CHAPTER 8
TEST OF HYPOTHESES

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8.1 *Introduction*

In many circumstances, to arrive at decisions about the population on the basis of sample information, we make assumptions about the population parameters involved. Such an assumption or statement is called a statistical hypothesis which may not be true. The truth or falsity of statistical hypothesis is never known with absolute certainty unless we examine the entire population which in most cases would be impractical. Instead, we take a random sample from the population and use the information contained in the sample to decide whether the hypothesis is likely to be true or false. The hypothesis that we formulate with the view of rejecting it is called null hypothesis. The rejection of null hypothesis leads to the acceptance of an alternate hypothesis. The procedures which enable us to decide whether to accept or reject hypothesis are called tests of hypothesis. Hypothesis is usually considered as the principal instrument in research[1]. While planning the study, a set of hypothesis has been formulated based on various theories. They have been presented in chapter 2 (section 8). In this chapter an attempt has been made to test these hypotheses.

8.2 *Testing of Hypotheses :*

8.2.1 ***The measure of general liquidity remains constant over the years.***

In order to test this hypothesis χ^2 (chi-square) method will be employed both for total sample and variable-wise analysis. The following theoretical model has been used to decide whether the liquid ratio and absolute liquid ratio, representing the measure of general liquidity, remains constant over the years or not.

$$\chi^2 = \text{(chi-square)} = \sum_{t=1}^{n}\left[\frac{(O_t - E_t)^2}{E_t}\right]$$

$$= \frac{(O_1 - E_1)^2}{E_1} + \frac{(O_2 - E_2)^2}{E_2} + \ldots\ldots + \frac{(O_n - E_n)^2}{E_n}$$

Where : O_t = Liquid ratio corresponding to period t

and E_t = Expected liquid ratio corresponding to period t.

We have taken the null hypothesis that liquid ratio is uniformly distributed over the years. On the basis of this hypothesis, we shall expect the average liquid ratio/ as the liquidity ratio for each year. The calculated value of χ^2 (chi-square) corresponding to different groups of companies have been presented in Table -8.1.

TABLE 8.1

GROUP WISE COMPUTED VALUES OF χ^2 (CHI-SQUARE)

	Company-Group	Calculated value of χ^2 (chi-square)
	INDUSTRY - WISE	
1.	General Engineering	16.7
2.	Metals, Alloys & Metal Products	22.5
3.	Cement	35.5
4.	Refractories	10.6
5.	Chemicals	40.2
6.	Aluminium	19.8
7.	Jute	13.1
8.	Cotton	62.7
9.	Synthetic	44.4
10.	Electro Electricals Equipments	51.7
11.	Paper	89.6

12.	Sugar	24.0
13.	Tea Plantations	24.9
14.	Food Products	11.7
15.	Miscellaneous	19.6
	AGE - WISE	
1	New	49.2
2	Moderately old	12.8
3	Old	14.5
4	Very Old	6.6
	SIZE - WISE	
1	Small	153.6
2	Medium	21.1
3	Large	20.2
4	Giant	13.3
	Total Sample Companies (Corporate Sector)	13.7

Source : Compiled and Calculated from the various volumes of Stock Exchange Official Directory, Mumbai.

The table value of χ^2 (chi-square) at 5 percent level of significance for 9 degrees of freedom = 16.919.

But the calculated value of χ^2 (Chi-square) in respect of different industries except refractories, jute textiles, and food products are more than the table value of χ^2. Similarly, on all size-wise groups of companies barring giant size companies the calculated χ^2 value is more than the table value. On the other hand, for different age group of companies the calculated value of χ^2 is less than the table value excepting new age group of companies. The foregoing analysis in general rejects our null hypothesis that the measure of general liquidity remains constant over the years.

8.2.2 ***The nature of the business, size and age of a firm have no bearing on its liquidity.***

An important assumption of variable-wise analysis is that significant differences in the distribution of variable-wise liquidity ratios exist. Here, the hypothesis is tested in reference to the liquid ratio (L.R.) only. The null hypothesis tested is that the mean industry liquid ratio of each of the 15 industries is the same. Similar null hypotheses have also been developed for size and age variables. The alternate hypotheses are that at least one industry, size-wise and age-wise mean liquid ratio is significantly different from other fourteen industries, three size groups and three age groups, respectively.

The statistical test used is a two-way analysis of variance (ANOVA) technique . Through this technique, we can not only test the group-wise differences, but also year-wise differences, if exist. Table 8.2 presents the summary calculations of ANOVA in relation to industry, size and age variables.

TABLE 8.2

SUMMARY CALCULATIONS OF ANALYSIS OF VARIANCE (ANOVA)

Source of Variance	Sum of Square	Mean sum of squares	Degree of Freedom	'F' Ratio Calculated	Critical Value	
					5%	1%
Between industries	5.152	0.368	14	17.013	1.70	2.10
Between years	1.211	0.135	9	6.211	1.88	2.41
Residual	2.725	0.022	126	—	—	—
Total	**9.088**	—	**149**	—	—	—
Between Age-groups	0.134	0.045	3	5.413	2.95	4.60
Between years	0.488	0.054	9	6.589	2.25	3.15
Residual	0.222	0.008	27	—	—	—
Total	**0.844**	—	**39**	—	—	—
Between Size-group	0.776	0.258	3	6.568	2.95	4.60
Between years	1.038	0.115	9	2.932	2.25	3.15
Residual	1.062	0.039	27	—	—	—
Total	**2.876**	—	**39**	—	—	—

Source : Same as in Table 8.1

It can be seen from the Table 8.2 that the calculated value of 'F' ratios between industries, between age-groups and between size-groups are more than the table value, both at 5 % and 1% level of significance. The calculated value of 'F' ratios between years for different groups of companies are more than the critical value at 5% and 1% level of significance except for size-groups at 1% level of significance.

