

Efficient Market Hypothesis continued...

Theory on insider Trading possible to ask in exam.

Insider Trading - Trading on the basis of insider info.

Insider information $\rightarrow$ material non-public information.

Insider Trading is a punishable offence. However, it is very difficult to completely stop insider trading. One requires a vibrant media & strong capital market regulator to stop insider trading.

Practical -

Tests of market efficiency



Test of weak form

Past icai exam $\checkmark$

Test of semi-strong form

Icai exam & mat $\times$

Imp $\rightarrow$ Auto-correlation Test
 $\rightarrow$ Runs Test

① Runs Test :- (maze wala test)

Focus on direction of Δ in price



Stock price $\uparrow$ '+'

Stock price $\downarrow$ '-'

Days Price Sign

1	330	+
2	342	+
3	345	+
4	347	+
5	358	-
6	350	-
7	348	-
8	340	-
9	338	+
10	346	+
11	350	+
12	360	+
13	372	-
14	370	-
15	362	-
16	350	-

$n_1 = \text{no. of '+'} = 8$

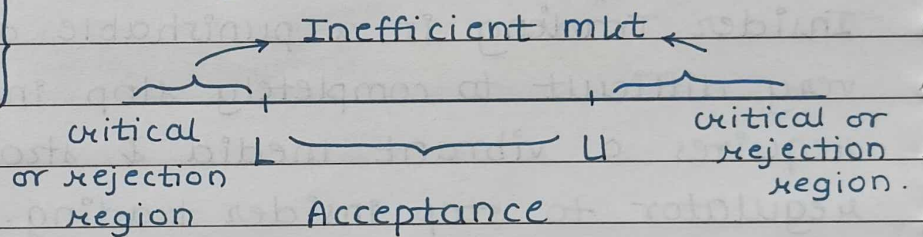
$n_2 = \text{no. of '-'} = 7$

A series of price Δ in one direction is called one run.

no. of runs = 'r' = 4

Yeh signs aur no. of runs show krna pdega answer me...

For the mkt to be efficient, 'r' should not be very high or very low.



L : Lower Limit = $\mu - k\sigma$ (where $k = t$)

U : Upper Limit = $\mu + k\sigma$ (where $\mu = \text{mean}$)

$$\mu = \frac{2n_1n_2}{n_1+n_2} + 1 = \frac{2 \times 8 \times 7}{8+7} + 1 = 8.47$$

$$\sigma = \sqrt{\frac{(\mu-1)(\mu-2)}{n_1+n_2-1}} = \sqrt{\frac{7.467 \times 6.467}{14}} = 1.857$$

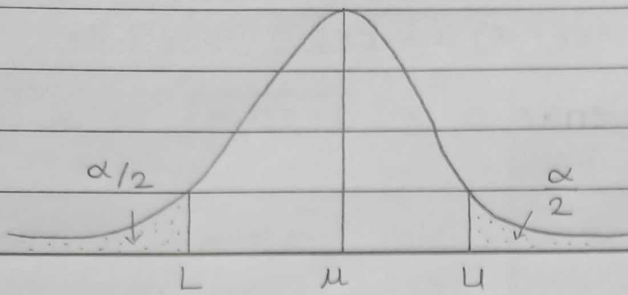
t = table → t distribution

value of 't' shall be given in the exam.

value of 't' depends on -

1) Level of significance (α) say 5%.

2) Degree of freedom (df) = $n_1 + n_2 - 1 = 14$



$$\begin{aligned}
 L &= \mu - t\sigma \\
 &= 8.467 - 2.145 \times 1.857 \\
 &= 8.467 - 3.983 \\
 &= 4.484
 \end{aligned}$$

$$U = \mu + t\sigma = 8.467 + 3.983 = 12.45$$

Since, $x = 4 < L = 4.484$, it falls in the rejection region & the market is weakly inefficient.

