PORTFOLIO MANAGEMENT

CLASS 15

CLASS WORK COVERAGE

To streamline our learning process, I've categorized the questions we'll tackle in class into four distinct groups:

1. ***Classic:*** *These questions are exactly as presented in your book, providing a familiar foundation.*
2. ***Transformed:*** *Here, we've converted book questions into multiple-choice format to enhance your analytical skills.*
3. ***Adapted:*** *These are similar to book questions but with altered numbers or names, presented as multiple-choice questions for varied practice.*
4. ***Original:*** *These are entirely new questions not found in your book, designed to challenge and expand your understanding.*

This structure will help us navigate through a range of problems, ensuring a comprehensive grasp of the material. Looking forward to our next session!

Q. No.	Type	Book	Page No.
51	***Classic***	CW Q BOOK	63
52	***Classic***	CW Q BOOK	64
53	***Classic***	CW Q BOOK	64
54	***Classic***	CW Q BOOK	65

PART V: EFFICIENT MARKET HYPOTHESIS (EMH)

Topic 19 AUTO CORRELATION TEST

Question 51: SSEI Book Page No. 63

Mr. X is of the opinion that market has recently shown the Weak Form of Market Efficiency. In order to test the validity of his impression he has collected the following data relating to the movement of the SENSEX for the last 20 days

Days	Open	High	Low	Close
1	33470.94	33513.79	33438.03	33453.99
2	33453.64	33478.11	33427.82	33434.83
3	33414.06	33440.29	33397.65	33431.93
4	33434.94	33446.18	33377.78	33383.41
5	33372.92	33380.27	33352.12	33370.93
6	33375.85	33389.49	33331.42	33340.75
7	33340.89	33340.89	33310.95	33330.98
8	33326.84	33340.91	33306.17	33335.08
9	33307.16	33328.22	33296.43	33301.97
10	33298.64	33318.60	33254.28	33259.03
11	33260.04	33228.85	33241.66	33251.53
12	33255.92	33289.46	33249.46	33285.89
13	33288.86	33535.67	33255.98	33329.28
14	33335.00	33346.21	33276.72	33284.17
15	33293.83	33310.86	33278.54	33298.78
16	33300.02	33337.79	33300.02	33325.38
17	33323.36	33356.34	33322.44	33329.95
18	33322.81	33345.98	33317.44	33319.67
19	33317.51	33321.18	33294.19	33302.32
20	33290.86	33324.96	33279.62	33319.61

You are required:

To test the **Weak Form of Market Efficiency** using Auto-Correlation test, taking time lag of 10 days.

(Source: ICAI)

ANSWER:

Period 1	Closing Prices	Change	Period 2	Closing Prices	Change
1	33453.99		11	33251.53	
2	33434.83	-19.16	12	33285.89	34.36
3	33431.93	- 2.90	13	33329.28	43.39
4	33383.41	- 48.52	14	33284.17	- 45.11
5	33370.93	- 12.48	15	33298.78	14.61
6	33340.75	- 30.18	16	33325.38	26.6
7	33330.98	-9.77	17	33329.95	4.57
8	33335.08	4.1	18	33319.67	-10.28
9	33301.97	- 33.11	19	33302.32	-17.35
10	33259.03	- 42.94	20	33319.61	17.29

X	Y	X^2	Y^2	XY
-19.16	34.36	367.11	1180.61	-658.34
-2.90	43.39	8.41	1882.69	-125.83
-48.52	-45.11	2354.19	2034.91	2188.74
-12.48	14.61	155.75	213.45	-182.33
-30.18	26.6	910.83	707.56	-802.79
-9.77	4.57	95.45	20.88	-44.65
4.1	-10.28	16.81	105.68	-42.15
-33.11	-17.35	1096.27	301.02	574.46
-42.94	17.29	1843.84	298.94	-742.43
$\sum X = -194.96$	$\sum Y = 68.08$	$\sum X^2 = 6848.66$	$\sum Y^2 = 6745.74$	$\sum XY = 164.68$
$\bar{X} = -21.66$	$\bar{Y} = 7.56$			

$$b = \frac{\sum XY - n\bar{X}\bar{Y}}{\sum X^2 - n(\bar{X})^2} = \frac{164.68 - 9(-21.66)(7.56)}{6848.66 - 9(-21.66)^2} = 0.624$$

$$a = \bar{Y} - b\bar{X} = 7.56 - 0.624(-21.66) = 21.08$$

$$r^2 = \frac{a\sum Y + b\sum XY - n(\bar{Y})^2}{\sum Y^2 - n(\bar{Y})^2} = \frac{21.08(68.08) + 0.624(164.68) - 9(7.56)^2}{6745.74 - 9(7.56)^2}$$

$r^2 = 0.164$

$r = 0.405$

There is moderate degree of correlation between the returns of two periods hence it can be concluded that the market does not show the weak form of efficiency.

