively related to the convenience yield (negative sign), as mentioned in the relative page. This means that as the interest rates and the the storage costs are getting higher, the higher will be the price of the future relatively to the spot price. This happens because in the case of interest rates the money that someone has to borrow in order to hold the real asset is more expensive and he/she will be better off if they have opened a long position in futures where the money borrowed will be less due to leverage. Also if the storage cost is high then it would be better for someone not to hold the real asset in order to avoid this cost. Instead he/she can buy futures contracts and the higher demand will augment their process.

### Theoretical Value of Stock Index Future

Below, we can see the formula by which we can estimate the theoretical value of an index future.

$$F_t = S_t \times e^{(r_f - q) \times (T - t)}$$

where,

$F_t$  = Theoretical price of contract

$S_t$  = Spot price of underlined asset

$r_f$  = Risk free rate

$q$  = Dividend yield

$T-t$  = Time until maturity of the contract

Notice that dividend yield is negatively related to futures price. This is happening because the higher the dividend yield the more an investor/trader is benefited from the dividends received by holding the underlying asset instead of a future contract which does not provide its holder with dividends.

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### **Pricing Index Futures**

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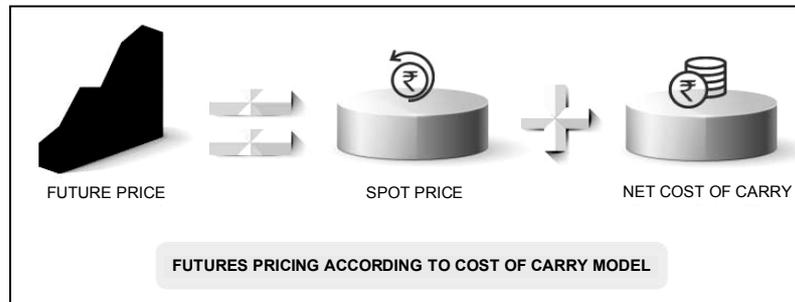
Index futures are futures contracts on a stock or financial index. For each index, there may be a different multiple for determining the price of the futures contract. For example, the S&P 500 Index is one of the most widely traded index futures contracts in the United States; stock portfolio managers who want to hedge risk over a certain period of time often use S&P 500 futures.

Futures are derivative products whose value depends largely on the price of the underlying stocks or indices. However, the pricing is not that direct. There remains a difference between the prices of the underlying asset in the cash segment and in the derivatives segment. This difference can be understood through two simple pricing models for futures contracts. These will allow you to estimate how the price of a stock futures or index futures contract might behave. These are:

- ✧ The Cost of Carry Model
- ✧ The Expectancy Model

However, remember that these models merely gives you a platform on which to base your understanding of futures prices. That said, being aware of these theories gives you a feel of what you can expect from the futures price of a stock or an index.

## What is the Cost of Carry Model



The Cost of Carry Model assumes that markets tend to be perfectly efficient. This means there are no differences in the cash and futures price. This, thereby, eliminates any opportunity for arbitrage – the phenomenon where traders take advantage of price differences in two or more markets.

When there is no opportunity for arbitrage, investors are indifferent to the spot and futures market prices while they trade in the underlying asset. This is because their final earnings are eventually the same.

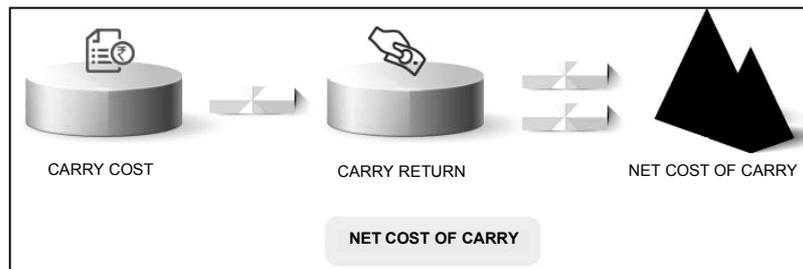
The model also assumes, for simplicity sake, that the contract is held till maturity, so that a fair price can be arrived at.

In short, the price of a futures contract (FC) will be equal to the spot price (SP) plus the net cost incurred in carrying the asset till the maturity date of the futures contract.

$$FC = SP + (\text{Carry Cost} - \text{Carry Return})$$

Here Carry Cost refers to the cost of holding the asset till the futures contract matures. This could include storage cost, interest paid to acquire and hold the asset, financing costs, etc. Carry Return refers to any income derived from the asset while holding it like dividends, bonuses, etc. While calculating the futures price of an index, the Carry Return refers to the average returns given by the index during the holding period in the cash market. A net of these two is called the Net Cost of Carry.