On the basis of the above analysis, our null hypotheses are rejected both at 5% and 1% level of significance for all the three variables under study. However, the null hypothesis, i.e., the mean liquid ratio of each year is same is accepted under size variables only at 1% level of significance.

Thus, we conclude that significant industry, size and age differences in liquidity ratios exist and the nature of business, size and age of the firm have a great bearing on their liquidity.

8.2.3 *The corporate sector's mean liquidity ratios are perceived as the target ratios by the industries.*

In this sub section we proceed to test whethe the corporate sector's mean (values weighted arithmetic mean) liquidity ratios can be perceived as the target ratios by the industries.

When an industry observes a deviation between its liquidity ratio and the corporate sector's mean liquidity ratio and there does not exist substantive reasons for the deviations, then it will take steps to adjust its liquidity ratio in the next period, so that its liquidity ratio approximates the corporate mean and the observed deviation will be partially eliminated. We have tested this hypothesis by using only one liquidity ratio, that is, liquid ratio for the period from 1987-88 to 1996-97. The following theoretical model has been used in our analysis in respect of each industry.

$$Y_i = \hat{\alpha} + \hat{\beta} x_i + \hat{e}i$$

Where : $Y_i = Z_t - Z_{t-1}$ and $X_i = Z_t * - Z_{t-1}$

Z_t* is the industry target liquid ratio for time 't' which is assumed to be the corporate mean for time 't-1' and Z_t is the industry's liquid ratio in time 't'.

The speed of adjustment is determined by the size of $\hat{\beta}$, the closer $\hat{\beta}$ is to 1, the faster the period adjustment.

The computed $\hat{\beta}$, t_{β}, R^2 and Durban-Watson statistic for the fifteen industries are presented in Table-8.3

TABLE - 8.3

INDUSTRY-WISE COMPUTED VALUE OF $\hat{\beta}$, $t_{\hat{\beta}}$, R^2 AND D-W STATISTIC

Sl. No.	Industry	$\hat{\beta}$	$t_{\hat{\beta}}$	R^2	D-W Stat.
1.	Gen. Engg.	0.331	0.410	0.023	1.945
2.	Metals & Alloys	0.715	1.444	0.229	1.310
3.	Cement	1.475	4.848	0.771	2.423
4.	Refractories	0.451	0.901	0.104	1.601
5.	Chemicals	0.538	1.261	0.185	1.922
6.	Aluminium	0.517	1.222	0.176	1.943
7.	Jute	0.172	1.723	0.298	2.282
8.	Cotton	0.696	1.839	0.326	2.170
9.	Electro, Electrical Equiments	0.522	1.322	0.200	2.296
10.	Synthetics	0.879	2.508	0.473	1.755
11.	Paper	0.547	1.587	0.265	1.744
12.	Sugar	0.121	0.412	0.024	1.805
13	Tea Plantation	1.023	9.289	0.925	2.133
14.	Food Products	0.897	2.062	0.378	1.863
15.	Miscellaneous	0.233	0.631	0.054	1.814

Note : The table value of $t_{(0.05)}$ for 7 degrees of freedom =1.895

Source : Compiled and calculated from the various volumes of Stock Exchange Official Directory, Mumbai.

The estimated $\hat{\beta}$ is statistically significant at 0.05 level of significance for Cement, Synthetics, Tea plantations and Food products industries . For other industries though $\hat{\beta}$ is insignificant, yet positive. The speed of adjustment is very high for Cement, Tea plantations, Food products, Synthetics, Metals and alloys and Jute industries. The R^2 is also high ($0.3 < R^2 < 0.7$) in case of five industries. Further D-W Statistic for most of the industries lie in between 1.35 and 2.65, and for some industries, this statistic is very nearer to 2. So, the residuals are serially uncorrelated for most of the industries. Hence the estimated $\hat{\beta}$ is an unbiased estimator of population $\hat{\beta}$ value.

The above analysis supports the hypothesis that liquidity ratios of industry are adjusted towards the corporate mean over time and corporate average liquidity indicator is the target liquidity of industries. The industries having lower liquidity try to adjust their liquidity towards corporate average liquidity

8.2.4 *A firm's liquidity could be well described as a random-walk model*

A random walk model implies that the liquidity of a firm does not follow a systematic pattern. In other words, there is almost no relationship between a company's liquidity in one period and that in the next. If this hypothesis is statistically accepted, then there is little point in fitting a trend line to past liquidity measures for forecasting the future liquidity and the best measure of past growth will be the simple average of past annual percentage growth rates. Then, the best forecast of liquidity of period 't' will be based on the liquidity of period 't-1' being adjusted for the simple average of the past growth rates.

In order to test the hypothesis, we have selected the liquid ratio, the measure of overall liquidity. The null hypothesis of this test is that the sequence of observations is random. Further, due to our limited number of observations (only 10), the results we obtain may be sensitive to violation of the assumption of test. To avoid this issue, we have attempted by subjecting the liquid ratio to two different tests.

