Market Efficiency

- ~~Risk~~ & Return should compensate the risk then market is efficient.
- Transaction cost for the market and market participants is relatively less in an efficient market.
- Utilization and allocation of resources in a market should be effective & productive.
- If market is inefficient, then some investors could get very high return and they will create huge opportunity for arbitrage and make a lot of money, whereas other investors would not make a lot of money.
- Arbitrage: Arbitrage is the simultaneous purchase and sale of the same asset in different markets in order to profit from tiny differences in the asset's listed price. It exploits short-lived variations in the price of identical or similar financial instruments in different markets or in different forms. → Riskless profit
- Law of one price: For any particular commodity, price of the commodity should be same across all markets at any ~~point of time~~. particular point of time.

- Characteristics of efficient/competitive market

1) Large number of participants and one participant is not influenced by other.

2) There is no dependency prevailing b/w two groups/individuals which participate in the market.

3) Active participation in the market

4) Any individual cannot affect the market price

5) Free and symmetric information.

6) Free entry and exit of the market failures.

* Five types of Market Efficiency

1) Information Arbitrage efficiency
2) Fundamental Valuation efficiency
3) ~~Fact~~ Full Insurance efficiency.
4) Functional/Operational efficiency
5) Allocational efficiency.

* Information Arbitrage efficiency

- Necessary informations about the companies should be available equally with all market participants.

- Difference in return would be there because of the different utilization of that information by the investors.

★ Fundamental Valuation Efficiency

- Market value of a stock or an asset should be equal to its intrinsic value.

- Five Rupee Coin:
  Market value = 5
  Intrinsic value = Cost of the metal & other manufacturing costs.

- Intrinsic value of a stock or asset ⇒ Net Present Value of all the future cash flows.

$$P_0 = \frac{CF}{(1+r)} = \frac{D_1}{(1+r)} \quad \frac{D_1}{(r-g)} = \frac{D_0(1+g)}{(r-g)}$$

D → Dividend r = discount rate
g = growth rate of dividend.

- When the market price of a security is equal to its intrinsic value or investment value, the market is said to be efficient. The intrinsic value of an asset is the present value of the future stream of cash flows associated with the investment in that asset, when the cash flows are discounted at an appropriate rate of discount.

★ Full Insurance Effect

- This indicates the extent of hedging against possible future ~~contig~~ contingencies. The greater the possibilities of hedging and reducing risk, the higher is the market efficiency.

- Hedging: Loss in one segment is compensated by gain in other segment, so return remains the same.

- A Hedge is an instrument that is made with the intention of reducing risk of ~~adve~~ adverse price movements in an asset.

- Usually, investors purchase securities inversely correlated with a vulnerable asset in their portfolio. In the event of an adverse price movement in the vulnerable asset, the inversely correlated security should move in the opposite direction, acting as a hedge against any losses. e.g. gold.

- Insurance: Transfer of risk from one segment to other. It is a contract, represented by a policy, in which an individual or entity receives financial protection or ~~rei~~ reimbursement against losses from an insurance company.

- Generally, when stock prices go down, gold price goes up and vice-versa. ∴, gold is a

hedging instrument.

- In case of diversifying the portfolio, investor minimize the risk and maximize the return.
- But in hedging, loss from one segment is compensated by gain from other segment, return is not necessarily maximized.

★ Functional or Operational Efficiency

- The market which minimises administrative and transactions costs, ~~or~~ and which provides maximum convenience (minimum inconvenience) to borrowers and lenders.

★ Allocational Efficiency

- When financial markets channelise resources into those ~~to~~ investment projects and other uses where marginal efficiency of capital adjusted for risk differences is the highest.

- Issues in Efficient Market

- How well do markets respond to new information?
- Should it be possible to decide between a profitable and unprofitable investment given current information?

* Efficient Market Hypothesis (EMH)

- Related to information symmetry & arbitrage in the market
- The current prices of ~~securities~~ securities reflect all information about the security (Random Walk Hypothesis)
- New information regarding securities comes to the market in a random fashion.
- Information is reflected through the ~~market~~ price, ∴ price is also random.
- Profit-maximizing investors adjust security prices rapidly to reflect the effect of new information. In an efficient market, adjustment is very quick.
- The expected returns implicit in the current price of a security should reflect its risk.

* Market Efficiency Forms.

- Efficient Market Hypothesis
- To what extent do securities markets quickly and fully reflect different available information.

* Three levels of market efficiency

- Weak form - prices reflect all security - market information
- Semi strong form - prices reflect all public information
- Strong form - prices reflect all public and private information

* Weak form EMH.

- Current price reflects all security - market information, including the historical sequence of prices, rates of return, trading volume data, and other market - ~~gener~~ generated information
- This implies that past rates of return and other market data should have no relationship with future rates of return.
- Whenever there is any new information then it is reflected in the price in that same period, so it cannot be used to predict future returns and price.
- Therefore, there is some independency in the prices of the securities over ~~the~~ different periods of time.