The bottom line of this pricing model is that keeping a position open in the cash market can have benefits or costs. The price of a futures contract basically reflects these costs or benefits to charge or reward you accordingly.



### What is the Expectancy Model of Futures Pricing

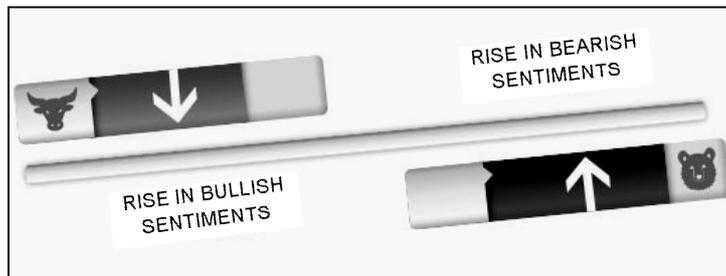
The Expectancy Model of futures pricing states that the futures price of an asset is basically what the spot price of the asset is expected to be in the future.

This means, if the overall market sentiment leans towards a higher price for an asset in the future, the futures price of the asset will be positive.

In the exact same way, a rise in bearish sentiments in the market would lead to a fall in the futures price of the asset.

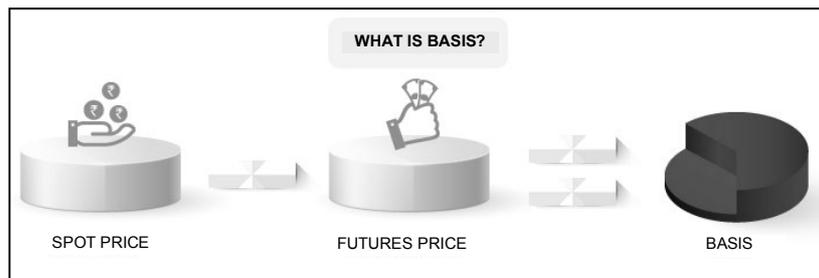
Unlike the Cost of Carry model, this model believes that there is no relationship between the present spot price of the asset and its futures price. What matters is only what the future spot price of the asset is expected to be.

This is also why many stock market participants look to the trends in futures prices to anticipate the price fluctuation in the cash segment.



### What is Basis?

At a practical level, you will observe that there is usually a difference between the futures price and the spot price. This difference is called the basis.



If the futures price of an asset is trading higher than its spot price, then the basis for the asset is negative. This means, the markets are expected to rise in the future.

On the other hand, if the spot price of the asset is higher than its futures price, the basis for the asset is positive. This is indicative of a bear run on the market in the future.

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## Initial Margin and Maintenance Margin

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### Initial Margin

Initial margin is the percentage of the purchase price of securities (that can be purchased on margin) that the investor must pay for with his own cash or marginable securities; it is also called the initial margin requirement. According to Regulation T of the Federal Reserve Board, the initial margin is currently 50 per cent, but

this level is only a minimum and some brokerages require you to deposit more than 50 per cent. For futures contracts, initial margin requirements are set by the exchange. A margin account enables investors to use leverage and purchase more securities than the cash balance in their account would allow. A margin account is essentially a loan account in which interest is charged on the outstanding margin balance. The securities purchased in the margin account are purchased with cash loaned to the investor by the broker, and the securities themselves are used as collateral. This allows for a potential magnification in gains, but also losses. In the extreme event that the securities purchased on margin decline to zero, the investor would need to deposit the full initial value of the securities in cash to cover the loss

### **Maintenance Margin**

Maintenance margin is the minimum amount of equity that must be maintained in a margin account. In the context of the NYSE and FINRA, after an investor has bought securities on margin, the minimum required level of margin is 25 per cent of the total market value of the securities in the margin account. Keep in mind that this level is a minimum, and many brokerages have higher maintenance requirements of 30-40 per cent. Maintenance margin is also referred to as “minimum maintenance” or “maintenance requirement.”

### **Difference between Initial and Maintenance Margin**

Buying securities on margin can be advantageous for an investor. Profit is magnified if there is a gain, and losses as well if there is a loss. Margin is much like buying stocks on loan. An investor borrows funds from a brokerage firm to purchase stocks and pays interest on the loan. The stocks themselves are held as collateral by the brokerage firm.

There are many set rules the brokerage firm and the investor must follow. The Federal Reserve Board sets the rules for margin requirements. There is an initial margin requirement and a maintenance margin requirement.

The Federal Reserve Regulation T states that an initial margin must be at least 50 per cent, although many brokerage firms set their requirements higher at 70 per cent. This means that an investor must pay 50 per cent, or more if the brokerage firm requires it, of the security's purchase price up front. The brokerage firm must provide the remainder of the funds.