The first test used is an examination of the auto correlation function for the first differences series of the liquid ratio of individuals firms in the sample. A theoretical property of the random walk model is that the auto correlations for all lags of liquidity changes are zero. The model used for estimating j th order auto correlation coefficient is :

$$r_j = \frac{(l \div T)\sum_{t=1}^{T-j}\left[(zt - \bar{z})(_{zt}tj - \bar{z})\right]}{vo}$$

Where Z_t is the first difference of firm's liquid ratio in time 't', i.e., $Y_t - Y_{t-1}$,

Y_t is the firm's liquid ratio in time 't'

$\bar{z}$ is the mean of the first differences series and

T is the number of observations.

The range of r_j for j = 1 to T- j is from -1 to +1.

To test whether the estimated auto correlation are significantly different from zero, we have found out the standard error (SE) of each r_j based on the following formula.

$$SE\,(r_j) = \sqrt{\frac{1}{T}}$$

If the sample r_j is no more than $\pm$1.96 (approximately 2) standard errors from zero, we can accept the null hypothesis that the population r_j = 0 at the 95% confidence level. The auto correlations (up to lag 3) computed for each firm are presented in Table 8.4

TABLE 8.4

AUTO CORRELATION OF LIQUID RATIOS

Sl No.	Company/Group	r_1	r_2	r_3
1.	Alfredarbet (Ind.) Ltd.	0.078	0.217	-0.348
2.	Hindustan Due Corp. Ltd.	-0.408	0.171	0.134
3.	Hindustan Motors Ltd..	-0.444	-0.031	0.124
4.	Ingersall-Rand (Ind) Ltd.	-0.385	-0.117	0.088
5.	Kilburn Engg. Ltd.	-0.097	-0.580	0.123
6.	TRF Ltd.	-0.393	-0.066	0.007
7.	Texma Co. Ltd.	-0.652	0.364	-0.293
8.	Tata Sponge Iron Ltd.	-0.018	0.267	-0.446

9.	Tata Engg.& Locomotives Co. Ltd.	-0.310	0.081	-0.119
10.	Tata Yodgawar Ltd.	-0.569	0.363	-0.200
11.	Binani Zinc Ltd.	-0.261	0.071	-0.302
12.	Century Extrusions Ltd.	-0.386	0.239	-0.476
13.	Electro Steel Casting Ltd.	-0.230	-0.137	0.252
14.	Ferro Alloys Corp. Ltd.	0.119	-0.436	-0.385
15.	GKW Limited	0.015	-0.161	0.038
16.	Goutermann Peipers (Ind)Ltd.	-0.309	-0.224	0.308
17.	Indian Charge Chrome Ltd.	-0.330	-0.075	0.017
18.	Ispat Alloys Ltd.	-0.129	0.030	-0.051
19.	Ispat Industries Ltd.	-0.208	-0.228	0.055
20.	IMFA Ltd.	-0.580	0.218	-0.147
21.	National Std. Duncan Ltd.	-0.466	0.129	0.006
22.	SWIL Ltd.	-0.671	0.303	-0.077
23.	Tinplate Co. of Ind. Ltd.	-0.044	-0.205	0.130
24.	Usha Martin Ind. Ltd.	-0.078	-0.030	-0.151
25.	Orissa Sponge Iron Ltd.	0.298	-0.077	-0.244
26.	OCL India Ltd.	-0.434	-0.204	0.391
27	Mangalam Cement Ltd.	-0.230	-0.423	0.339
28.	Kalyanpur cements Ltd.	-0.057	-0.239	-0.206
29.	Indo-Asahi Glass CO Ltd.	-0.227	0.088	-0.150
30.	Hindustan Sanitaryware & Ind. Ltd.	0.092	-0.018	-0.198
31.	Hindustan National Glass&Ind.Ltd.	-0.301	-0.257	0.355
32.	Nalco Chemicals & India Ltd.	-0.096	0.080	0.069
33.	Reckitt & Colman of India Ltd.	-0.346	0.104	-0.317
34.	ICI India Ltd.	0.091	-0.325	-0.309
35.	Eveready India Ltd.	-0.196	-0.237	0.120
36.	Indian Aluminium Co. Ltd.	-0.250	0.058	0.224
37.	Indian Foils Ltd.	0.223	-0.146	-0.218
38.	Hukum Chand jute & Ind. Ltd.	-0.014	-0.086	-0.371

39.	GIS Ltd.	-0.312	0.016	-0.168
40.	Cheviot Co. Ltd.	0.372	0.331	-0.143
41.	Birla Corp. Ltd.	-0.273	-0.283	0.370
42.	Mahalaxmi Fibre & Ind. Ltd.	-0.401	0.009	0.159
43.	Dhana Laxmi Mill Ltd.	-0.398	0.009	-0.038
44.	Sterlite Project Ltd.	-0.018	0.034	-0.0004
45.	Ceeta Ind. Ltd.	0.305	-0.263	-0.285
46.	Century Enka Ltd.	-0.108	-0.272	0.179
47.	Exide Ind. Ltd.	-0.262	-0.162	-0.159
48.	Usha Beltron Ltd.	-0.543	0.165	-0.086
49.	Philips India td.	-0.361	-0.147	0.243
50.	Orient Papers & Ind. Ltd.	0.036	-0.046	-0.437
51.	J K Corporation Ltd.	-0.319	0.06	-0.309
52.	Upper Ganges Sugar & Ind. Ltd.	-0.494	0.043	-0.022
53.	Sakti Sugar Ltd.	-0.554	0.308	-0.244
54.	Balarampur Chini Mills Ltd.	-0.367	-0.052	-0.076
55.	Berger Paints Ind. Ltd.	-0.091	-0.091	0.051
56.	Dunlop India Ltd.	-0.120	-0.247	0.112
57.	Kitply Ind. Ltd.	-0.450	0.028	-0.133
58.	ITC Ltd.	-0.275	-0.183	-0.123
59.	EIH Ltd.	-0.040	-0.325	-0.090
60.	Bells Controls Ltd.	-0.333	-0.204	0.260
61.	Bata India Ltd.	-0.409	0.148	-0.279
62.	AFT India Ltd.	-0.177	-0.235	-0.159
63.	Assam Co. Ltd.	-0.181	0.134	-0.110
64.	Assam Brook Ltd.	0.075	-0.300	-0.243
65.	B & A Plantation & India Ltd.	-0.540	0.170	0.108
66.	Bishnauth Tea & Co. Ltd.	-0.283	-0.106	-0.277
67.	George Williamson (Assam) Ltd.	-0.479	0.022	0.001