Q.52	Pg
CW.64	

$$n_1 = 11, n_2 = 8, \mu = 8$$

[exam me
table likna]

$$\mu = \frac{2 \times 11 \times 8}{11 + 8} + 1 = 10.263$$

$$\sigma = \sqrt{\frac{9.263 \times 8.263}{11 + 8 - 1}} = 2.062$$

$$\alpha = 5\%, t = 2.101, df = 11 + 8 - 1 = 18$$

$$\therefore L = \mu - t\sigma = 10.263 - 2.101 \times 2.062 = 5.931$$

$$\therefore U = \mu + t\sigma = 10.263 + 2.101 \times 2.062 = 14.595$$

x lies b/w L & U , hence mkt is weakly efficient.

$$\alpha = 10\%, t = 1.734, df = 18$$

$$\therefore L = \mu - t\sigma = 10.263 - 1.734 \times 2.062 = 6.688$$

$$\therefore U = \mu + t\sigma = 10.263 + 1.734 \times 2.062 = 13.838$$

x lies b/w L & U , hence mkt exhibits weak form of efficiency.

Self practice: HW. Q. 25) pg. 39

② Auto - Correlation Test :-

Data on last 10 days price given -

Days	Price	ΔP
1	250	<u>x</u>
2	252	2
3	260	8
4	247	-13
5	243	-4
6	250	<u>y</u>
7	260	10
8	270	10
9	264	-6
10	265	1

Period 1

Period 2

Use auto-correlations test to conclude whether markets are weakly efficient.

x	y	x^2	y^2	xy
2	10	4	100	20
8	10	64	100	80
-13	-6	169	36	78
-4	1	16	1	-4
-7	15	253	237	174

$$\bar{x} = \frac{-7}{4} = -1.75, \quad \bar{y} = \frac{15}{4} = 3.75$$

$$b = \beta = \frac{\sum xy - n\bar{x}\bar{y}}{\sum x^2 - n\bar{x}^2} = \frac{174 - 4 \times (-1.75) \times (3.75)}{253 - 4 \times (-1.75)^2} = 0.8318$$

$$a = \bar{y} - b\bar{x} = 3.75 - 0.8318 \times (-1.75) = 5.206$$

$$x^2 = \frac{a \sum y + b \sum xy - n\bar{y}^2}{\sum y^2 - n\bar{y}^2}$$

$$r^2 = \frac{5.206 \times 15 + 0.8318 \times 174 - 4 \times (3.75)^2}{237 - 4(3.75)^2} = 0.9216$$

$$\therefore r = \sqrt{0.9216} = 0.96$$

If correlation $r=0$, market is efficient (past prices k bich correlation zero hai...)

Since, $r \neq 0$, market is weakly inefficient.

Note: If $-0.2 < r < 0.2$, we will consider r as '0' & market to be weakly efficient.

Q.51 pg Discussed verbally.

cw. 63

self practice: HW. Q.24] pg. 39

Part-3

Tests for semi-strong efficiency :- Exam me nhi aya h but idea hona jruri h

↓

It is not possible to generate supernormal return consistently using publicly available info.

→ Residual Analysis.

→ Event studies.

① Residual Analysis:

Characteristic Line (CL) : $\hat{y} = a + bx \rightarrow$ given for a stock.

Actual data given -

Period	$R_m(x)$	$R_i(y)$
xx	xx	xx
xx	xx	xx
xx	xx	xx

We calculate abnormal return in error term also called residue.

$$e = y - \hat{y}$$

For the market to be efficient $\sum e = 0$

Period	$R_m(x)$	$R_i(y)$	$\hat{y} = a + bx$	$e = y - \hat{y}$	
1	xxx	xx	xxx	xx	
2	xxx	xx	xxx	xx	
3	xxx	xx	xxx	xx	
⋮	⋮	⋮	⋮	⋮	
				$\sum e = 0$	← mkt semi-strong efficient

Q.53	Pg	Discussed verbally.
CW.64		Self practice : HW. Q.26] pg. 40

② Event studies:

Major events in companies like M & A, Buyback, cost restructuring, etc. Event took place at $T=0$. We are given returns on a few stocks 3 periods prior & after the event.

	Firm A		Firm B		Firm C		Also CL for each stock is given -
Period	x	y	x	y	x	y	
-3							$\hat{y}_A = a_A + b_A x$ $\hat{y}_B = a_B + b_B x$ $\hat{y}_C = a_C + b_C x$
-2							
-1							
0							
1							
2							
3							

We need to do the same as we did in residual analysis i.e. calculate $e = y - \hat{y} \rightarrow$ Abnormal Return (AR_t)

Then for each period, find out Average Abnormal Return (AAR_t)

Sum total of AAR_t called cumulative Average Abnormal Return (CAR) should be zero for market to be efficient.

Q.54 PG

Discussed verbally.

cw. 65

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