



E-CONTENT-SERIES ON ENTREPRENEURSHIP AND MSMEs



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DECISION MAKING UNDER CERTAINTY CONDITIONS
(BASED ON FUNCTIONAL ANALYSIS)

As a result of industrial revolution in the form of liberalization, privatization and Globalization, India's economy has undergone several significant changes during the nineties, giving rise to realization of the overwhelming importance of the corporate governance. The role of management has, therefore, become the most challenging task and the contribution of decision making skills to improving both productivity and efficiency at the organizational level has been much more recognized as need of the hour rather than usually thought of previously. Broadly, the adequacy of decision making policies can be adjudged in terms of growth and expansion of business, huge earned profits, diversified areas of activities and finally the surplus value generated in the companies. Obviously, this will lead to achieving higher orders of retained income, net income, net worth, gross fixed assets (GRA), net fixed assets (NFA) and total assets. Of these, the retained income is considered to be the most crucial variable and has, therefore, become the challenging issue to the decision makers in the present day business environment.

Considering the overwhelming importance of the aforesaid, this chapter is devoted to assess and analyze as to how under the conditions of certainty, decisions regarding the various independent variables (like net income, total assets, etc.) contributing to the dependent variable (i.e., retained income) are taken. The underlying assumption behind this exercise being that this will help a lot to company managers in decision making through better application of their decision making skills.

For purposes of the present study, a sample of thirty companies was drawn. The collection of data was the most difficult exercise as the companies hesitated, for obvious reasons, in providing the required statistics regarding their income,



E-CONTENT-SERIES ON ENTREPRENEURSHIP AND MSMEs

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assets, dividend, etc. It was then in their most co-operative gesture that whatever data was supplied by these companies was deemed to be reliable. Further, their hesitation of revealing the recent data was to be honored and therefore, the data made available to us by them was used in the work in the previous chapters.

Moreover, the present chapter is more directed to structuring a sample framework or a process, guiding the corporate manager as to how decisions can be taken when information available are under certainty conditions and not very reliable and recent statistics are available. This process can be replicated as a standard or an ideal framework, which can be applied to any data available with the corporate managers under certainty conditions.

The analysis is based on the data of the selected variables compiled from the single company (out of the total 30 companies) for the period of 25 years as given in table one. The data prior to this period was very unreliable, incomplete and hardly available. Besides, possibility of procuring data of the recent past (i.e., 1998 and 1999) was also ruled out.

In the aforesaid context, it is deemed worthwhile to mention that the role of corporate governance is primarily concerned with monitoring of the progress and performance of the companies. This mainly includes approval of corporate goals, formulation of strategies and business plans, review of financial budgets and plans, compliance with laws and regulations, sharing of gains, bonus or rights issues and public offering and communication to shareholders the plans, strategies and performance of the companies. For this purpose, delegation of complete freedom in decision making authority to management committee will be required. Taking this specific core area a base for initiating decisions on sensitive issues of the companies, the management will be deliberately committed on taking decisions on the matters of income and profit as it would be the outcome of the performance of the decisions itself. Taking this objective in view, the data of the single selected company consisting of balance sheet showing



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financial position, at the end of the accounting period, profit and loss accounts showing the working of the company during the period the proposed appropriation of profits accounts has been taken into consideration before making an application of the regression analysis.

Why Conditions of Certainty

The present exercise is confining to decision making under the conditions of certainty, which is primarily governed by two-fold reasons. First, the aspect of decision making under risk and uncertainty has already been taken care of in the previous work at appropriate place in the dissertation. Therefore, a question of repeating the same thing here and also making part of this exercise, does not arise. Second, almost all the corporate managers interviewed were of the opinion that no decision can be taken without availability of at least some of the information. The information may be scanty, insufficient or incomplete, but the availability of required information is a pre-requisite for carrying out the exercise and taking up the decisions.

Decision Making and Functional Analysis

During the course of primary investigations, it was realized that in case of available information for different variable being given, the managers must build up some statistical technique and use it as a ready reckoned for studying and establishing the relationship among the variables and finding out the effectiveness of each one for application or forecasting purposes before arriving at the final decision. This could strengthen their personal decision making skills as well as efficient decision base for companies. Keeping this in view, the decisions based on functional analysis have been attempted, studied and analyzed.