68.	Hasimara (Ind.) Ltd.	-0.022	-0.234	-0.154
69.	Jayshree Tea & Ind. Ltd.	-0.277	0.195	0.035
70.	Ledo Tea Co. Ltd.	-0.126	-0.430	0.147
71.	Mc Ledo Russel Ind. Ltd.	-0.440	0.025	0.094
72.	Moran Tea Co. (Ind.)Ltd	-0.261	-0.030	-0.004
73.	New Terai Asso, Ltd.	-0.272	0.104	-0.075
74.	Rani Chera Tea Co. Ltd.	0.214	0.034	-0.064
75.	Rossell Ind. Ltd.	-0.608	0.323	-0.140
76.	Tata Tea Ltd.	0.048	0.006	0.009
77.	Warren Tea Ltd.	0.162	-0.005	-0.390
78.	Alipurdur Ltd.	-0.132	-0.042	-0.026
79.	Britannia Ind. Ltd.	-0.141	-0.136	-0.010
80.	Rasoi Ltd.	-0.356	-0.127	0.038
	INDUSTRY GROUP			
1.	General Engineering	-0.282	0.002	0.004
2.	Metalsand Alloyes	0.124	-0.260	-0.106
3.	Cement	-0.418	-0.211	0.325
4.	Refractories	-0.285	0.096	0.012
5.	Chemicals	-0.126	-0.222	-0.332
6.	Aluminium	-0.261	0.029	0.293
7.	Jute	0.372	-0.154	0.374
8.	Cotton	-0.450	0.139	-0.165
9.	Synthetics	-0.128	-0.312	0.227
10.	Electro, Electricals & Equipments	-0.466	0.113	0.007
11.	Paper	-0.070	-0.113	-0.424
12.	Sugar	-0.007	-0.445	-0.332
13.	Tea plantations	-0.347	-0.059	0.344
14.	Food products	-0.418	0.037	-0.267
15.	Miscellaneous	-0.040	-0.229	-0.004

	AGE-WISE :			
1	New	0.021	-0.490	0.197
2	Moderately old	-0.374	-0.046	-0.180
3	Old	-0.522	0.159	-0.101
4	Very Old	-0.545	0.182	-0.234
	SIZE-WISE :			
1	Small	-0.372	0.228	0.043
2	Medium	-0.428	-0.022	0.239
3	Large	-0.430	0.265	-0.170
4	Giant	-0.457	-0.139	0.450
	Corporate sector	-0.412	-0.041	0.097

Source : Compiled and Calculated from the various volumes of Stock Exchange Official Directory, Mumbai.

There are 9 (nine) observations used to compute the r_js for the first different series— this implies SE (r_1) = 0.333, SE (r_2) = 0.354 and SE (r_3) = 0.378. Hence, the significant values of r_j at 5% level of significance are $r_1 \pm 0.653$, $r_2 = \pm 0.694$ and $r_3 = \pm 0.741$. The r_1, r_2 and r_3, in all 80 companies as well as different groups of companies and corporate sector as a whole are within ± 1.96 SE. Thus, the auto-correlations for the first differenced series suggest that a random-walk model could have considerable descriptive validity for firm's liquidity series.

The second test used is the runs test. This test examines if the sign of successive changes in liquid ratio are independent. A run has been defined as a succession of identical observations. If there is increase in the ratio in comparision to the ratio of the immediately preceeding year, then we assign '+' sign and vice versa. The null hypothesis of this test is that the sequence of observations is random. The mean number of runs expected under this null hypothesis is :

$$\mu_r = \frac{2N_1N_2}{N_1 + N_2} + 1$$

Where μ_r = Mean number of runs expected

N_1 = Number of '+' signs and

N_2 = number of '-' signs

The standard deviation of the number of runs under the null hypothesis is :

$$\delta_r = \sqrt{\frac{2N_1N_2(2N_1N_2 - N_1 - N_2)}{(N_1 + N_2)^2(N_1 + N_2 - 1)}}$$

To test whether the mean number of runs are significantly different from actual number of runs, we have found the 'Z' statistic as follows :

$$Z = \frac{\mu_r - r}{\delta_r}$$

Where, r = The number of runs in the sample.