Date
Page

★ Semi Strong Form EMH

- Current security prices reflect all public information such as earnings, stock and cash dividends, splits, mergers and takeovers, interest rate ~~chao~~ changes etc. It also says that prices adjust to such information quickly and accurately so abnormal profits on a consistent basis can not be ~~ea~~ earned.

- This implies that decisions ~~mde~~ made on new information after it is public should not lead to above-average risk-adjusted profits from those transactions.

- Because every participant has the same information, ∴ no individual/group can use it to derive more returns.

★ Strong Form EMH

- Stock prices fully reflect all information from public and private sources.

- No group/individual has monopolistic access to any extra information which is relevant to formation of stock price. ie. information which ~~affects~~ the stock price.
affects

- This implies that no group of investors should be able to consistently derive above-average risk-adjusted ~~returns~~ rates of returns.
- This assumes perfect markets in which all information is cost-free and available to everyone at the same time.

★ Implications of Efficient Market Hypothesis

- What should investors do if markets efficient?
- Techical analysis
  Not valuable if weak form holds
- Fundamental analysis of intrinsic values
- Analysing other factors which have an impact on the stock prices. like industry and company related variables.
  Macroeconomic fundamentals, ~~indu~~ size of the company, profit, growth opportunity of the company, industry cycle, growth of the industry, etc.
- Not valuable if semi strong form holds.
- Experience average results

* Implications of Efficient Market Hypothesis

- For professional money managers.

- less time spent on individual securities

Passive investing favoured - holding on to an investment for a longer period of time, not changing positions in the market frequently

Otherwise must believe in superior insight.

- Tasks if markets ~~a~~ informationally efficient

Maintain correct ~~dives~~ diversification

Achieve and maintain desired portfolio risk

Manage tax burden

Control transaction costs.

* Tests of Weak-Form EMH

- statistical tests of independence b/w rates of return.
  - Autocorrelation tests
  - Runs test
  - Filter Rules Test

Autocorrelation – Similarity or relation in the values of a variable in different time periods.

Correlation – Similarity or relation b/w two different variables at the same time.

Autocorrelation tests: If there is no dependency or autocorrelation in a variable at different time periods then the market is weakly efficient.

Coefficient of determination = r^2

$$r^2 = \frac{a\sum Y + b\sum XY - n\bar{Y}^2}{\sum Y^2 - n\bar{Y}^2}$$

$$b = \frac{\sum XY - n\bar{X}\bar{Y}}{\sum X^2 - n\bar{X}^2} \quad a = \bar{Y} - b\bar{X}$$

	July 2020 S.P.	July 2021 Stock price
1	X_1	Y_1
2	X_2	Y_2
5		
6		
7		
8		
20	X_{20}	Y_{20}

Price change (X)	Price change (Y)	X^2	Y^2	XY
$X_2 - X_1$	$Y_2 - Y_1$			
$X_3 - X_2$	$Y_3 - Y_2$			
$X_4 - X_3$	$Y_4 - Y_3$			
⋮	⋮			
$X_{i+1} - X_i$	$Y_{j+1} - Y_j$			
⋮	⋮			

$\sum X^2 = 1590$ $\quad \sum Y^2 = 315270.625$ $\quad \sum XY = -830.375$

$\sum X = 65$

$\sum Y = -215$

$\bar{X} = 3.25$ $\quad \bar{X}^2 = 10.5625$

$\bar{Y} = -10.75$ $\quad \bar{Y}^2 = 115.5625$

$$b = \frac{-830.375 - 20(3.25)(-10.75)}{1590 - 20(10.5625)} = -0.095.$$

$r^2 = 3.9 \times 10^{-5}$ $\quad r = 0.0063$

If autocorrelation coefficient is small, i.e. close to zero then it implies that the dependency in prices b/w two time periods is less and the prices are distributed in different time periods in a random fashion and the market is weakly efficient.

★ Run test

Sequence of identical occurences, ~~proceede~~ proceeded and followed by different occurrences.

2020 August	Stock price		
1	881.5	⊖	R_1
2	856.5	⊕	
3	859.75	⊕	
4	918.5	⊕	
5	1010.25	⊕	R_2
6	1072.25	⊕	
7	1074.5	⊕	
8	1123.0	⊕	
9	1203	⊕	
10	1256	⊕	
11	1341	⊕	
12	1469	⊖	R_3
13	1450	⊖	
14	1306	⊖	
15	1258		
16	1330	⊕	R_4
or more			

Two consecutive positive or consecutive -ve changes in the price constitute one run.

Total no of runs (n) = 4
No. of positive price changes = 11
No. of negative price changes = 4

$$\text{Mean} = \frac{2n_1n_2}{n_1+n_2} + 1 = \frac{2 \times 11 \times 4}{15} + 1 = 6.87$$

$$\text{S.D.} = \sqrt{\frac{2n_1n_2(2n_1n_2 - n_1 - n_2)}{(n_1+n_2)^2(n_1+n_2-1)}}$$

$$= \sqrt{\frac{2 \times 44(88-15)}{225 \times 14}} = 1.42$$

Value of 'z' at 5% level of significance = 1.96

Upper limit = $6.87 + (1.96 \times 1.42) = 9.65$
Lower limit = $6.87 - (1.96 \times 1.42) = 4.09$.