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As stated earlier, since the retained income is an important variable for companies, it is felt necessary to study and analyze the functional relationship of the retained income with the aforesaid variables of single selected company. After all, it is the retained income, which adds to the financial strength of the companies. The retained income is, therefore, taken as the dependent variable, which is influenced by the independent variables of net income, net worth, etc. of the company. This would enable us to see as to how far these variables are inter-related and to what extent on the basis of their inter relationships, manager could come up with a decision and decide on the financial positions of the companies.

Before taking up the regression analysis, first of all the table one has been case out of a single company, in which data have been registered of different variables. Using this data, the simple regression analysis for decision making has been carried out, as argued in the introductory chapter. For obtaining definite results, as mentioned earlier, retained income is taken as the dependent variable, whereas those of net income, total assets, net worth, gross fixed assets and net fixed assets are taken as the independent variables. The various forms of regression equations developed for each of the selected independent variables are briefly discussed and recorded here as under:

Net Income:

It is an established fact that retained income will increase with an increase in the net income of the company. Hence, the regression coefficient of the retained income in respect of net income (i.e. b_1) is likely to be positive. The equation form of relationship can be put as under:

$$Y = b_0 + b_1x_1 \quad \text{-----} \quad (i)$$

where Y = retained income

b_1 = coefficient of retained income in respect of net income

x_1 = net incom

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Table One
Year-wise Data of Selected Variables
(A case of a selected company)

No. of Years	Retained Income	Net Income	Net Worth	Total Assets	Gross Fixed Assets	Net Fixed Assets
1	116	351	4634	9430	8039	3489
2	-168	9	4614	9789	8463	3607
3	508	882	5277	11988	9401	4155
4	238	558	5618	13378	10698	4850
5	-52	157	5699	13841	11707	5150
6	36	206	4705	12131	9976	4109
7	-260	-178	4575	13665	10550	4209
8	-441	-386	5927	13129	11037	4263
9	-158	-87	4264	13702	11726	4648
10	-279	-203	4138	15199	12352	4863
11	94	216	4686	17282	13896	5514
12	556	794	5211	18216	14479	5256
13	-17	153	5207	18529	158662	5539
14	-641	-578	4603	21940	16143	5864
15	662	769	5637	24331	17741	6689
16	-227	-121	4287	19671	14999	5404
17	-1252	-1194	2941	19120	15552	5555
18	-1291	-1231	1655	20463	16113	5778
19	-762	-689	587	20034	14776	5486
20	2347	2494	3038	24299	15975	5780
21	1070	1188	4488	26410	17668	7230
22	0	0	0	0	0	0
23	0	0	0	0	0	0
24	0	0	0	0	0	0
25	0	0	0	0	0	0
	79	3110	91791	536547	419953	107438

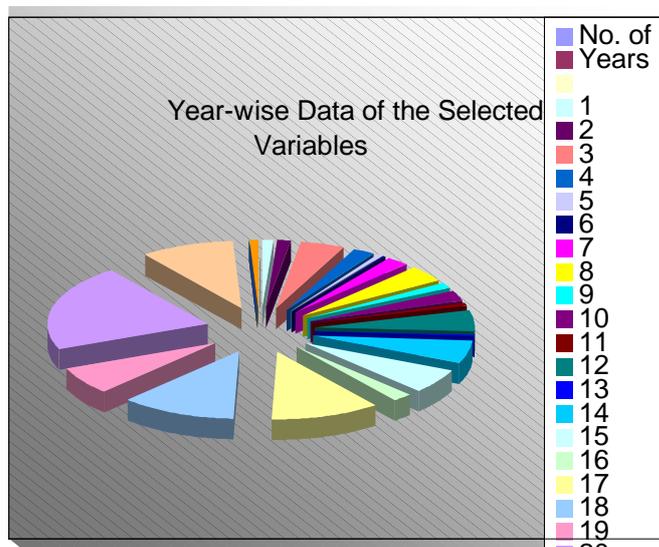
Source: Primary investigation with a company.