If z is greater than ± 1.96, we can reject the null hypothesis of randomness at the 95% confidence level. We have applied the above model again to the liquid ratio series (1987-97) of different groups of companies. The values of r, μ_r δ_r and Z statistic corresponding to different groups of companies and total sample companies are presented in Table 8.5

TABLE 8.5

GROUP WISE COMPUTED VALUES OF R, μ_r δ_r AND Z STATISTIC

Sl. No.	INDUSTRIES GROUP	r	μ_r	δ_r	Z Stat.
1	General Engg.	5	4.11	0.953	-0.934
2	Metals and Alloys	3	5.44	8.94	0.273
3	Cement	8	5.44	8.94	-0.286
4	Refractories	6	5.44	8.94	-0.663
5	Chemicals	3	4.11	0.953	1.165
6	Aluminium	7	5.44	8.94	-0.174
7	Jute	5	5.00	1.225	0
8	Cotton	7	5.44	8.94	-0.174

9	Synthetics	5	4.11	0.953	-1.137
10	Electro, Electricals & Equipments	5	4.11	0.953	-1.137
11	Paper	4	5.44	8.94	0.161
12	Sugar	4	5.44	8.94	0.161
13	Tea plantation	4	4.11	0.953	-1.137
14	Food Products	5	5.00	1.225	0
15	Miscellaneous	5	4.11	0.953	-1.137
	AGE - GROUPS :				
1	New	5	5.44	8.94	0.049
2	Moderately old	5	4.11	0.953	-0.934
3	Old	7	5.00	1.225	-1.633
4	Very old	7	5.00	1.225	-1.633
	SIZE - GROUPS :				
1	Small	7	5.00	1.225	-1.633
2	Medium	7	4.11	0.953	-3.033
3	Large	5	4.11	0.953	-0.934
4	Giant	5	4.11	0.953	-0.934
	Total Sample Companies	3	2.77	0.416	-0.553

Source : Compiled and calculated from the various volumes of Stock Exchange Official Directory, Mumbai.

The calculated values of Z for the different groups of companies (except the companies coming under medium size-group) as well as the total sample companies do not exceed ± 1.96. Hence, we cannot reject the null hypothesis of randomness at 5% level of significance.

Thus, both the tests support the null hypothesis that the liquidity of firm does not follow a systematic pattern, rather a random walk model.

8.2.5 *The Industry-wide factors are important factors affecting an individual firm's liquidity*

It is commonly believed that changes in the liquidity series of firms are influenced by industry and economic factors. Since the sample size of different industries is not large, we have selected only one industry having the highest sample size. So, the sample tea plantations industry consisting of 17 companies (out of 15 industries with 80 sample companies) has been subjected to this test. We have tested the importance of industry-wide factors only, ignoring the economic factors. Further, the test has been conducted with reference to the liquid ratio series of each tea plantations companies.

The following regression model has been used for each tea plantations companies: $\Delta Y_t = \hat{\alpha} + \hat{\beta}\,\Delta X_t + \hat{e}_t$

Where : Δ = First differences operator,

Y_t = liquid ratio of a selected firm at time 't'

X_t = value of weighted average liquid ratio of tea plantations at time 't'

If industry-wide factors are important in explaining the variability ina firm's liquidity ratios, the average adjusted R^2 will be significant for the aforesaid model. The adjusted R^2 and Durban-Watson Statistic in respect of each Tea plantations companies are given in Table 8.6.

The average adjusted R^2 and Durban-Watson Statistic worked out to be -0.123 and 2.377, respectively. Though a value of 2 of D-W Statistic indicates no first-order serial correlation in the $\hat{e}_t$ series, still a bench mark for suspecting serial correlation in the $\hat{e}_t$ series, is a sample of 30 observations is a D-W Statistic < 1.35 or 2.65. In our case, each sample has only 10 observations. Therefore, the value of D-W Statistic may be sensible to violation of the ideal bench mark. It is evident that the D-W Statistic is not below 1.35 though for B & A Plantations and Industries Ltd. and Rossel Industries Ltd. the value exceeds 2.65. However, the average D-W Statistic remained within the limit. Hence, we cannot accept the presence of serial correlation in $\hat{e}_t$. Therefore, the ordinary least square (OLS) regression model used in this test is not subject to suspicion.

TABLE 8.6

INDUSTRY INFLUENCE ON LIQUID RATIO OF TEA PLANTATIONS COMPANIES (1987-97)

Sl. No.	Name of the company (Group)	$\hat{\beta}$	$t\hat{\beta}$	R^2	Adj.R^2	D-W Stat.
	Tea Plantations Companies					
1.	AFT India Ltd.	0.429	0.830	0.090	-0.041	1.954
2.	Assam Co. Ltd.	0.456	1.229	0.177	0.060	2.315
3.	Assam Brook Ltd.	-0.734	-0.480	0.319	-0.106	1.712
4.	B &A Plantation & Ind. Ltd.	0.928	0.432	0.026	-0.113	3.126
5.	Bishnauth Tea & Co. Ltd.	-1.553	-1.373	0.212	0.100	2.435
6.	GeorgeWilliamson (Assam)Ltd	1.960	1.630	0.275	0.172	2.484
7.	Hasimara Ind. Ltd.	0.035	0.134	0.003	-0.140	1.934
8.	Jayashree Tea & Ind. Ltd.	-1.461	-0.895	0.103	-0.026	2.024
9.	Ledo Tea CO Ltd.	0.406	0.913	0.106	-0.021	2.274
10.	Mc Ledo Russel Ind. Ltd.	4.688	1.819	0.321	0.224	2.233
11.	Moran Tea Co. Ind. Ltd.	0.365	0.179	0.005	-0.138	2.655
12.	New Terai Co. Ind. Ltd.	-0.336	-0.302	0.013	-0.128	2.593
13.	Ranichera Tea Co.Ind. Ltd.	-0.256	-0.257	0.009	-0.132	2.195
14.	Rossell Ind. Ltd.	4.069	0.879	0.100	-0.029	2.962
15.	Tata Tea Ltd.	0.877	1.012	0.128	0.003	1.910
16.	Warren Tea Ltd.	0.557	1.871	0.334	0.238	2.022
17.	Alipurdur Ltd.	0.459	1.037	0.133	0.009	2.577
	Average	—	—	—	-0.123	2.377

Source : Same as in Table 8.1

The average adjusted R^2 of -0.123 indicates that the variability of a firm's liquidity ratio in general cannot be associated with the industry average liquidity.

