

## **VALUATION OF SECURITIES**

### **EFFICIENT MARKET HYPOTHESIS**

Financial Markets are influenced by money flows and information -flows. In free and highly competitive markets, demand and supply pressures determine the prices or interest rates. In a theoretical sense, markets are said to be efficient, if there is a free flow of information and market absorbs this information fully and quickly.

James Lorie has defined the efficient security market as follows: “Efficiency...means the ability of the capital market to function so that prices of securities react rapidly to new information.

Such efficiency will produce prices that are appropriate in terms of current knowledge, and investors will be less likely to make unwise investments.” In the above context, what will happen is that market making mechanism is free and unfettered? There are no pockets withholding information or interested parties making undue gains by insider information by manipulation of supply and demand forces.

There will be no monopoly elements and malpractices or corruption etc. is not prevalent. Information flow is free and costless. In the normal course, capital or money flows into areas which are most profitable which in turn depends on their efficiency and competitiveness? Money flows also from less profitable to more profitable avenues if information flow is free, fast and costless. In such market scenario, all investors will have the same information, which is immediately reflected in the stock prices and nobody can gain extra profits.

All instruments in the market will be correctly priced, as all the available information is perfectly absorbed and any investor entering the market any time will have the same advantage or returns. No excess profits are possible in this scenario. As the demand and supply forces are playing their role freely, the emerging prices are fair and move in a random manner. Prices of today are no more a function of the prices in the past as the day-to-day forces move in an independent and random manner. This concept of randomness has led to the theory of random Walk in the determination of prices. This Random Walk hypothesis is thus a special case of the Efficient Market Theory.

### **Assumptions**

For the capital market efficiency theory to operate, the following assumptions are made

1. Information is free and quick to flow.
2. All investors have the same access to information.
3. Transaction costs, taxes and any bottlenecks are not there and not hampering the free forces of market.
4. Investors are rational and behave in a cost effective competitive manner for optimization of returns.
5. Every investor has access to lending and borrowing at the same rate.
6. Market prices are not sticky and absorb the market information quickly and the market responds to new technology, new trends, changes in tastes, habits of consumers etc., efficiently and quickly.

### **Random Walk Theory**

As per this theory, changes in stock prices are independent of each other. The prices of today are independent of the past trends. The present price is randomly determined and only information flow can influence prices. As information is free and independent, the resulting prices are free and independent. A word of caution is necessary here.

This Random walk hypothesis was postulated by researchers on the basis of empirical work on the market price behaviour. It does not therefore tantamount to the same theory as the capital market efficiency theory.

Only market efficiency promotes randomness and is therefore not a necessary condition. The fact that prices move independently has been found empirically and the analysts found an explanation for this in the efficient functioning of the markets and the market absorption of the information quickly and efficiently. The equilibrium price of a stock is determined by demand and supply forces, based on the available information. Quickly as the fresh information becomes available, a new equilibrium point is reached and the resultant price is thus independent of the past.

This Random walk hypothesis contradicts the Chartist and Technical School which believes that the present prices are the result of the past trends and that averages discount all fluctuations and that the average trends move in a predictable manner as the history of trends repeats itself.

On the other hand, fundamental school postulates that the prices are a function of the intrinsic value of the stock and prices result from changes in the intrinsic value and information relating to fundamental factors influence the equilibrium prices.

Random walk hypothesis is an offshoot or a phase of the capital market efficiency theorem. The market efficiency theory postulates that prices are the result of free flow of information which the market absorbs quickly and efficiently.

### **Assumption of Random Walk Theory**

1. Market is supreme and no individual investor or group can influence it.
2. Stock prices discount all information quickly.
3. Markets are efficient and that the flow of information is free and unbiased.
4. All investors have free access to the same information and nobody has superior knowledge or expertise.
5. Market quickly adjusts itself to any deviation from equilibrium level due to the operation of free forces of demand and supply.
6. Market prices change only on information relating to the fundamentals, when the equilibrium level itself may shift.
7. These prices move in an independent fashion, without undue pressures or manipulation.
8. Nobody has better knowledge or insider information
9. Investors behave in a rational manner and demand and supply forces are the result of rational investment decisions.
10. Institutional investors or any major fund managers have to follow the market and market cannot be influenced by them.
11. A large number of buyers & sellers and perfect market conditions of competition will prevail;

## **Random Walk and Efficient Market Theory**

Random Walk hypothesis is considered as restatement or a form of Efficient Market Theory by some Analysts. The EM - (Efficient Market Hypothesis) is based on the flow of free and correct information and the market absorption of it.

This information flow and its absorption by the market are the critical elements of this theory. There are three types of information affecting the market, namely, past Prices and trends, other public information and inside information.

If all these types are not absorbed perfectly by the market, there is a possibility of some gaining above average returns, from the investments. Based on the above three types of information, the analysis have placed the market absorption and the related theory under three heads; namely:

- a. Weak Form of EMH, which absorbs only market price information,
- b. Semi strong Form which absorbs price information and also all other public information and
- c. Strong Form which absorbs all types of information including insider information.

Weak form of EMH is closely related to the Random Walk Hypothesis, as the past prices are already absorbed by the market and the present prices move therefore independently of the past, which is the same as the Random walk hypothesis. The present trends are thus random variables, and past data cannot be used to predict the future. All the information on the past data on price trends and volumes was already absorbed earlier. It is futile exercise that the present day price can be derived by any past data, at least in short run. If that is proved empirically, then prices move in a random fashion like the walk of a Drunkard, each move independent of the other. It is anybody's guess or the result of a toss of coin of what will be the price of TISCO today or Dr. Reddy Labs tomorrow. Thus the Random Walk hypothesis states that prices move in random manner, independent of the past prices.

In the real world, the weak form of market efficiency may exist, as prices do move in an independent manner which the empirical evidence has shown as the past prices are already absorbed by the market. However, it is to be conceded those market imperfections, costs of information and blocks to the free flow of information may stand in the way of free play of market forces. Speculators and groups of interested parties or even brokers may manipulate the prices through cornering of shares and reducing the flatting stock of the market.

Both the Random walk hypothesis and weak form of EMH, state almost the same thing, namely, that knowledge of the past stock price does not aid the investors to gain any improved performance. The prices move independent of the other; although they may move in a random manner they move around a trend line decided by the anticipated real earnings of the company and its fundamentals. Both EMH in weak form and the Random Walk Theory thus postulate that analyzing the past does not improve the forecasting ability of stock prices and new information and prices that result from them cannot be predicted.

## **Efficient Market Hypothesis**

As referred to earlier, there are three forms of the Hypothesis, namely, weak form of EMH discussed under Random Walk Theory, semi strong form and strong form. In the words of Fama, efficient market is defined as the market where there are a large number of rational profit maximisers actively competing with each trying to predict the future market and where the current information is almost freely and equally available to all participants. Analysis of the Research studies done so far confirm partly the weak form of EMH. But the other two forms of the Theory are found not really realistic in the Practical Market Scene.

### **Semi Strong Form of EMH**

This form of EMH postulates that the market absorbs quickly and efficiently not only the price information but all publicly available information. Examples of this public information are found in the financial reports, Balance Sheets and Profit and Loss Accounts, Earnings and Dividend Reports, financial results etc. In addition to financial data, any material information affecting the financial position, such as financial structure, liquidity, solvency etc. is also found relevant and absorbed by the market in the price formation. Some data and information may be contradictory and biased information, rumours etc. would also flow in as news affecting the market. Revision of data or changes in conditions of the company also affect the price. Studies on the time lag involved in the impact of any change of fundamentals on the company share price showed varied time lags, some being discounted even before the event is announced and some before the event took place. Such matters like earnings reports, bonus, and rights affect the market even in anticipation before the formal announcement.

The studies on the semi strong form of market efficiency related to the effect of any public information released, on the share price. The tests are invariably based on pricing models, as under the CAPM or some econometric models. These studies showed that the absorption of this information on share prices was inefficient and varied from scrip to scrip, and the time period studied. The inefficiency in the market mechanism absorbing this data is found to be corrected over a time period as investors take time to analyses and conclude the effect of any public information. Thus, the semi strong form is empirically not well supported, but in many foreign markets, the semi strong form is found to be applicable and markets quickly absorb all published information.

This is possible in those markets due to strict law enforcement, but the market authorities, instantaneous display of all market information through electronic media and investor awareness of their impact and their quick absorption of the data. The revolution in informatics and communication technologies has made it possible for the application of the semi strong form of the EMH to these markets in developed countries.