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Total Assets

An increase in the total assets is an indication of the company's sound financial position. It can be afforded only on the basis of increasing returns. Thus, an increase in the total assets can have a direct bearing on retained income. Our belief is that under this situation, the regression coefficient of the retained income in respect of the total assets would be positive. The mathematical equation can be derived as follows:

$$Y = b_0 + b_1 \times x_1 \quad \text{-----} \quad \text{(ii)}$$

where

Y = retained income

x1 = total assets

b1 = coefficient of retained income in respect of total asset

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Gross and Net Fixed Assets

As is the case with the total assets, the gross and the net assets will be having a positive relationship with the retained income and the mathematical equations can be derived as follows:

$$Y = b_0 + b_1x_1 \quad \text{----- (iii)}$$

where

Y = retained income

x₁ = gross fixed assets

b₁ = coefficient of the retained income in respect of gross fixed assets

$$Y = b_0 + b_1x_1 \quad \text{----- (iv)}$$

where

Y = retained income

x₁ = net fixed assets

b₁ = coefficient of the retained income in respect of the net fixed assets

Net Worth

Net worth has a positive relationship with retained income and mathematical equation is derived as follows:

$$Y = b_0 + b_1x_1 \quad \text{----- (v)}$$

where

Y = retained income

x₁ = net worth

b₁ = coefficient of the retained income in respect of the net worth

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CORPORATE DECISIONS BASED ON REGRESSION ANALYSIS

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Referring to Table One, if we first take up the simple equations for analysis, it is observed that most powerful variable influencing the retained income is net income. The managers must, therefore, lay more emphasis on the increase of net income, if profitability of the company is to be assured.

The step by step analysis is given as follows;

Decisions based on Regression Coefficient (b_0)

Usually we ignore the negative sign of regression coefficient (b_0) because as we take up the decisions for net income and retained income, it would become evident that negative retention can be ignored. Either it should be 0 or it must show a positive sign. If it is a positive sign, the managers can decide that the company can retain some amount of income even when the net income has fallen to 0. In case the regression coefficient is 0, the decision will be that the retained income is 0 because the net income is 0.

In the present examples given in different Tables, the Regression coefficient is negative. It stands for -136.3806 for net income, -781.9084 for net worth, -707.6031 for total assets, -331.0682 and -844.3789 for gross fixed assets and net fixed assets respectively. Here the negative sign indicates that functional relationship will not be effected and thus, b_0 can be ignored.

Regression Coefficient (b_1)

The regression coefficient b_1 is an important parameter. A positive sign is an indication of a direct relationship between the two variables and vice-versa. A close analysis of the Tables of the individual companies indicates that this parameter is showing a positive association and in most of the cases a high degree of positive sign. This relationship can be explained on a broader structure as follows:

E-CONTENT-SERIES ON ENTREPRENEURSHIP AND MSMEs

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If the first Table is compared to the rest of the Tables, we find that the net income is the strongest independent variable affecting the retained income. It is not just positive but the functional relationship is also very close. Retained income is that part of the corporate income, which after meeting the obligations of the company is retained as an internal fund. It is, thus, the part of the net income and maintains a direct relationship. In case the net income increases, the retained income is most likely to increase and vice-versa. In the given Table One, it is quite clear to the decision maker that not only the regression coefficient is the strongest in the case of net income but at the same time it is the highest. (b_1 is maximum at the net income with .9457) as compared to the rest of the variables as it is just .1797 in case of net worth, .0419 in case of total assets and even much less in cases of gross and net fixed assets.

Thus, the decision makers can strongly feel that the relationship between retained income and net income is the most significant while analyzing financial position of a company. In the present case, the net income is also 94 per cent of the retained income, showing greater closeness between the two.

Coefficient of Correlation (r)

It ranges from 0 to 1. It is the strongest concise formula to measure the relationship between two variables. The more is the r , the greater is the relationship and the lower the r , the weaker is the relationship. The values may vary from -1 to $+1$. In case r is positive, it means variables have a direct relationship. The variables X and Y may increase or decrease in the same direction. Similarly, if it is negative, the variables X and Y will move in the opposite directions. In contrast, -1 value of r will indicate that there will be a perfect negative correlation.