Thus, industry factors are not important factors affecting an individual firm's liquidity. Hence, we conclude that a firm's liquidity is mainly governed by its policy decisions.

8.2.6 *There is always a negative relationship between liquidity and profitability*

Generally it is believed that there is an inverse relationship between liquidity and profitability, i.e., rise in liquidity gives rise to low profitability because excess or idle investment in current assets is unproductive. There is always need for the minimum level of liquidity in all enterprises. Sound liquidity position up to a certain level enhances profitability. Beyond that profitability remains constant. Any further attempt to hold more current assets to increase liquidity will lead to decline in profitability. So it is assumed that the relationship between liquidity and profitability has the shape of an inverted cup.

To test this hypothesis, a liquidity ratio and a profitability ratio have been selected. Liquid ratio has been taken as a measure of liquidity as it represents a more penetrating measure of liquidity. GSR (Ratio of earnings before depreciation, interest and tax to gross total assets) has been selected to represent the overall profitability of an enterprise.

The statistical techniques used to test this hypothesis is OLS Regression Analysis. The following theoretical model has been used in respect of each group of companies.

$$\Delta Y_t = \hat{\alpha} + \hat{\beta}\Delta X_t + \hat{e}_t$$

Where Δ = First differences operator, and Y_t and X_t are respectively the liquid ratio and Gross surplus ratio of a selected group of companies at time t. The computed $\hat{\beta}, t\hat{\beta}$ and Durban-Watson Statistic for different groups of companies are presented in table 8.7.

TABLE 8.7

GROUPWISE COMPUTED VALUES OF β , $t_{\hat{\beta}}$ AND D.W. STATISTIC

Sl. No.	Company Group	$\hat{\beta}$	$t_{\hat{\beta}}$	D-W Stat.
	INDUSTRY-WISE			
1.	General Engg.	-0.056	-0.784	1.707
2.	Metals & Alloys	-0.037	-0.538	2.935
3.	Cement	0.043	0.096	2.072
4.	Refractories	0.147	2.864	1.933
5.	Chemicals	0.064	0.587	2.714
6.	Aluminium	0.078	1.484	1.135
7.	Jute	0.056	0.320	2.141
8.	Cotton	-0.075	-1.254	2.119
9.	Synthetics	0.104	2.085	2.170
10.	Electro, Electricals Equipments	-0.085	-1.087	1.268
11.	Paper	0.099	3.910	1.787
12.	Sugar	0.185	0.612	2.637
13.	Tea Plantations	0.086	0.671	2.217
14.	Food Products	-0.018	-0.286	2.206
15.	Miscellaneous	-0.251	-1.482	2.179
	AGE- WISE :			
1	New	-0.048	-0.859	2.211
2	Moderately Old	-0.219	-5.798	2.357
3	Old	0.038	0.484	2.149
4	Very old	-0.018	-0.358	1.833
	SIZE-WISE :			
1	Small	-0.012	-0.203	2.810
2	Medium	0.113	1.698	2.413
3	Large	0.051	0.788	1.732
4	Giant	-0.061	0.782	2.772
	CORPORATE SECTOR	-0.054	-0.793	2.078

Source : Same as in Table 8.1

Note : (Table value of $t_{(0.05)}$ for 7 d.f. = 1.895)

If there exists negative relationship between liquidity and profitability, then the estimated value of β will be negative and significant for the aforesaid model . The value of $\hat{\beta}$ will be significant at 5% level of significance if the calculated value of $t_{\hat{\beta}}$ is greater than 1.895.

It is observed from Table 8.7 that $\hat{\beta}$ is negative for the corporate sector as whole. Out of 15 industries, 4 age groups and 4 size-groups of companies, the estimated $\hat{\beta}$ is negative in case of six industries, three age-groups and two size-group of companies. Further, the $\hat{\beta}$ value is significant only for moderately old age group of companies and for other groups of companies (having negative $\hat{\beta}$ values), it is insignificant. The D-W Statistic for most of the groups lies between 1.35 and 2.65, and for many it is nearer to 2. So the residuals are serially uncorrelated for most of the groups of companies. Hence, the estimated β can be taken as unbiased estimator of population β value.

The above analysis does not strongly support our hypothesis that the liquidity and profitability are inversely related. The reason being increase in liquidity up to a particular level enhances the profitability. Hence, we conclude that there is a positive relationship between liquidity up to a particular level and beyond that level there exists an inverse relationship.

8.2.7 *Liberalisation policy adopted by the Government has no effect on the liquidity management practice of the firms*

The liberalisation policy was adopted and pursued by the Govt. in July 1991. In order to test the hypothesis, we have divided the study period into two parts, namely the first part covering a period of 5 years from 1987-88 to 1991-92 (period-I) called Pre-liberalisation period and the second part covering a period of 5 years from 1992-93 to 1996-97 (period - II) called Post-Liberalisation period. We then proceed with the null hypothesis that there is no significant difference between the mean liquid ratios of two periods. One tailed 't' test has been applied to study whether the difference is significant or not. The following theoretical model has been used.

$$t = \frac{\overline{X}_2 - \overline{X}_1}{s\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

Where $\overline{x}_1$ is the mean LR of preliberalisation period,

$\overline{x}_2$ is the mean LR of post-liberalisation period,

n_1 and n_2 refers to number of years covered under pre and post liberalisation period, respectively, and

$$S = \sqrt{\frac{\Sigma(x_1 - \overline{x}_2)^2 + \Sigma(x_2 - \overline{x}_2)^2}{n_1 + n_2 - 2}}$$

The computed value of $\overline{x}_1 - \overline{x}_2$, standard error (SE) of difference between means and 't' statistic are given below in Table 8.8 for each individual companies as well as different group of companies.