### **Strong Form of EMH**

Under this hypothesis markets are so perfect that all information including private information, insider information and unpublished data, affecting the market are absorbed in the stock prices. Any investor can then gain the same average returns, whenever he enters the market. The information of all types is flashed to all investors simultaneously and all players have the same information at the same time. This means that only superior analysis and interpretation can give better market returns. This is possible for inside traders, floor brokers and institutional investors who have highly efficient market research component. The acumen with which price movements can be forecast can only result in superior return and not otherwise.

Studies made in developed markets have showed that strong form of efficient market does not exist there also. Investors have not shown consistently higher returns seen with all the information available to them. It was also found that average investor could do better by picking up securities in a random fashion.

### **Critique of EMH**

Opinion is divided as to the validity of the EMH particularly in the strong form. In weak form Random Walk hypothesis holds good, as per some studies. The semi strong form has found less support from the empirical studies. The perfect markets do not exist, as the stocks as a rule do not sell at the best price based on intrinsic values. Many times, speculative fervor sentiment and expectations play a greater role on the stock prices than the fundamental factors.

Similarly news does not spread evenly among all segments of the market and among all investors. Institutional investors gain through market equity research and through economic of scale and better expertise. But individual investors do not gain by speedy spread of information and the absorption of the same by market. To gain, superior advantage, there was no adequate evidence from any of the empirical studies, based on prices or information. There is thus a controversy on the validity of Efficient Market Theory. In real market operations, this theory did not find support, as portfolio managers did not perform better based on the results of this theory. This theory posed a challenge to both the chartist school and the fundamentalist school. If Random Walk or Weak Market Efficiency holds good, chartist school finds its tools are not of real value to gain superior returns. Similarly if random walk holds good, chartist school finds its tools are not of real value to gain superior returns. Similarly if random walk holds good, following the study of fundamentals will not secure better returns, unless additional information and insights into the company or better insider knowledge are available to investors

### **Anomalies**

- Anomalies are unexplained empirical results that contradict the EMH:
  - The Size effect.
  - The “Incredible” January Effect.
  - P/E Effect.
  - Day of the Week (Monday Effect)

### **The Size Effect**

Beginning in the early 1980’s a number of studies found that the stocks of small firms typically outperform (on a risk-adjusted basis) the stocks of large firms. This is even true among the large-capitalization stocks within the S&P 500. The smaller (but still large) stocks tend to outperform the really large ones

### **The “Incredible” January Effect.**

- Stock returns appear to be higher in January than in other months of the year.
- This may be related to the size effect since it is mostly small firms that outperform in January.
- It may also be related to end of year tax selling.

### **P/E Effect**

- It has been found that portfolios of “low P/E” stocks generally outperform portfolios of “high P/E” stocks.
- This may be related to the size effect since there is a high correlation between the stock price and the P/E.

It may be that buying low P/E stocks is essentially the same as buying small company stocks.

### **The Day of the Week Effect**

- Based on daily stock prices from 1963 to 1985 Keim found that returns are higher on Fridays and lower on Mondays than should be expected.
- This is partly due to the fact that Monday returns actually reflect the entire Friday close to Monday close time period (weekend plus Monday), rather than just one day.
- Moreover, after the stock market crash in 1987, this effect disappeared completely and Monday became the best performing day of the week between 1989 and 1998.

### **Efficient Markets and Fundamental Analysis**

- Past vs. Future
  - The EMH, importantly, considers the incorporation of available information, which is primarily historic in nature.
  - Much of what is involved in fundamental analysis, including aggregate market analysis and industry analysis, involves estimating future values.
  - Superior analysts are those who will be better at predicting this uncertain future

### **Efficient Markets and Portfolio Management**

- Does active portfolio management pay off?
  - Research indicates that most money managers do keep pace with the market
- Certainly with a superior analyst, recommendations should be followed
  - Opportunities may be present in smaller, neglected stocks (although risk must be taken into account)

### **The Rationale and Use of Index Funds**

- Efficient capital markets and a lack of superior analysts imply that many portfolios should be managed passively (so their performance matches the aggregate market, minimizes the costs of research and trading)
- Institutions created market (index) funds which duplicate the composition and performance of a selected index series

## **Fundamental and Technical Analysis**

### **Trading Futures**

Trading futures as a speculator is no different from trading any other commodity or asset. Success depends on the ability to

- Accurately predict futures prices, and
- Efficiently manage risks

Two techniques are commonly used to forecast prices

- Fundamental Analysis
- Technical Analysis

**Technical analysis** involves the analysis of market prices in an attempt to predict future price movements for the particular financial asset traded on the market. This analysis examines the trends of historical prices and is based on the assumption that these trends or patterns repeat themselves in the future.

**Fundamental analysis** in its simplest form is focused on the evaluation of intrinsic value of the financial asset. This valuation is based on the assumption that intrinsic value is the present value of future flows from particular investment. By comparison of the intrinsic value and market value of the financial assets those which are underpriced or overpriced can be identified.

### **Fundamental Analysis**

Fundamental analysis seeks to identify the fundamental economic and political factors that determine a commodity's price. It is basically an analysis of the (current and future) demand for and supply of a commodity to determine if

- A price change is imminent, and
- In which direction and by how much prices are expected to change.

This approach requires

- **gathering** substantial amounts of economic data and political intelligence,
- **assessing** the expectations of market participants, and
- **analyzing** these information to predict futures price movement

Fundamental analysis focuses on cause and effect causes external to the trading markets that are likely to affect prices in the market.

- These factors may include the weather, current inventory levels, government policies, economic indicators, trade balances and even how traders are likely to react to certain events.
- Fundamental analysis maintains that markets may misprice a commodity in the short run but that the "correct" price will eventually be reached. [Profits](#) can be made by trading the mispriced commodity and then waiting for the market to recognize its "mistake" and correct it.

### **Various Techniques of Fundamental Analysis**

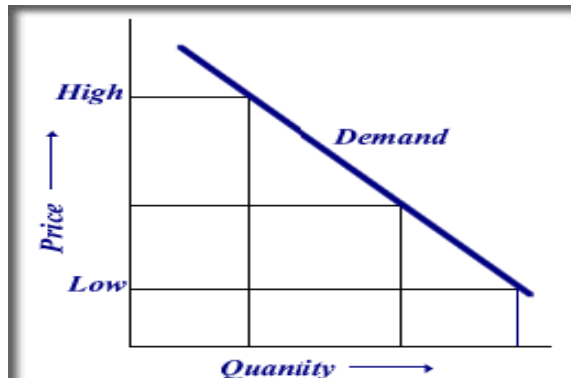
1. The Demand-Supply Framework
2. Price Elasticity
3. The Balance Table
4. Stocks-to-Disappearance Ratio

5. The Tabular and Graphic Approach
6. The Regression Analysis
7. Econometric Models
8. Seasonal Price Index

### The Demand-Supply Framework

**Market Demand:** Market demand represents how much people are willing to purchase at various prices. Thus, demand is a relationship between price and quantity demanded, with all other factors remaining constant. The economics of consumer behavior derives the law of demand

- When price of a good goes up, people buy less of that good
- Leads to downward sloping demand curve



### Changes in Market Demand

Price change does not lead to change in demand

Change in anything other than price lead to demand changes - **Entire curve shifts**

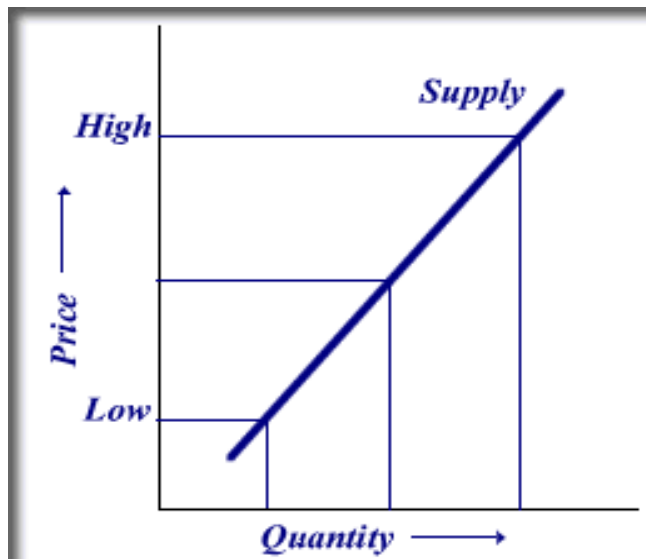
- Income
- Price of related goods - **Substitutes** and **Complements**
- Consumer preference or Taste
- Sales Tax
- Consumer Expectations about future prices, product availability, and income
- Rise in demand – the demand curve shifts to the right
- Fall in Demand – the demand curve shifts to the left.