~~3.09 < r < 9.65~~

~~r lies~~ If r lies within the confidence level, then null hypothesis is accepted.

Ho: The prices across different time periods are independent of each other i.e. they are random.

⇒ Market is weakly efficient.

★ Filter rules test

An investor trades a stock when its price is greater than the filter value.

But if the prices are random, then any investor following this strategy will not

get extra returns compared to other investors who are trading traditionally.

If investors following this particular strategy get more returns then the market is inefficient as there is some pattern in the prices of the stocks at different periods.

★ Tests of Semi Strong Form EMH.

- Residual analysis
- Event studies

★ Residual Analysis

Expected Return $= \alpha + \beta(Rm)$

$E(R) = 1.33\% + 1.1\ Rm$

Month	Actual Return (%)	Rm	E(R)	Abnormal return
1	14.75	12.15	14.70	0.05
2	14.4	11.95	14.48	-0.08
3	14.82	12.2	14.75	0.07
4	15.01	12.35	14.92	0.09
5	14.92	12.3	14.86	0.06
6	14.68	12.2	14.75	-0.07
7	14.38	11.95	14.48	-0.10
				0.02

Total abnormal return is 0.02 i.e. small and close to zero.

It implies that ~~market~~ ~~is~~ price is reflecting all ~~th~~ the publicly available information ∴ over the time returns can be more than expected or less than expected.

∴ There will be some adjustments over the time and the ~~total~~ abnormal return will tend to zero in a semi-strongly efficient market.

★ Event Studies

How is abnormal return changing corresponding to different events in a company.

$$E(R_1) = 1.7\% + 1.05 R_m$$
$$E(R_2) = 1.53\% + 1.08 R_m$$
$$E(R_3) = 1.92\% + 1.02 R_m$$
$$E(R_4) = 1.42\% + 1.09 R_m$$

Event → Companies have increased their cash dividends.

Company-1

Days	Actual Return	Rm	E(R)	Abnormal return.
4				ARC_{44}
3				ARC_{43}
2				ARC_{42}
1				ARC_{41}
0				ARC_{40}
1				ARC_{-11}
2				ARC_{-12}
3				ARC_{-13}
4				ARC_{-14}

Before change ↑ / Announcement of return / After change ↓

Similarly, calculations can be done for companies 2, 3, 4.

Average return for each day is calculated by returns of the different companies

Before

$4 \rightarrow ARC_{14} + ARC_{24} + ARC_{34} + ARC_{44} = AR_4$

$0 \rightarrow ARC_{10} + ARC_{20} + ARC_{30} + ARC_{40} = AR_0$

$-1 \rightarrow ARC_{-11} + ARC_{-21} + ARC_{-31} + ARC_{-41} = AR_{-1}$

Cumulative Average Abnormal Return is calculated (CAAR)

$\rightarrow AR_4 + AR_3 + AR_2 + AR_1 + AR_0 + AR_{-1} + AR_{-2} + AR_{-3} + AR_{-4}$.

If CAAR is very small or close to zero then the market is semi-strongly efficient.

Because when an event occurs, it has an impact on the returns and if that

impact is not too high i.e. average return before and after the event is close to zero then it implies that the market is semi strongly efficient.

If there is some pattern in the stock prices and return over a period of time then it compels the investor to act according to the predicted future returns

E.g. January Anomaly: Price of the stocks is higher in the month of January compared to the prices in November and December. It may occur due to investors tending to engage their tax sellings at the end of the year, to establish a loss in the stocks ∴ there is more selling pressure on the stocks because they want to show loss in their balance sheets. and then they buy back the stocks in the month of January itself. Now ~~there~~ there is buying pressure on the stocks and the price goes up.

Weekend effect: ~~Mean returns~~ Comparing Friday closing price and Monday closing price

→ Weekend effect: Friday closing to Monday opening price → Negative

→ Monday effect: Monday open to Monday close price → always +ve.

Friday closing price > Monday opening price

Monday opening price < Monday closing price

Monday effect on an average is +ve for January & -ve for other months.

For large firms, weekend effect occurs, whereas for small firms, monday positive effect is more predominant.

* Tests of Strong form EMH

Division of investors:

1) Corporate insiders - Major corporate officers, owners with more than 10% equity shares

2) Stock exchange specialist - Some special access to information

3) Security analyst - Possess some private information related to security prices.

4) Professional money managers - Investement management activities

5) Retail investors

We test over time, how one group is outperforming the other by comparing returns on their portfolio.

If the return of one group is consistently higher than that of the other then the market is inefficient.

If there is no such pattern in the returns of the different groups then the market is strongly efficient.

Studies do not support strong form of EMH because corporate insiders and stock exchange specialists have some kind of monopolistic access to information and helps them to get extra returns and makes the market inefficient.

Small size companies are consistently performing better than large size companies. ∴ Size is a major efficient market anomaly.

Companies with lower Market-to-book ratio are performing better than companies with higher.

Companies with low price earning ratio have more opportunity to grow and higher expected returns compared to high price earning ratio.