TABLE 8.8

FIRM-WISE AND GROUP-WISE COMPUTED VALUES OF $\overline{x}_2 - \overline{x}_1$, SE & 't' STATISTIC

Sl. No.	Name of the Firm/Group	Difference in two mean LR $(\overline{X}_2 - \overline{X}_1)$	SE	't'
1.	Alefrederbet Ind. Ltd.	0.391	0.141	2.781
2.	Hindustan Due Corp. Ltd.	0.331	0.144	2.303
3.	Hindustan Motor Ltd.	0.065	0.138	0.471
4.	Ingersall Rand Ind. Ltd.	-0.253	0.270	-0.939
5.	Kilburn Engg. Ltd.	0.053	0.065	0.822
6.	TRF Ltd.	-0.106	0.121	-0.878
7.	Texmaco Ltd.	0.250	0.010	2.482

8.	Tata Sponge Iron Ltd.	1.118	0.310	3.603
9.	TELCO.	0.155	0.057	2.714
10.	Tata Yodgawar Ltd.	0.018	0.079	0.229
11.	Binani Zinc Ltd.	-0.101	0.361	-0.279
12.	Century Extrusions Ltd.	-0.056	0.242	-0.233
13.	Electro Steel Casting Ltd.	-0.042	0.312	-0.135
14.	Ferro Alloys corp. Ltd.	0.020	0.031	0.641
15.	GKW Limited	0.170	0.087	1.958
16.	Gontermann Pipers Ind. Ltd.	0.025	0.164	0.150
17.	Indian charge chrome Ltd.	0.036	0.127	0.285
18.	Ispat Alloy Ltd.	0.937	0.719	1.302
19.	Ispat Ind. Ltd.	0.236	0.156	1.507
20.	IMFA Ltd.	0.438	0.189	2.318
21.	National Std. Duncan Ltd.	0.202	0.081	2.484
22.	SWIL Ltd.	-0.215	0.251	-0.857
23.	Tinplate Co. of India. Ltd.	-0.165	0.211	-0.783
24.	Usha Martin Ind. Ltd.	0.274	0.101	2.717
25.	Orissa Sponge Iron Ltd.	0.312	0.178	1.753
26.	OCL India Ltd.	0.306	0.165	1.850
27.	Mangalam Cement Ltd.	-0.353	0.102	-3.447
28.	Kalyanpur Cement Ltd.	0.103	0.074	1.405
29.	Indo-Asahi Glass Co. Ltd.	-0.105	0.359	-0.293
30.	Hindustan Sanitary Glass & Ind	0.124	0.102	1.217
31.	Hindustan National Glass Ltd .	-0.009	0.019	-0.638
32.	Nalco Chemicals & Ind. Ltd.	1.024	0.193	5.297
33.	Reckitt & Colman of India Ltd.	0.392	0.240	1.632
34.	ICI India Ltd	0.257	0.064	4.009
35.	Eveready Ind. Ltd.	0.168	0.084	2.000
36.	Indian Aluminium Co. td	0.023	0.138	0.164
37.	Indian Foils Ltd.	0.193	0.059	3.298

38.	Hukum Chand Jute & Ind. Ltd.	-0.028	0.222	-0.125
39.	GIS Ltd.	0.153	0.089	1.721
40.	Cheviot Co. Ltd.	0.423	0.183	2.313
41.	Birla Corp. Ltd.	0.115	0.062	1.857
42.	Mahalaxmi Fibres & Ind. Ltd	0.170	0.092	1.860
43.	Dhana Laxmi Mill Ltd.	-0.167	0.131	-1.279
44.	Sterlite Project Ltd.	2.001	1.685	1.187
45.	Ceeta Ind. Ltd.	1.934	1.147	1.686
46.	Century Enka Ltd.	0.084	0.167	0.504
47.	Exide Ind. Ltd.	0.300	0.114	2.627
48.	Usha Beltron Ltd.	2.097	0.657	3.192
49.	Philips India Ltd.	0.128	0.040	3.164
50.	Orient Papers & Ind. Ltd.	0.323	0.117	2.756
51.	J. K. Corporation Ltd.	0.539	0.176	3.662
52.	Upper Ganges Sugar & Ind. Ltd	-0.082	0.104	-0.793
53.	Sakti Sugar Ltd.	-0.398	0.144	-2.773
54.	Balarampur Chini Mills Ltd.	0.253	0.197	1.284
55.	Berger Paints Ind. Ltd.	0.033	0.047	0.705
56.	Dunlop Ind. Ltd.	0.207	0.104	1.984
57.	Kitply Ind. Ltd.	0.295	0.144	2.043
58.	ITC Ltd.	0.034	0.071	0.474
59.	EIH Ltd.	0.948	0.275	3.450
60.	Bells Controls Ltd.	0.267	0.099	2.714
61.	Bata India Ltd.	0.042	0.034	1.243
62.	AFT Ind. Ltd.	0.636	0.142	4.480
63.	Assam Co. Ltd.	-0.046	0.110	-0.416
64.	Assam Brook Ltd	0.161	0.221	0.726
65.	B & A Plantations & Ind. Ltd.	0.350	0.199	1.763
66.	Bishnauth Tea & Co. Ltd.	0.466	0.127	3.676