Coefficient of Determination (R^2)

This test is the squared value of the correlation coefficient (R^2). It gives the explanatory power of the linear regression of Y on X . It indicates the variation Y , which is explained by variations in X . It ranges from 0 to 1.

E-CONTENT-SERIES ON ENTREPRENEURSHIP AND MSMEs

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The more the figure of R^2 is to 1, the better the relationship and more it is closer to 0, the worse is the relationship. From the Table One, it is clear that the highest figure of R^2 is shown while working out the results of net income and retained income, where it is .9952. In case of net worth it is .0927, for total assets it is .0676 and for gross fixed assets it is .0094 and for net fixed assets it is .0397. Thus, in case of the retained income it is demonstrating the highest degree of explanatory power.

Adjusted Coefficient of Determination (\bar{R}^2)

The formula of adjusted coefficient of determination is

$$\bar{R}^2 = 1 - \frac{(1-R^2)_{n-1}}{n-k}$$

where k is the number of parameters taken from the table, n is the number of sample observation's and R^2 is the is the unadjusted multiple correlation coefficient. The greater is the figure of \bar{R}^2 , the lesser will be the difference between \bar{R}^2 and R^2 . Again the highest figure of this coefficient also lies in the modes no. 1 establishing a strong relationship between net and retained income. It is .9948 for net income, .0449 for net worth, .0186 for total assets, -0.0427 and -0.0109 for gross fixed assets and net fixed assets respectively.

The decision maker can now easily decide on the confirmation of the strong relationship between net income and retained income.

't' test

To find out the statistical reliability of the estimates, it would be wise for the corporate managers to apply 't' test before declaring their final decisions. The sample value is derived by dividing the estimate b_1 by its standard error. This value is then analyzed with the theoretical values of the t which define the critical region in a two tailed test, with $n-k$ degrees of freedom. It must be mentioned that in

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practice this test must be applied to the sample which is smaller ($n < 30$). If the results are $-t_{0.025} < t < +t_{0.025}$ with $n-k$ degrees of freedom, this will prove to be a null hypothesis, meaning thereby that our estimates b_1 is not statistically significant at the 5 per cent level of significance.

Now if we analyze the company's variables, it is evident that the computed value of 't' is always greater than the theoretical value in all the companies and therefore the parameters are significant. In case of net income $t(b_1)$ is 57.589751 and $t(b_2)$ is 1.259623, for net worth $t(b_0)$ is -1.3288 and $t(b_1)$ is 1.3931, for total assets it is $t(b_0)$ -1.1241 and $t(b_1)$ is 1.1739, for gross fixed assets and for net fixed assets it is $t(b_0)$ is -0.0969 and $t(b_1)$ is 0.4244; $t(b_1)$ is -0.8680 and $t(b_1)$ is 0.8860 respectively. This again confirms that the net income is major factor and it is the most important variable which influenced retained income. 't' values have been compared at 5% level of significance for $(N-K) = 19$ degree of freedom.

The F test

The theoretical value of F is that degree which defines the critical region of the rest out the chosen level of significance. If $F^* < F$ we admit that it is a null hypothesis and if $F^* > F$ we reject the null hypothesis and the difference between the means is significant. The test will judge the overall significance of the results. In the tables we see that it ranges from 0.1801 to 1206.7825. Again the computed value of F is highest in the case of net income which is our first model. F values have been compared at 5% level of significance for $(N-K) = 19$ degree of freedom.



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This is the most crucial and difficult test to apply in practice. Here, it ranges from 0 to 2, indicating that there is some degree of multicollinearity between independent variables also.

Standard Error (SE) and Standard Error of Estimate (S.E.E.)

The smaller is the error, the greater is the accuracy and reliability of the results. The table shows that the standard error of all β s is smaller than half the numerical value of the parameter estimates and the SE is lowest in case of net income of the company.