Topic 20 RUNS TEST

Question 52: SSEI Book Page No. 64

The closing value of Sensex for the month of October, 2007 is given below :

Date Closing	Sensex Value
1.10.07	2800
3.10.07	2780
4.10.07	2795
5.10.07	2830
8.10.07	2760
9.10.07	2790
10.10.07	2880
11.10.07	2960
12.10.07	2990
15.10.07	3200
16.10.07	3300
17.10.07	3450
19.10.07	3360
22.10.07	3290
23.10.07	3360
24.10.07	3340
25.10.07	3290
29.10.07	3240
30.10.07	3140
31.10.07	3260

With the help of above data evaluate the weak form of efficient market hypothesis by applying the run test at 5% and 10% level of significance.

Following value can be used:

Value of t at 5% is 2.101 at 18 degrees of freedom

Value of t at 10% is 1.734 at 18 degrees of freedom

(Source: ICAI)

ANSWER:

Date	Closing Sensex	Sign of Price Charge
1.10.07	2800	
3.10.07	2780	-
4.10.07	2795	+
5.10.07	2830	+
8.10.07	2760	-
9.10.07	2790	+
10.10.07	2880	+
11.10.07	2960	+
12.10.07	2990	+
15.10.07	3200	+
16.10.07	3300	+
17.10.07	3450	+
19.10.07	3360	-
22.10.07	3290	-
23.10.07	3360	+
24.10.07	3340	-
25.10.07	3290	-
29.10.07	3240	-
30.10.07	3140	-
31.10.07	3260	+

Total of sign of price changes (r) = 8

No of Positive changes = $n_1 = 11$

No. of Negative changes = $n_2 = 8$

$$\mu_r = \frac{2n_1n_2}{n_1+n_2}+1$$

$$\mu = \frac{2\times 11\times 8}{11+8}+1 = 176/19+1 = 10.26$$

$$\hat{\sigma}_r = \sqrt{\frac{2n_1n_2\left(2n_1n_2-n_1-n_2\right)}{\left(n_1+n_2\right)^2\left(n_1+n_2-1\right)}}$$

$$\hat{\sigma}_r = \sqrt{\frac{\left(2\times 11\times 8\right)\left(2\times 11\times 8-11-8\right)}{\left(11+8\right)^2\left(11+8-1\right)}} = \sqrt{\frac{176\times 157}{\left(19\right)^2\left(18\right)}} = \sqrt{4.252} = 2.06$$

Since too few runs in the case would indicate that the movement of prices is not random. We employ a two- tailed test the randomness of prices.

Test at 5% level of significance at 18 degrees of freedom using t- table

The lower limit

$$= \mu - t \times \hat{\sigma}_r = 10.26 - 2.101 \times 2.06 = 5.932$$

Upper limit

$$= \mu + t \times \hat{\sigma}_r = 10.26 + 2.101 \times 2.06 = 14.588$$

At 10% level of significance at 18 degrees of freedom

Lower limit

= 10.26 – 1.734 × 2.06 = 6.688

Upper limit

= 10.26 + 1.734 × 2.06 = 13.832

As seen r lies between these limits. Hence, the market exhibits weak form of efficiency.

*For a sample of size n, the t distribution will have n-1 degrees of freedom.

Topic 20 RESIDUAL ANALYSIS

Question 53: SSEI Book Page No. 64

Mr. Sumeet Gulati is a young analyst who is encouraged by the performance of Dr. Reddy Labs in the year ended March, 2002. On close examination he finds that the announcement regarding sale of molecule DRF 4158 by Dr. Reddy's Lab (DRL) to Novartis took place on May 31, 2001 and there was a renewed interest in the scrip as the company received USD 55 mn as milestone payment. The company would further receive royalties from sale if and when the product comes to market.

To check the market efficiency in semi strong form in the above case, Mr. Gulati collected following relevant information:

Month	Closing Price of DRL stock (Rs.)	Closing Price of Sensex (Rs.)
January, 2001	1299.90	4326.72
February, 2001	1332.80	4247.04
March, 2001	1247.25	3604.38
April, 2001	1121.50	3519.16
May, 2001	1406.30	3631.91
June, 2001	1610.25	3456.78
July, 2001	1688.35	3329.28
August, 2001	1771.35	3244.95
September, 2001	1785.30	2811.60
October, 2001	1045.20	2989.35

Further using the data for 3 previous years the characteristic line arrived by Mr. Gulati is

$$r_{s,t} = 3.92 + 0.51 r_{m,t}$$

Where $r_{m,t}$ is % monthly return on market in any month t

$r_{s,t}$ is % monthly return on DRL stock in the same month t

You are required to conduct the residual analysis to test semi-strong form of market efficiency

(Source: FOD)

ANSWER:

Months (I)	Actual Return on Reddy's stock (%) (II)	Return on sensex (%) (III)	Expected return on Reddy's stock using characteristic line (IV)	Above normal return % (V) = (II) – (IV)
January 2001	–	–	–	
February, 2001	2.53	–1.84	2.98	–0.45
March, 2001	–6.42	–15.13	–3.80	–2.62
April, 2001	–10.08	–2.36	2.72	–12.80
May, 2001	25.39	3.20	5.55	19.84
June, 2001	14.50	–4.82	1.46	13.04
July, 2001	4.85	–3.69	2.04	2.81
August, 2001	4.92	–2.53	2.63	2.29
September, 2001	0.79	–13.35	–2.89	3.68
October, 2001	–41.46	6.32	7.14	–48.60
			Σ Above normal return =	–22.81%

From the above computation we observe that sum of abnormal return is not close to zero. Therefore, we conclude that market is not efficient in semi-strong form.