67.	George Willamson (Assam) Ltd	0.176	0.141	1.293
68.	Hasimara Ind. Ltd.	0.109	0.020	5.380
69.	Jayshree Tea & Ind. Ltd.	0.647	0.307	2.106
70.	Ledo Tea Co. Ltd.	-0.139	0.062	-2.249
71.	Mc Ledo Russel Ind. Ltd.	0.205	0.284	0.723
72.	Moran Tea Co. (Ind.)Ltd	0.220	0.259	0.849
73.	New Terai Asso,Ltd.	0.245	0.139	1.758
74.	Rani Chera Tea Co. Ltd.	0.014	0.128	0.106
75.	Rossell Ind. Ltd.	1.749	0.528	3.310
76.	Tata Tea Ltd.	-0.015	0.126	-0.122
77.	Warren Tea Ltd.	0.321	0.122	2.634
78.	Alipurdar Ltd.	0.065	0.073	0.892
79.	Britannia Ind. Ltd.	0.126	0.051	2.463
80.	Rasoi Ltd.	-0.125	0.374	-0.333
	INDUSTRY			
1.	General Engg. Industry	0.194	0.066	2.931
2.	Metals and Alloys Industry	0.144	0.098	1.467
3.	Cement Industry	0.045	0.063	0.713
4.	Refractories Industry	0.334	0.065	5.136
5.	Chemicals Industry	0.038	0.102	0.372
6.	Aluminium Industry	0.130	0.051	2.570
7.	Jute Industry	-0.088	0.104	-0.846
8.	Cotton Industry	0.107	0.156	0.687
9.	Synthetics Industry	0.353	0.084	4.191
10.	E. E. & Equip.Industry	0.471	0.128	3.667
11.	Paper Industry	-0.122	0.063	-1.944
12.	Sugar & Breweries Industry.	0.183	0.054	3.406
13.	Miscellaneous Industry	0.215	0.077	2.778
14.	Tea Plantation Industry	0.085	0.059	1.443
15.	Food products Industry	0.179	0.040	4.456

	AGE GROUP			
1.	New	0.328	0.094	3.490
2.	Moderately old	0.177	0.039	4.529
3.	Old	0.160	0.048	3.314
4.	Very Old	0.068	0.044	1.558
	SIZE GROUP			
1.	Small	0.543	0.225	2.414
2.	Medium	0.029	0.086	0.338
3.	Large	0.232	0.041	5.690
4.	Giant	0.163	0.046	3.535
	Corporate Sector	0.169	0.057	2.996

Source : Same as in Table 8.1

(The Critical value of $t_{(0.05)}$ for 8 d.f. = $\pm$1.860, $t_{(0.10)}$ for 8 d.f. = $\pm$ 1.397)

It can be observed from Table 8.8 that the difference in mean liquid ratios, i.e., $\overline{x}_2 - \overline{x}_1$, is positive for 62 individual companies (out of 80). It implies that there is an increase in the mean liquid ratio during post-liberalisation period. The increase in mean liquid ratio is statistically significant for 31 companies (at 5% level of significance) and for 41 companies (at 10% level of significance). Though 18 individual companies revealed a decrease in their mean liquid ratios during post-liberalisation period, only 3 of them (Mangalam Cement Ltd., Sakti Sugar Ltd. and Ledo Tea Co. Ltd.) revealed a significant decrease in their liquid ratios (at 10% level of significance).

Industry-wise analysis revealed that out of 15 industries, the difference in mean ratios is positive for 13 industries. This implies that the mean liquid ratio of 13 industries has shown an improvement during post-liberalisation period. Only jute and paper industries revealed a decrease in their mean liquid ratio. Out of 13 industries revealing a high mean liquid during post-liberalisation period, 10 industries revealed a significant increase in their liquid ratio (at 10% level of significance).

All the four age-groups of companies revealed an increase in their mean liquid ratio during post-liberalisation period and this increase was also statistically significant for all age-groups. Similarly, all the four size-groups of companies revealed an increase in their mean liquid ratio during post-liberalisation period and this increase was statistically significant for 3 size-groups. In case of medium sized companies only, the increase was not statistically significant.

The corporate sector as a whole also revealed a significant increase in its mean liquid ratio during post-liberalisation period.

Therefore, we reject our null hypothesis and conclude that the liquidity of firms in general has increased during post-liberalisation period. Thus, the liberalisation policy adopted by the Government has a great bearing on the liquidity management practices of the firms.

8.3 *Summary*

8.3.1 The measure of general liquidity does not remain constant from year to years.

8.3.2 Significant industry-wise, size-wise and age group-wise differences in liquidity ratios exist. The nature, size and age of the firm have a great bearing on their liquidity.

8.3.3. The liquidity ratio of industry are adjusted towards the corporate mean over time and the corporate average liquidity indicator is the target liquidity of industries. The industries try to adjust their liquidity towards corporate average liquidity.

8.3.4. The liquidity of the firm does not follow a systematic pattern rather a random-walk model.

8.3.5 The industry-wide factors are not important factors affecting an individual firms liquidity and that a firm's liquidity is governed by its policy decisions.

8.3.6 There is a negative relationship between liquidity and profitability is not strongly supported by the analysis.

8.3.7. The liberalisation policy adopted by the Government has a great bearing on the liquidity management practices of the firms.

Note

1. Kothari, C.R., Research Methods and Techniques, Wiley Eastern Limited, New Delhi,1990, p.223.