**Market Supply:** Market supply represents how much producers are willing to sell at various prices. Thus, supply is a relationship between price and quantity supplied, with all other factors remaining constant

The producer theory derives the law of supply

- When price of a good goes up, quantity supplied goes up
- Leads to an upward sloping supply curve





### Changes in Market Supply

Price change does not lead to change in supply

Change in anything other than price lead to supply changes - **Entire curve shifts**

- Production costs
- Improvement in production technology
- Change in the wage rate
- Weather condition
- Excise Tax

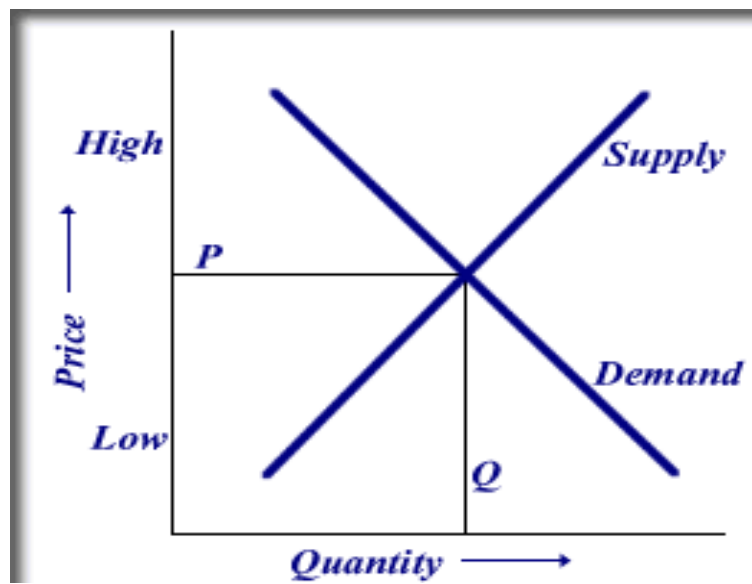
Rise in Supply – the supply curve shifts to the right

Fall in Supply – the supply curve shifts to the left.

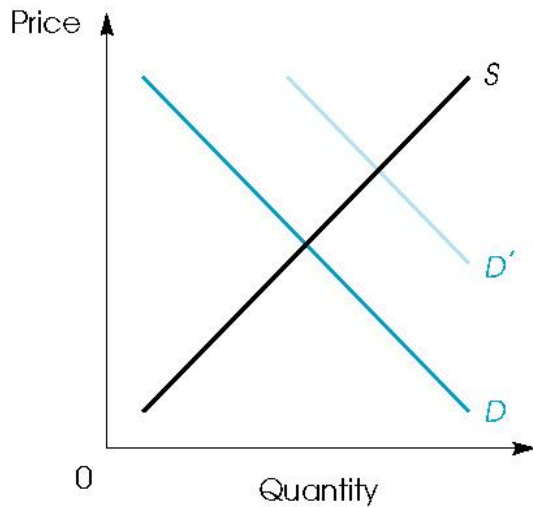
**Market Equilibrium:** Actual price and Quantity determined by interactions between demanders (consumers) and suppliers (sellers)

**Equilibrium Point:** The point where the market demand and supply curves intersect

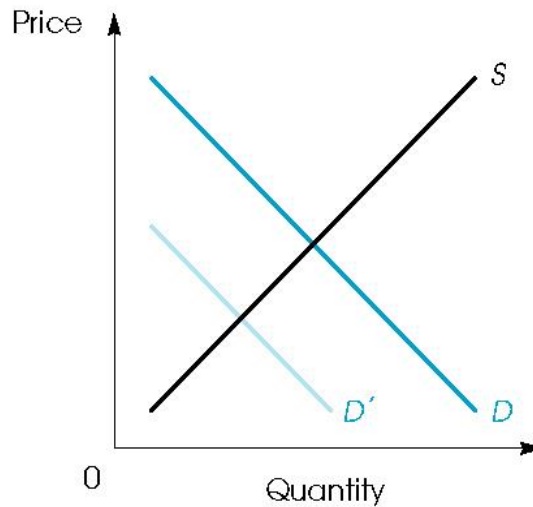
- Price at which quantity demanded equals quantity supplied



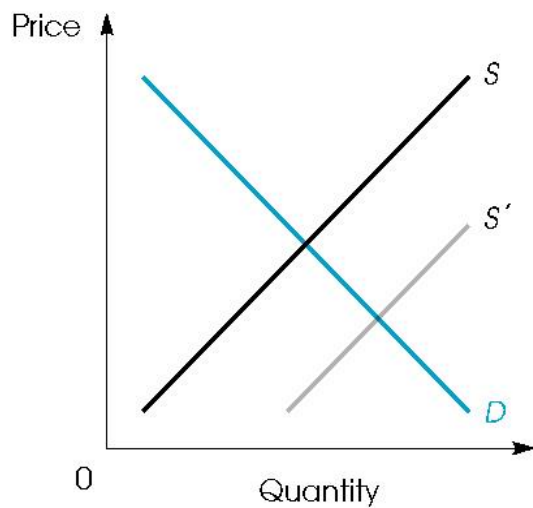
The Effects of Supply and Demand Shifts



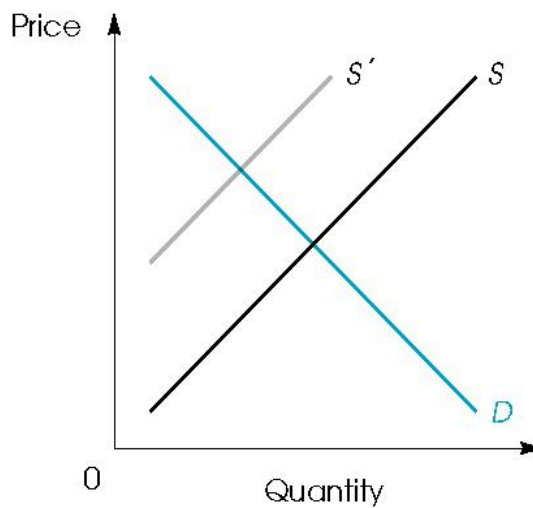
**A**



**B**



**C**



**D**

Although price is determined by the intersection of the market demand and supply curves, typically demand is not readily quantifiable. The only theoretically acceptable means of quantifying demand is to estimate demand curves through a detailed analysis of historical consumption and price data.

- Demand function for corn:

- Similarly the supply function can also be estimated using historical data.

The law of demand implies that the demand curve is negatively sloped. However, the slope may vary. Steeply-sloped demand curve –

**Inelastic demand** - Large change in price leads to small change in quantity demanded

**Flat demand curve** – Elastic demand Small change in price leads to large change in the quantity demanded

- The elasticity of demand is primarily determined by two factors
  - Availability of substitutes
  - Percentage of total income spent on the good
- The price elasticity of demand is a measure of the responsiveness of quantity demanded to a price change

**Own Price Elasticity of Demand:** The percentage change in the quantity demanded relative to a percentage change in its own price.

For a smooth (differentiable) demand curve, the price elasticity of demand is given by

$$E_D = \frac{\Delta Q_D}{Q_D} \div \frac{\Delta P}{P} = \frac{\Delta Q_D}{\Delta P} \times \frac{P}{Q_D}$$

$$E_D = \frac{\partial Q_D}{\partial P} \times \frac{P}{Q_D}$$

### The Price Elasticity of Demand

- Elasticity is a pure ratio independent of units.
- Since price and quantity demanded generally move in opposite direction, the sign of the elasticity coefficient is generally negative.