After the initial purchase, a maintenance margin is set. Regulation T sets this requirement at 25 per cent, although many brokerage firms require more, such as 30-40 per cent. A maintenance margin at 25 per cent means that there must be a minimum amount of equity valued at 25 per cent or more of the total value of the margin account.

If one or more securities in the account falls below a certain price and these requirements are not met, the investor receives a margin call, sometimes known as a "fed call." In this situation, a brokerage firm then requires the investor to deposit funds to bring the account back up to the minimum maintenance requirement.

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## **Mark to Market (Variation Margin)/Marking to Market Margin**

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### **Variation Margin/Mark To Market - Definition**

Variation Margin, also known as Mark To Market Margin, is additional amount of cash you are required to deposit to your futures trading account after your futures position have taken sufficient losses to bring it below the "Maintenance Margin". Futures traders are typically required to provide variation margin through "Margin Calls".

In futures trading, it is the process of valuing assets covered in a futures contract at the end of each trading day and then profit and loss is settled between the long and the short.

### **Mark to Market/Marking to Market – Introduction**

Mark To Market, or Marking to Market, is when asset values are determined "according to market prices" at the end of each day in

order to arrive at the profit or loss status of the parties in a futures transaction. Mark to market is not an exclusive futures trading term. It is a procedure used across the finance world in asset valuation. Mark to market has an extremely big impact in futures trading as it directly determines if you've made some money or has lost some money for the day.

### **What is Mark to Market in Futures Trading?**

As mentioned above, Mark to Market or "Marking to Market" isn't an exclusive futures trading term. It is a term which is used in finance to describe how assets are being priced based on the value that is given on it by the open market instead of considering its true intrinsic value. Indeed, this procedure has contributed to the 2008 subprime crisis as illiquid assets are priced to markets that really do not exist.

### **What does Mark to Market Mean in Futures Trading?**

In futures trading, Marking to Market is also known as "**Daily Settlement**". This is a procedure conducted by the clearinghouse daily which determines the value for the asset covered by the futures contracts, known as the "**Settlement Price**", and then convert the paper gains and losses to actual gains and losses in the accounts of the parties involved.

In fact, the process of marking to market effectively closes the existing futures contract entered into based on the last trading day's price and reopens it into a new futures contract expiring on the same day at the new settlement price today. This process prevents the accumulation of losses beyond the point of affordability by the losing party and helps the clearinghouse reduce its risk of guaranteeing the performance of every futures contract. This amount of loss deducted from one's margin account is sometimes referred to as the "Mark to Market Margin".

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## Questions

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### 1. Fill in the Blanks

- In futures trading, Marking To Market is also known as \_\_\_\_\_.  
(a) daily settlement (b) settlement price  
(c) daily price (d) none of the above
- Variation Margin, also known as \_\_\_\_\_ margin  
(a) daily settlement (b) mark to market  
(c) initial margin (d) none of the above
- \_\_\_\_\_ margin is the minimum amount of equity that must be maintained in a margin account.  
(a) Initial (b) Maintenance  
(c) Variation (d) none of the above
- No collateral is required for a \_\_\_\_\_ contract.  
(a) option (b) future  
(c) forward (d) none of the above
- \_\_\_\_\_ or fair value is the mathematical estimation of the price that a particular future contract should have.  
(a) Theoretical (b) Initial  
(c) Variation (d) none of the above

### 2. True or False

- A margin account enables investors to use leverage and purchase more securities than the cash balance in their account would allow.
- The securities purchased in the margin account are purchased with cash loaned to the investor by the broker, and the securities themselves are used as collateral.
- The Expectancy Model of futures pricing states that the futures price of an asset is basically what the spot price of the asset is expected to be in the future.
- Index futures are futures contracts on a stock or financial index.
- Forward contracts are settled on the maturity date, whereas futures contracts are 'market to market' on a daily basis.

**3. Match the Following**

- |         |  |
|---------|--|
| 1. FC = | (a) $SP + (\text{Carry Cost} - \text{Carry Return})$   |
| 2. Q    | (b) dividend yield                                     |
| 3. y    | (c) convenience yield                                  |
| 4. T-t  | (d) Time until the maturity of the contract            |
| 5. u    | (e) Storage cost per annum as % of the commodity price |

**4. Write Short Notes On**

1. Theoretical Future Price
2. Forward v/s Future

**5. Answer the Following in Brief**

1. Explain in detail about initial, maintenance, marking to market and variation margin.
2. What are derivatives? Explain the features of forward and future contracts.

**Answer Keys:**

1. 1.-(a), 2.-(b), 3.-(b), 4.-(c), 5.-(a)
2. All are true
3. 1-(a), 2.-(b), 3.-(c), 4.-(d), 5.-(e)