Topic 21 EVENT STUDIES

Question 54: SSEI Book Page No. 65

During the year 2002-03, three companies Star Software Ltd., Kanishka Airways and Indian Auto Ltd. have announced higher dividends on December 31, 2002. A financial analyst working in a brokerage firm wanted to test the consistency of the semi-strong form of market efficiency. He estimated the characteristic lines for a period of 4 years on a monthly basis upto September 30, 2002. The relationship between the returns on these three companies and the market index are represented by following equations.

$r_{S,t} = 1.25\% + 0.92 r_{mt}$

$r_{K,t} = 1.39\% + 1.03\ r_{mt}$

$r_{I,t} = 1.78\% + 1.07\ r_{mt}$

Where $r_{S,t}$ $r_{K,t}$ and $r_{I,t}$ are the returns of Star Software, Kanishka Airways and Indian Auto during period t and $r_{m,t}$ is return of the market index during the same period. The following data pertains to the returns of the companies and market for the period 3 months before and 3 months after the dividend was declared.

Period (Months)	Actual return (%)			Market return (%)
	$r_{S,t}$	$r_{K,t}$	$r_{I,t}$	r_{mt}
Sep 30, 2002	11.21	11.78	12.25	10.25
Oct 31, 2002	11.42	12.49	13.25	10.75
Nov 30, 2002	12.02	13.02	13.39	10.90
Dec 31, 2002	11.98	12.29	13.10	10.80
Jan 31, 2003	12.92	13.45	14.25	11.25
Feb 28, 2003	12.23	13.02	14.01	10.92
Mar 31, 2003	12.75	13.21	14.19	11.15

Using event studies approach you are required to verify the validity of semi-strong form of market efficiency in the Indian stock market.

(Source: FOD)

ANSWER:

First we should find out abnormal return by deducting the actual return from the expected return

Star Software Limited

Period	Actual return (rSt)	Market return (rmt)	Expected return (%) (1.25 + 0.92 rmt)	Abnormal return
3	11.21	10.25	10.68	0.53
2	11.42	10.75	11.14	0.28
1	12.02	10.90	11.28	0.74
0	11.98	10.80	11.19	0.79
1	12.92	11.25	11.60	1.32
2	12.23	10.92	11.30	0.93
3	12.75	11.15	11.51	1.24

Kanishka Airways

Period	Actual return (r_{Kt})	Market return (r_{mt})	Expected return 1.39 + 1.03 (r_{mt})	Abnormal return
3	11.78	10.25	11.95	– 0.17
2	12.49	10.75	12.46	0.03
1	13.02	10.90	12.62	0.40
0	12.29	10.80	12.51	– 0.22
1	13.45	11.25	12.98	0.47
2	13.02	10.92	12.64	0.38
3	13.21	11.15	12.87	0.34

Indian Auto

Period	Actual return ($r_{I,t}$)	Market return (l_{mt})	Expected return (1.78 + 1.07 r_{mt})	Abnormal return
3	12.25	10.25	12.75	– 0.50
2	13.25	10.75	13.28	– 0.03
1	13.39	10.90	13.44	– 0.05
0	13.10	10.80	13.34	– 0.24
1	14.25	11.25	13.82	0.43
2	14.01	10.92	13.46	0.55
3	14.19	11.15	13.71	0.48

We will now estimate the average abnormal return to each of the months before and after the dividend was announced

Third month before the announcement of dividend

$$AAR_{(-3)} = \frac{1}{3}(0.53 - 0.17 - 0.50) = -0.0467$$

Second month before the announcement of dividend

$$AAR_{(-2)} = \frac{1}{3}(0.28 + 0.03 - 0.03) = 0.093.$$

First month before the announcement of dividend

$$AAR_{(-1)} = \frac{1}{3}(0.74 + 0.40 - 0.05) = 0.363$$

Month during which the dividend was announced

$$AAR_{(0)} = \frac{1}{3}(0.79 - 0.22 - 0.24) = 0.11$$

First month after the announcement of dividend

$$AAR_{(1)} = \frac{1}{3}(1.32 + 0.47 + 0.43) = 0.74.$$

Second month after the announcement of dividend

$$AAR_{(2)} = \frac{1}{3}(0.93 + 0.38 + 0.55) = 0.62$$

Third month after the announcement of dividend

$$AAR_{(3)} = \frac{1}{3}(1.24 + 0.34 + 0.48) = 0.686.$$

Now we will compute the cumulative Average Abnormal returns for the period of three months before and after the announcement of dividend.

$$CAAR = (-0.0467 + 0.093 + 0.363 + 0.11 + 0.74 + 0.62 + 0.686) = 2.5653\%.$$

As the value of CAAR is not close to zero, we conclude that market is not efficient in the semi-strong form.