Interpretation: If  $E_D = -2.72$ : A one percent increase in price results in a 2.72% decrease in quantity demanded

- Example

$$E_{DXY} = \frac{\Delta Q_X}{Q_X} \div \frac{\Delta P_Y}{P_Y} = \frac{\Delta Q_X}{\Delta P_Y} \times \frac{P_Y}{Q_X}$$

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- Elasticity of Demand for Cotton:  $E_d = -0.67$
- Cotton disappeared in quarter 3 of 2010 = 6.64 bill. Lbs
- Cotton disappeared in quarter 4 of 2010 = 7.45 bill. Lbs
- % change in Eq. Quant. Dem. =  $\Delta Q/Q = (7.45 - 6.64)/6.64 = 0.122$
- $E_d = (\Delta Q/Q) / (\Delta P/P)$
- $-0.67 = 0.122 / (\Delta P/P)$
- $\Delta P/P = -0.122 / 0.67 = -0.182$

- The cross price elasticity of demand is a measure of the responsiveness of quantity demanded of  $X$  to a price change of  $Y$

**Cross Price Elasticity of Demand:** The percentage change in the quantity demanded of  $X$  relative to a percentage change in the price of  $Y$ .

$$E_{DXY} = \frac{\Delta Q_X}{Q_X} \div \frac{\Delta P_Y}{P_Y} = \frac{\Delta Q_X}{\Delta P_Y} \times \frac{P_Y}{Q_X}$$

For a smooth (differentiable) demand curve, the cross price elasticity of demand for  $X$  is given by

$$E_{DXY} = \frac{\partial Q_X}{\partial P_Y} \times \frac{P_Y}{Q_X}$$

The Income Elasticity of Demand is a measure of the responsiveness of quantity demanded to change in consumers' income

**Income Elasticity of Demand:** The percentage change in the quantity demanded relative to a percentage change in income.

$$E_I = \frac{\Delta Q_D}{Q_D} \div \frac{\Delta I}{I} = \frac{\Delta Q_D}{\Delta I} \times \frac{I}{Q_D}$$

For a smooth (differentiable) demand curve, the income elasticity of demand is given by

$$E_I = \frac{\partial Q_D}{\partial I} \times \frac{I}{Q_D}$$

The price elasticity of supply is a measure of the responsiveness of quantity supply to a price change

**Own Price Elasticity of Supply:** The percentage change in the quantity supplied relative to a percentage change in its own price.

$$E_S = \frac{\Delta Q_S}{Q_S} \div \frac{\Delta P}{P} = \frac{\Delta Q_S}{\Delta P} \times \frac{P}{Q_S}$$

For a smooth (differentiable) demand curve, the price elasticity of demand is given by

$$E_S = \frac{\partial Q_S}{\partial P} \times \frac{P}{Q_S}$$

The concept of elasticity is also useful for forecasting changes in prices and quantities resulting from supply and demand curve shifts.

- Supply of pork decreases due to a tougher regulation on manure treatment and disposal
- Demand for pork increases due to an increase in the price of beef

If we know the elasticities of demand and supply, we can calculate the changes in price and quantity demanded (or supplied) by incorporating elasticities into a model called an **equilibrium displacement model**.

#### **Demand Equation**

- $Q_d = f(\text{price, income, tastes and preferences, expectations, and prices of other goods})$
- Demand changes (shifts) if any right hand side factor other than price of the commodity changes

## Supply Equation

- $Q_s = f$  (price, input prices, prices of other goods, expectations, technological change, number of producers)
- Supply changes (shifts) if any right hand side factor other than price of the commodity changes

**Equilibrium:** Price and quantity are determined by the intersection of the demand and supply curves, where

- $Q_d = Q_s$  (i.e., quantity demanded = quantity supplied)
- Equilibrium changes (gets displaced) if demand and/or supply changes because of changes in any right hand side demand and/or supply factor other than the price of the commodity.

Suppose that an increase in income shifts the demand curve to the right, and an increase in the production cost shifts the supply curve to the left. As a result, new equilibrium price will be higher and equilibrium quantity will be lower.

We can formalize this concept and write the demand equation as

- $\% \Delta Q_d = E_d \times (\% \Delta P) + S_d$
- Where,  $E_d$  is the elasticity of demand
- $S_d$  represents any exogenous demand shift – the percentage change in quantity demanded due to a change in the value of any right hand side variable other than own price

Similarly, we can write the supply equation as

- $\% \Delta Q_s = E_s \times (\% \Delta P) + S_s$
- Where,  $E_s$  is the elasticity of supply
- Where,  $S_s$  represents any exogenous demand shift – the percentage change in quantity supplied due to a change in the value of any right hand side variable other than own price

In equilibrium the percentage change in quantity demanded must equal the percentage changed in quantity supplied, i.e.,

$$\% \Delta Q_d = \% \Delta Q_s$$

$$E_d \times (\% \Delta P) + S_d = E_s \times (\% \Delta P) + S_s$$

$$E_s \times (\% \Delta P) - E_d \times (\% \Delta P) = S_d - S_s$$

$$[E_s - E_d] \times (\% \Delta P) = S_d - S_s$$

$$\% \Delta P = [S_d - S_s] / [E_s - E_d]$$

Thus, once we know the values of percentage change in demand and/or supply because of an exogenous shock, we can easily calculate the percentage change in price

$$\% \Delta P = [S_d - S_s] / [E_s - E_d]$$

Note that the denominator  $[E_s - E_d]$  is always positive, because  $E_s$  is positive and  $E_d$  is negative.

- If  $S_d > 0$  and  $S_s = 0$ , then  $\% \Delta P > 0$
- If  $S_d = 0$  and  $S_s > 0$ , then  $\% \Delta P < 0$
- If  $S_d > 0$  and  $S_s > 0$  and  $S_d > S_s$ , then  $\% \Delta P > 0$
- If  $S_d > 0$  and  $S_s > 0$  and  $S_d < S_s$ , then  $\% \Delta P < 0$

Once we calculate the percentage change in price  $\% \Delta P$ , we can substitute that value into the demand or supply equation to calculate the percentage change in quantity demanded or supplied

$$\% \Delta Q_d = E_d \times (\% \Delta P) + S_d = E_d \times [S_d - S_s] / [E_s - E_d] + S_d$$

#### **General steps in solving an equilibrium displacement model**

- **Step 1:** Determine the values of percentage change in demand ( $S_d$ ) and supply ( $S_s$ )
- **Step 2:** Specify the % changes in quantity demanded and supplied as

$$\% \Delta Q_d = E_d \times (\% \Delta P) + S_d$$

$$\% \Delta Q_s = E_s \times (\% \Delta P) + S_s$$

- **Step 3:** Set  $\% \Delta Q_d = \% \Delta Q_s$  and solve for  $\% \Delta P$

**Step 4:** Plug the calculated value for  $\% \Delta P$  into the  $\% \Delta Q_d$  or  $\% \Delta Q_s$  equation to calculate the percentage change in quantity

#### **Example: Impact of manure regulation in the pork market**

- Elasticity of pork demand,  $E_d = -1.96$
- Elasticity of pork supply,  $E_s = 2.15$
- Because of a newly introduced tighter manure regulation, pork supply falls by 4.3%, i.e.,  $S_s = -4.3\%$
- There is no change in pork demand, i.e.,  $S_d = 0$
- Suppose that the current price for pork is \$100/cwt and the quantity bought and sold is 1,000 cwt per day.
- What would be the new equilibrium price and quantity?

#### **The Tabular and Graphic (TAG) Approach**

The balance table only involves supply and disappearance statistics, without any direct consideration of price – thus, may lead to incorrect conclusions. The tabular and graphic (TAG) approach examines the relationship between the balance table statistics along with prices. The TAG method also considers other factors such as the supply of substitute goods and income using the TAG approach, analysts collect and plot historical disappearance data against corresponding prices, and analyze the correlation. Inconsistencies are further explained by using disappearance data for substitute goods. The TAG approach is only well-suited to situations in which price fluctuations can be largely explained by one or two variables.

#### **The Regression Analysis**

- Regression analysis provides a statistical procedure that can be used to formalize the TAG approach.
- For example, the price prediction equation for hogs can be expressed as follows:
- The values of the coefficients  $\alpha$ ,  $\beta_1$ ,  $\beta_2$ , and  $\beta_3$ , can be estimated by regressing historical hog prices on hog and cattle slaughter data along with the time trend.
- Given the estimates  $\alpha$ ,  $\beta_1$ ,  $\beta_2$ , and  $\beta_3$ , and projections for hog and cattle slaughter and the time trend, one can plug those values into the above equation and obtain a precise price forecast.
- Regression analysis is probably the single most useful analytical tool in fundamental analysis.
- Example: Hog slaughter and pig crop
  - $Y = a + bX$ ; Assume that estimates of  $a = 0.232$ , and  $b = 0.9256$ .
  - $Y$  = June-Nov Hog slaughter
  - $X$  = Dec-May Pig crop
  - If  $X = 46$  million, then  $Y = 0.232 + 0.9256 \times 46 = 42.8$  million.

### **Econometric Models**

- Regression analysis employs only a single equation.
- In some instances, it is theoretically more accurate to construct multiple-equation models in which the equations are interrelated and must be solved simultaneously.

Such models are frequently referred to as econometric models

### **Seasonal Price Index**

- Various markets exhibit seasonal tendencies.
- The concept of utilizing seasonal patterns in making trading decisions is based on the assumption that seasonal influences will cause biases in the movements of market prices.
- Calculating a Seasonal Index – the **Average Percentage Method**
  - Calculate an annual average for each year or season
  - Express each data item as a percentage of the corresponding annual average
  - Average the percentage values for each period. The resulting numbers are the seasonal index.



	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
1998	12.8	11.4	9.9	8.8	9.3	8.4	7.5	7.1	7.8	7.2	6.7
1999	8.5	9.3	11.5	12.5	12.1	12.5	11.2	10.8	9.6	8.7	7.7
2000	9.1	8.6	7.5	7.2	6.0	5.4	5.5	5.9	5.6	4.6	4.4
2001	5.5	5.0	4.2	3.8	4.0	5.0	5.8	5.6	6.1	6.1	5.6
2002	8.3	9.0	8.6	7.5	6.8	6.9	6.1	6.6	6.8	6.5	7.0
2003	8.3	7.6	7.7	7.4	7.0	6.7	6.9	7.4	7.7	8.6	9.8
2004	8.6	8.7	9.1	10.3	12.4	10.4	9.8	9.8	10.4	11.3	10.0
2005	11.3	11.7	11.6	12.0	13.0	12.9	13.5	14.0	14.8	13.5	14.5
2006	14.0	14.4	14.1	12.3	11.4	10.7	10.7	9.7	9.9	9.7	9.0
Q`	8.5	8.3	7.8	8.3	8.7	8.4	8.8	8.8	8.6	8.9	8.4
2008	8.6	8.8	9.0	9.5	9.4	9.1	8.9	8.8	8.7	8.3	8.5

## TECHNICAL ANALYSIS

Technical analysis is the study of historical prices for the purpose of predicting prices in the future. Technical analysts frequently utilize charts of past prices to identify historical price patterns. These price patterns are then used to forecast prices in the future. A basic belief of technical analysts is that market prices themselves contain useful and timely information. Prices quickly reflect all available fundamental information, as well as other information, such as traders' expectations and the psychology of the market

### Role of Technical Analysis

- Identify and predict changes in direction of price trends
- Determine the timing of action – entry and exit decisions

### Chart Analysis - the basic tool of technical analysis

A price chart is a sequence of prices plotted over a specific time frame. In statistical terms, charts are referred to as time series plots. Chart analysts plot historical prices in a two-dimensional graph in order to identify price patterns which can then be used to predict the future direction of prices. The goal of any chart analyst is to find consistent, reliable, and logical price patterns with which to predict future price movements. Chart analysts rely primarily on three bodies of data

- Prices (monthly, weekly, daily, and intra-day)
- Trading volumes, and
- Open interest

### Price Pattern Recognition Charts

The most commonly used price pattern recognition charts are: *bar* charts, *line* charts, *candlestick* charts, and *point-and-figure* charts. On these charts, the Y-axis (vertical axis) represents the price scale and the X-axis (horizontal axis) represents the time scale. Prices are plotted from left to right across the X-axis with the most recent plot being the furthest right.

#### Bar Charts:

Bar charts mark trading activity of a specified trading period (e.g., day) by a single vertical line on the graph

- This line connects the high and low prices for the trading period
- The closing price is indicated by a horizontal bar



### Bar Charts: One-Day Price Reversals

Bar charts are frequently used to identify one-day price reversals. A one-day price reversal occurs in a **rising market** when prices make a **new high** for the current **advance** but then **close lower** than the previous day's close. A one-day price reversal occurs in a **falling market** when prices make a **new low** for the current **decline** but then **close higher** than the previous day's close.

### Line Charts:

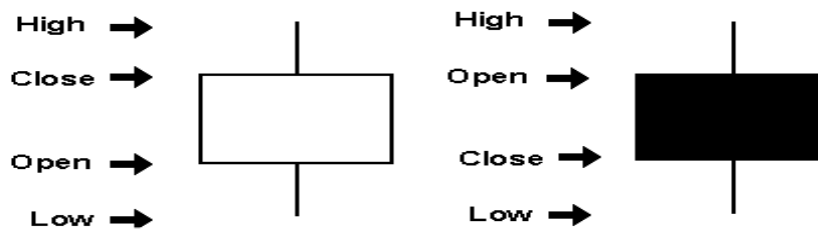
In a line chart, only the closing prices are plotted for each time period. Some investors and traders consider the closing level to be more important than the open, high or low. By paying attention to only the close, intraday swings can be ignored.



### Candlestick Charts:

For a candlestick chart, the open, high, low and close are all required.

- **Hollow** (clear) candlesticks form when the close is higher than the open and **Filled** (solid) candlesticks form when the close is lower than the open.
- The white and black portion formed from the open and close is called **the body** (white body or black body). The lines above and below are called **shadows** and represent the high and low.
- A daily candlestick is based on the open price, the intraday high and low, and the close. A weekly candlestick is based on Monday's open, the weekly high-low range and Friday's close.



### Bulls vs. Bears

A candlestick depicts the battle between Bulls (buyers) and Bears (sellers) over a given period of time.

1. Long white candlesticks indicate that the Bulls controlled trading for most of the period – buying pressure.
2. Long black candlesticks indicate that the Bears controlled trading for most of the period – selling pressure.
3. Small candlesticks indicate that neither the bulls nor the bears were in control of trading – consolidation.
4. A long lower shadow indicates that the Bears controlled trading for some time, but lost control by the end and the Bulls made an impressive comeback.
5. A long upper shadow indicates that the Bulls controlled trading for some time, but lost control by the end and the Bears made an impressive comeback.

6. A long upper and lower shadow indicates that both the Bears and Bulls had their moments during the trading period, but neither could put the other away, resulting in a standoff.

#### Hollow vs. Filled Candlesticks

- Hollow candlesticks, where the close is higher than the open, indicate buying pressure.
- Filled candlesticks, where the close is lower than the open, indicate selling pressure.

#### Long vs. Short Bodies

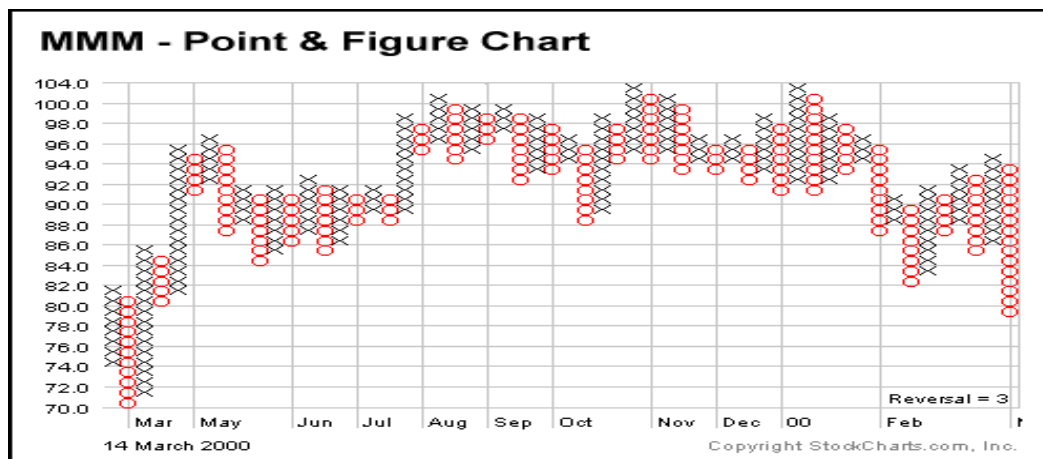
Generally speaking, the longer the body is, the more intense the buying or selling pressure.

- Long white candlesticks show strong buying pressure – buyers are aggressive.
- Long black candlesticks show strong selling pressure – sellers are aggressive.
- Conversely, short candlesticks indicate little price movement and represent consolidation.

#### Point-and-Figure Charts:

Point-and-figure charts are constructed by filling in boxes with either a X or an O. A price increase or decrease is defined as a price change that exceeds a specified magnitude – a price change less than that magnitude does not receive an X or O in the chart. If prices are rising, the appropriate Xs are entered in a particular column. When prices begin to decline, a new column is started, and Os are entered in that column

- Each price reversal results in the start of a new column
- Point-and-figure Charts are based solely on price movement, and do not take time into consideration. There is an x-axis but it does not extend evenly across the chart.



#### Point-and-Figure Charts:

The objective of point-and-figure chart is to provide a smoothing effect on the price changes that appear in a bar chart in order to detect significant price trends and reversals. Point-and figure charts can also be used to generate buy and sell signals.

- A buy signal occurs when an X in a new column surpasses the highest X in the immediately preceding X column.
- A sell signal occurs when an O in a new column is below the lowest O in the immediately preceding O column.

This focus on price movement makes it easier to identify support and resistance levels, bullish breakouts and bearish breakdowns

### **Common Technical Price Patterns**

Chart analysis uses both trend lines and geometric formations to predict market *tops* and *bottoms*, as well as future price movements. The most popular technical price patterns are

- Support and Resistance,
- Trend lines,
- Double tops and bottoms, and
- Head-and-shoulder.

### **Support and Resistance**

A **support** level is a price level at which there appears to be substantial buying pressure to keep prices from falling further

A **resistance** level is a price level at which there appears to be substantial selling pressure to keep prices from rising further

A **congestion area** occurs when prices move sideways, fluctuating up and down within a well-defined range for a considerable time period

- A **support** level is a price level at which there appears to be substantial buying pressure to keep prices from falling further
  - As the price declines towards support and gets cheaper, buyers become more inclined to buy and sellers become less inclined to sell. By the time the price reaches the support level, it is believed that demand will overcome supply and prevent the price from falling below support.
  - Support can be established with the previous reaction lows.

A **resistance** level is a price level at which there appears to be substantial selling pressure to keep prices from rising further

- As the price advances towards resistance, sellers become more inclined to sell and buyers become less inclined to buy. By the time the price reaches the resistance level, it is believed that supply will overcome demand and prevent the price from rising above resistance.
- Resistance can be established with the previous reaction highs.



- Another principle of technical analysis is that support can turn into resistance and vice versa.
- Once the price breaks below a support level, the broken support level can turn into resistance. The break of support signals that the forces of supply have overcome the forces of demand. Therefore, if the price returns to this level, there is likely to be an increase in supply, and hence resistance.
- The other turn of the coin is resistance turning into support. As the price advances above resistance, it signals changes in supply and demand. The breakout above resistance proves that the forces of demand have overwhelmed the forces of supply. If the price returns to this level, there is likely to be an increase in demand and support will be found.

### Congestion Area – Trading Range

- A **congestion area** occurs when prices move sideways, fluctuating up and down within a well-defined range for a considerable time period
- A **congestion area** signals that the forces of supply and demand are evenly balanced.
- When the price breaks out of the congestion area, above or below, it signals that a winner has emerged - A break above is a victory for the bulls (demand) and a break below is a victory for the bears (supply).
  - When the price breaks out of the congestion area by penetrating the support it is a signal to *sell*.
  - When the price breaks out of the congestion area by penetrating resistance it is a signal to *buy*.



## Support and Resistance Zones

- Because technical analysis is not an exact science, it is sometimes useful to create support and resistance zones.
- Sometimes, exact support and resistance levels are best, and, sometimes, zones work better.
- Generally, the tighter the range, the more exact the level.
- If the trading range spans less than 2 months and the price range is relatively tight, then more exact support and resistance levels are best suited.
- If a trading range spans many months and the price range is relatively large, then it is best to use support and resistance zones.
- These are only meant as general guidelines, and each trading range should be judged on its own merits.
- Identification of key support and resistance levels is an essential ingredient to successful technical analysis.
- Even though it is sometimes difficult to establish exact support and resistance levels, being aware of their existence and location can greatly enhance analysis and forecasting abilities.
- If a futures contract is approaching an important support level, it can serve as an alert to be extra vigilant in looking for signs of increased buying pressure and a potential reversal.
- If a futures contract is approaching a resistance level, it can act as an alert to look for signs of increased selling pressure and potential reversal. **If a support or resistance level is broken, it signals that the relationship between supply and demand has changed.**
- A resistance breakout signals that demand (bulls) has gained the upper hand and a support break signals that supply (bears) has won the battle.

## Trend Lines

- Technical analysis is built on the assumption that prices trend.
- A common trading strategy is to identify a price trend and then go with the trend.



- A trend line is a straight line that connects periodic highs or lows on a price chart and then extends into the future to act as a line of resistance or support.
- Two common types of trend lines
  - Uptrend lines
  - Downtrend lines

### Uptrend Lines

An **uptrend line** has a **positive slope** and is formed by connecting two or more low points. The second low must be higher than the first for the line to have a positive slope.

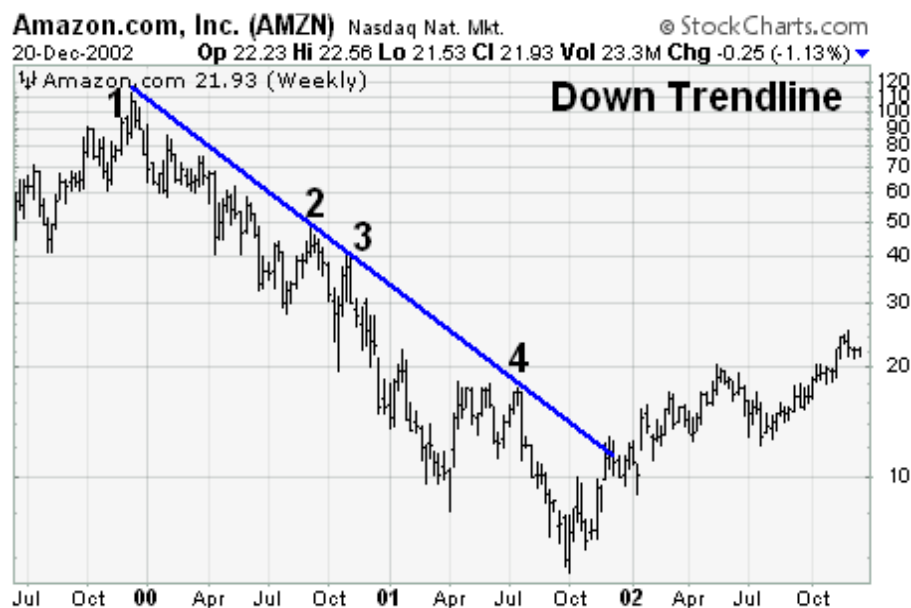
- **Uptrend lines act as support** and indicate that net-demand (demand less supply) is increasing even as the price rises.
  - A rising price combined with increasing demand is very bullish, and shows a strong determination on the part of the buyers.
  - As long as prices remain above the trend line, the uptrend is considered solid and intact.
  - A break below the uptrend line indicates that net-demand has weakened and a change in trend could be imminent.
- When price falls below the uptrend



line, this is a signal to sell or go short.

## Downtrend Lines

- A **downtrend line** has a **negative slope** and is formed by connecting two or more high points. The second high must be lower than the first for the line to have a negative slope.
  - **Downtrend lines act as resistance**, and indicate that net supply (supply less demand) is increasing even as the price declines.
  - A declining price combined with increasing supply is very bearish, and shows the strong resolve of the sellers.
  - As long as prices remain below the downtrend line, the downtrend is solid and intact.
  - A break above the downtrend line indicates that net-supply is decreasing and that a change of trend could be imminent.
- When price breaks above the downtrend line, this is a signal to buy or go long.

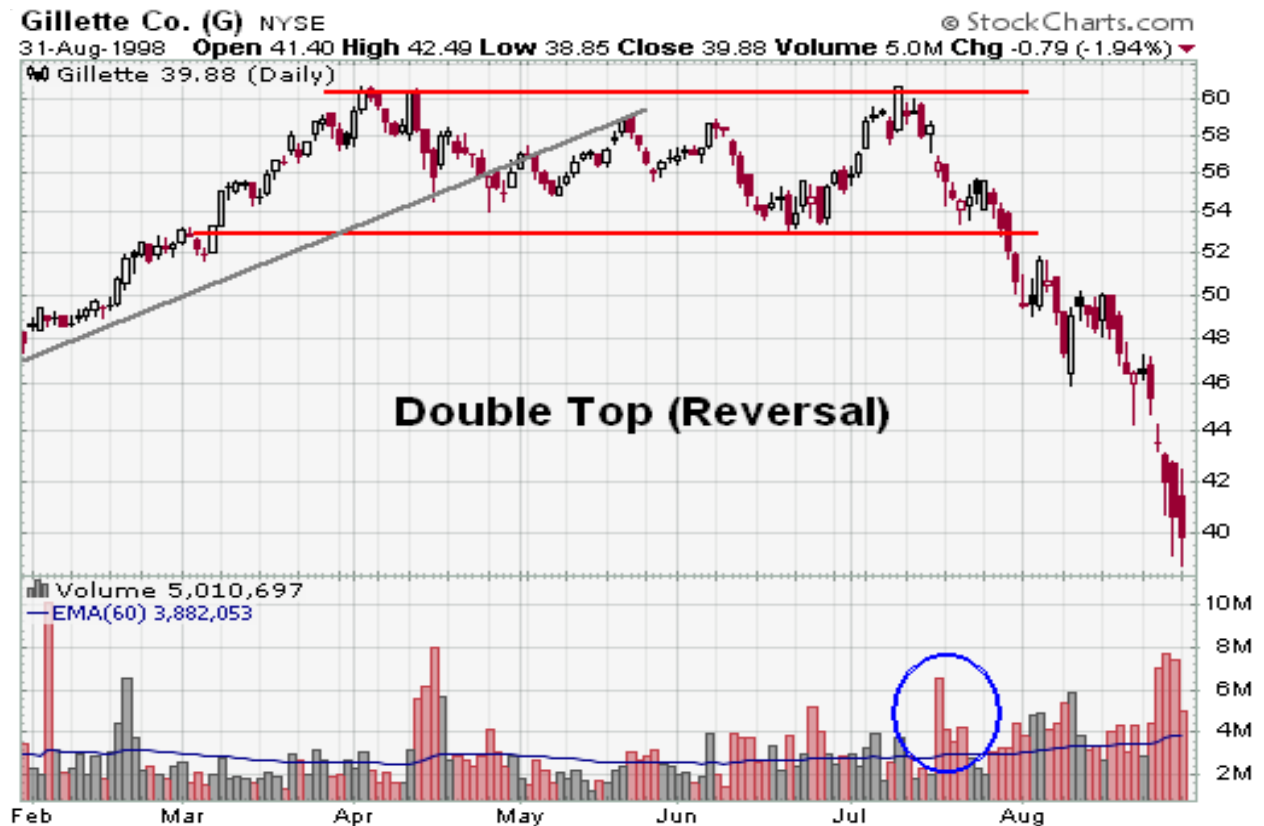


- The general rule in technical analysis is that it takes two points to draw a trend line and the third point confirms the validity.
- It can sometimes be difficult to find more than 2 points from which to construct a trend line.

- Even though trend lines are an important aspect of technical analysis, **it is not always possible to draw trend lines on every price chart. Sometimes the lows or highs just don't match up, and it is best not to force the issue.**
- Trend lines can offer great insight, but if used improperly, they can also produce false signals
- **Trend lines should not be the final arbiter, but should serve merely as a warning that a change in trend may be imminent.**

### **Double Tops or Bottoms**

- Double tops or bottoms are frequently used to identify a price reversal.
- In an uptrend, the failure of prices to exceed a previous price peak on two occasions is considered a ***double top***.
  - This is a warning signal that the uptrend may be about to end and a downtrend to commence
  - However, the formation of a double top is not considered confirmed until falling prices penetrate the previous low from the above.
  - A double bottom is just the mirror image of a double top.
- In a downtrend, the failure of prices to penetrate previous support levels on two occasions is considered a ***double bottom***.
  - This is a warning signal that the downtrend may be about to end and an uptrend to commence



### Double Tops

- **Prior Trend:** In the case of the double top, a significant uptrend should be in place.
- **First Peak:** The first peak should mark the highest point of the current trend.
- **Trough:** After the first peak, a decline takes place that typically ranges from 10 to 20%.
- **Second Peak:** The advance off the lows usually occurs with low volume and meets resistance from the previous high. [Resistance](#) from the previous high should be expected. Usually a peak within 3% of the previous high is adequate.
- **Decline from Peak:** The subsequent decline from the second peak should witness an expansion in volume and/or an accelerated descent, perhaps marked with a gap or two.
- **Support Break:** Breaking support from the lowest point between the peaks completes the double top. This too should occur with an increase in volume and/or an accelerated descent.
- **Support Turned Resistance:** Broken support becomes potential resistance and there is sometimes a test of this newfound resistance level with a reaction rally. Such a test can offer a second chance to exit a position or initiate a short.
- **Price Target:** The distance from support break to peak can be subtracted from the support break for a price target. This would infer that the bigger the formation is, the larger the potential decline.

### **Double Bottoms**

- **Prior Trend:** In the case of the double bottom, a significant downtrend should be in place.
- **First Trough:** The first trough should mark the lowest point of the current trend.
- **Peak:** After the first trough, an advance takes place that typically ranges from 10 to 20%.
- **Second Trough:** The decline off the reaction high usually occurs with low volume and meets [support](#) from the previous low. Support from the previous low should be expected. While exact troughs are preferable, there is some room to maneuver and usually a trough within 3% of the previous is considered valid.
- **Advance from Trough:** Volume is more important for the double bottom than the double top. There should be clear evidence that volume and buying pressure are accelerating during the advance off of the second trough.
- **Resistance Break:** Breaking resistance from the highest point between the troughs completes the double bottom. This too should occur with an increase in volume and/or an accelerated ascent.
- **Resistance Turned Support:** Broken resistance becomes potential support and there is sometimes a test of this newfound support level with the first correction. Such a test can offer a second chance to close a short position or initiate a long.
- **Price Target:** The distance from the resistance breakout to trough lows can be added on top of the resistance break to estimate a target. This would imply that the bigger the formation is, the larger the potential advance.

### **Head-and-Shoulders Tops or Bottoms**

- Head-and-Shoulders formations are among the most frequently used technical patterns for identifying a price reversal.
- Head-and-Shoulders formations consist of four phases:
  - The left shoulder
  - The head
  - The right shoulder
  - The penetration of the neckline
- A head-and-shoulder reversal pattern is complete only when the neckline is penetrated, either in an upward or downward direction.

- **Head-and-Shoulder top:** The formation is complete when price penetrates the neckline from above indicating a **reversal from an uptrend to a downtrend**.

**Head-and-Shoulder bottom:** The formation is complete when price penetrates the neckline from below indicating a **reversal from a downtrend to an uptrend**



## Head-and-Shoulders Tops

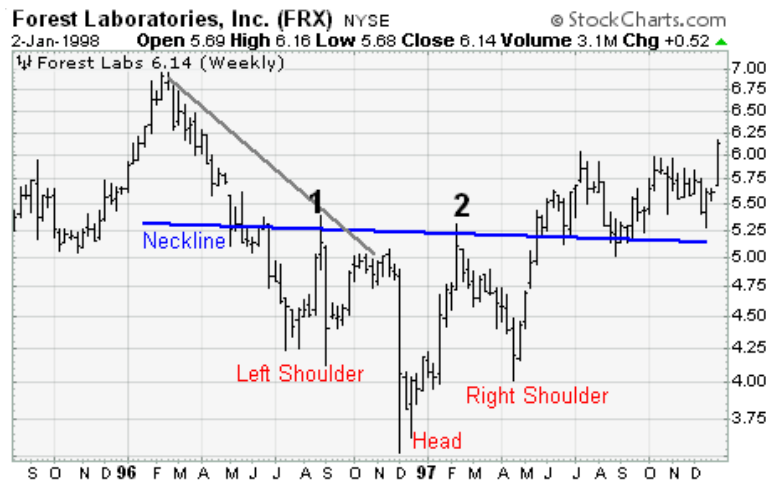
### Head-and-Shoulders Tops

- **Prior Trend:** Without a prior uptrend, there cannot be a Head and Shoulders reversal pattern.
- **Left Shoulder:** While in an uptrend, the left shoulder forms a peak that marks the high point of the current trend. After making this peak, a decline ensues to complete the formation of the shoulder (1). The low of the decline usually remains above the trend line, keeping the uptrend intact.
- **Head:** From the low of the left shoulder, an advance begins that exceeds the previous high and marks the top of the head. After peaking, the low of the subsequent decline marks the second point of the neckline (2). The low of the decline usually breaks the uptrend line, putting the uptrend in jeopardy.
- **Right Shoulder:** The advance from the low of the head forms the right shoulder. This peak is lower than the head (a lower high) and usually in line with the high of the left shoulder. While symmetry is preferred, sometimes the shoulders can be out of whack. The decline from the peak of the right shoulder should break the neckline.
- **Neckline:** The neckline forms by connecting low points 1 and 2. Low point 1 marks the end of the left shoulder and the beginning of the head. Low point 2 marks the end of the head and the beginning of the right shoulder. Depending on the relationship between the two low points, the neckline can slope up, slope down or be horizontal.

- **Volume:** As the Head and Shoulders pattern unfolds, volume plays an important role in confirmation. Ideally, but not always, volume during the advance of the left shoulder should be higher than during the advance of the head. This decrease in volume and the new high of the head, together, serve as a warning sign. The next warning sign comes when volume increases on the decline from the peak of the head. Final confirmation comes when volume further increases during the decline of the right shoulder.
- **Neckline Break:** The head and shoulders pattern is not complete and the uptrend is not reversed until neckline support is broken. Ideally, this should also occur in a convincing manner, with an expansion in volume.
- **Support Turned Resistance:** Once support is broken, it is common for this same support level to turn into resistance. Sometimes, but certainly not always, the price will return to the support break, and offer a second chance to sell.
- **Price Target:** After breaking neckline support, the projected price decline is found by measuring the distance from the neckline to the top of the head. This distance is then subtracted from the neckline to reach a price target. Any price target should serve as a rough guide, and other factors should be considered as well. These factors might include previous support levels, Fibonacci retracements, or long-term moving averages.



## Technical Analysis: Head-and-Shoulders Bottom



### Head-and-Shoulders Bottoms

- **Prior Trend:** Without a prior downtrend, there cannot be a Head and Shoulders Bottom formation.

- **Left Shoulder:** While in a downtrend, the left shoulder forms a trough that marks a new reaction low in the current trend. After forming this trough, an advance ensues to complete the formation of the left shoulder (1).
- **Head:** From the high of the left shoulder, a decline begins that exceeds the previous low and forms the low point of the head. After making a bottom, the high of the subsequent advance forms the second point of the neckline (2).
- **Right Shoulder:** The decline from the high of the head (neckline) begins to form the right shoulder. This low is always higher than the head, and it is usually in line with the low of the left shoulder. When the advance from the low of the right shoulder breaks the neckline, the Head and Shoulders Bottom reversal is complete.
- **Neckline:** The neckline forms by connecting reaction highs 1 and 2. Reaction High 1 marks the end of the left shoulder and the beginning of the head. Reaction High 2 marks the end of the head and the beginning of the right shoulder. Depending on the relationship between the two reaction highs, the neckline can [slope](#) up, slope down, or be horizontal.
- **Volume:** While volume plays an important role in the Head and Shoulders Top, it plays a crucial role in the Head and Shoulders Bottom. Without the proper expansion of volume, the validity of any breakout becomes suspect.
  - Volume on the decline of the left shoulder is usually pretty heavy and selling pressure quite intense.
  - The advance from the low of the head should show an increase in volume
- **Neckline Break:** The Head and Shoulders Bottom pattern is not complete, and the downtrend is not reversed until neckline resistance is broken. For a Head and Shoulders Bottom, this must occur in a convincing manner, with an expansion of volume.
- **Resistance Turned Support:** Once resistance is broken, it is common for this same resistance level to turn into support. Often, the price will return to the resistance break, and offer a second chance to buy.
- **Price Target:** After breaking neckline resistance, the projected advance is found by measuring the distance from the neckline to the bottom of the head. This distance is then added to the neckline to reach a price target. Any price target should serve as a rough guide, and other factors should be considered, as well.





### Technical Analysis: Head-and-Shoulders Tops or Bottoms

- 70-80% reliable in terms of significant move after neckline is broken
- Time required to complete can be days or up to several weeks
- Frequently seen in grains and livestock commodities
- Easy to recognize
- Low trading volume on each side of the “head” confirms the formation

### Market Trend Analyses:

Market trend analyses use more complex price charts as well as volume and open interest figures to determine both the existence of price trends and the strength of these trends.

- Moving Averages
- Rate of Change Indicators: Momentum and Oscillator
- Volume and Open Interest

### Moving Averages

Moving averages are used to determine price trends and trend changes. A moving average is a statistical technique for smoothing price movements in order to identify trends more easily.

- A **simple  $n$ -day** moving average is the average of the most recent  $n$  daily closing prices. A 5-day moving average is the average of the last 5 daily closing prices.
- A 25-day moving average is the average of the last 25 daily closing prices.
- The number of days used to compute the average determines the sensitivity of the average to new price movements
  - The more days that are used, the less sensitive is the average
- **Weighted** moving averages can also be constructed
  - If greater weights are given to more recent prices, the average becomes more sensitive to price change

### Simple Moving Averages (SMA)

Day	Daily Close	5-Day SMA	10-Day SMA
1	60.33		
2	59.44		
3	59.38		
4	59.38		
5	59.22	59.55	
6	58.88	59.26	
7	59.55	59.28	
8	59.50	59.31	
9	58.66	59.16	
10	59.05	59.13	59.34



### Moving Averages: Trading strategy

- Sometimes traders use two moving averages to determine buy and sell decisions.
- Using a slow moving average (more days) together with a fast moving average (fewer days) generates the following trading strategies:
  - Buy when the faster moving average goes above (crosses) the slower one (from below). Sell when the faster moving average goes below (crosses) the slower one (from above).

- Buy when prices are above both the fast and slow moving averages. Sell when prices are below both the fast and slow moving averages.
- As with most tools of technical analysis, moving averages should not be used on their own, but in conjunction with other tools that complement them. Using moving averages to confirm other indicators and analysis can greatly enhance technical analysis.

### Rate of Change Indicators: Momentum and Oscillator

- Rate of change indicators, such as momentum and oscillator indices, are used as leading indicators of price changes.

- Rate of Change (ROC):

$$ROC = \frac{\text{Today's change} - \text{Change } n \text{ periods ago}}{\text{Change } n \text{ periods ago}} \times 100$$

- **Momentum** and **Oscillator** are based on price changes rather than price levels, and are used to determine when a price trend is weakening or strengthening, or losing or gaining momentum.
- **Momentum Index:** A momentum index measures the acceleration or deceleration of a price advance or decline by using absolute price movements over a fixed time interval.
- **Oscillator Index:** An oscillator index is a normalized form of a momentum index.

### Relative Strength Index (RSI)

- The **Relative Strength Index (RSI)** is an extremely useful and popular momentum oscillator - Developed by J. Welles Wilder (1978).
- The RSI compares the magnitude of a stock's or future's recent gains to the magnitude of its recent losses and turns that information into a number that ranges from 0 to 100. It takes a single parameter, the number of time periods (standard 14 days) to use in the calculation.
- $RSI = 100 - 100/(1+RS)$ 
  - $RS = \text{Average Gain} / \text{Average Loss}$
  - $\text{First Average Gain} = \text{Total of gains during the first 14 periods} / 14$
  - $\text{Average Gain} = [\text{previous average gain} \times 13 + \text{Current Gain}] / 14$
  - $\text{First Average Loss} = \text{Total of losses during the first 14 periods} / 14$
  - $\text{Average Loss} = [\text{previous average loss} \times 13 + \text{Current Loss}] / 14$

Losses are also reported as positive values

Days	Price Change	Gain	Loss	Avg. Gain	Avg. Loss	RSI
1	0.5	0.5				
2	0.2	0.2				
3	-0.3		0.3			
4	0.6	0.6				
5	0.2	0.2				

- Wilder recommended using 70 and 30 as overbought and oversold levels respectively.
  - $RSI \geq 70 \Rightarrow$  Market is overbought – Don't buy (long)
  - $RSI \leq 30 \Rightarrow$  Market is oversold – Don't sell (short)
- Generally, if the RSI rises above 30 it is considered bullish for the underlying stock. Conversely, if the RSI falls below 70, it is a bearish signal.
- The centerline for RSI is 50. A reading above 50 indicates that average gains are higher than average losses and a reading below 50 indicates that losses are winning the battle.
- Some traders look for a move above 50 to confirm bullish signals or a move below 50 to confirm bearish signals.



- Technical analysts believe that volume and open interest provide information about whether a price move is strong or weak.
  - If **prices** are **rising** and **open interest and volume** are **increasing** – new money is thought to be flowing in the market, reflecting aggressive new buying – **Bullish**
  - If **prices** are **rising** but **volume and open interest** are **declining** – the rally is thought to be caused primarily by short covering – money is leaving rather than entering the market – the uptrend will probably end once the short covering is complete – **Bearish**.
  - If **prices** are **falling** but **volume and open interest** are **rising** – new money is thought to be flowing in the market – reflecting aggressive new short selling – the downtrend will probably continue – **Bearish**
  - If **prices** are **falling** and **volume and open interest** are **declining** – the price decline is considered to be the result of losing longs liquidating their positions - weak downtrend – the downtrend will probably end soon – **Bullish**