Thus, after the overall analysis for more efficient corporate governance in concrete terms, the managers can take specific decisions in quantitative terms directing the company's goal in definite shape. The whole analysis can be summarized in the following chart:

Summary of the Results of the Empirical Analysis leading to final corporate decisions for efficient corporate governance

Results of Net	Net	Total	Gross	Net
Empirical Income	worth	Assets	Fixed	Fixed
Analysis			Assets	Income

E-CONTENT-SERIES ON ENTREPRENEURSHIP AND MSMEs

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Mean	148.19	4371	16978.43	13173.95	5116.1
bo	-136.3806	-781.908	-707.601	-331.068	-844.379
b1	0.9457	0.1797	0.0419	0.0254	0.1658
var b₀	307.9508	346269.9	396219.7	653221.7	946271
var b₁	0.0005	0.0166	0.0013	0.0036	0.035
s(b₀)	17.5485	588.447	629.4599	808.2213	972.7651
s(b₁)	0.0213	0.129	0.0357	0.0599	0.1871
t(b₀)	-7.7716	-1.3288	-1.1241	-0.4096	-0.868
t(b₁)	44.3248	1.3931	1.1739	0.4244	0.886
Ysq.com	122931246	1150377	839348.3	116554.6	492446.6
esq	118883.79	11261653	11572682	12295465	11919583
R	0.9952	0.3044	0.26	0.0969	0.1992
dsq	6257.0413	592718.5	609088.5	647129.7	627346.5
R²	0.9904	0.0927	0.0676	0.0094	0.0397
Adj qR²	0.9899	0.0449	0.0186	-0.0427	-0.0109
S.E.	0.0021	0.198	0.2035	0.2162	0.2096
Min. limit	0.9889	-0.2895	-0.3503	-0.5516	-0.4295
Max. limit	1.0015	0.8984	0.8704	0.7454	0.8279
F	1964.6899	1.9408	1.378	0.1801	0.785
DW	0.5691	1.2777	1.3652	1.3752	1.4319

Note: Details of the results based on regression analysis separately for each of the selected independent variables available with the author

Thus, from the above results, the managers could easily take up decisions on the financial position of the company. By application of the empirical analysis in the aforesaid method, the managers could establish functional relationship between dependent variable on one hand (as with the case of retained income) and other



E-CONTENT-SERIES ON ENTREPRENEURSHIP AND MSMEs

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several variables on the other to reach a concrete decision. Corporate governance requires complete transparency and accountability and application of statistical testing with its strong tool would ensure perfection more accuracy in the decisions taken by the corporate managers. The scope of fault is reduced and efficiency increased. The present analysis has been devised on aggregate data to infer out definite conclusions and corporate decisions.

The managers on the basis of the above empirical analysis could decide that the retained income has a direct relationship with net income, total assets, gross fixed assets, net fixed assets and net worth.

Although all the variables have some or the other degree of relationship over one another but the impact of net income over retained income is noticed to be the most crucial and important as compared to other explanatory variables.

It is heartening to record that all the independent variables comprising net income, net worth, GFA, NFA and total assets are found to have made positive contribution to the retained income at the company level. Further, it is interesting to put forth that the contribution of net income to retained income works out to be the highest and is therefore, identified as the most significant factor at the company level. The rest of the independent variables although contributing positively but to a negligible extent only.

The tests were also done to verify our conclusions. The regression coefficient b_1 of the model $Y_{RI} = f(NI)$ was the highest, whereas the variables of TA, GTA, NTA and NW were very low towards retained income, which proves that the



E-CONTENT-SERIES ON ENTREPRENEURSHIP AND MSMEs

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role of these variables (as compared to net income) is very insignificant as far as functional relation is concerned.

The coefficient 'r' is rather high which suggests that net income is an important factor in determining the amount of income to be retained by the corporation. Even in the case of R^2 , its explanatory power is taken to be in a good fit in terms of net income, which also establish a high degree of correlation between retained income and net income. The figures coming out from the application of adjusted \bar{R}^2 , once again built a strong confirmation to the fact that net income is the most important factor for deciding the behavior of retained income as compared to other variables in order to expedite functional relationship.

The 't' test confirms the same relationship. The D.W. test maintains that there is some degree of multi-collinearity between independent variables.

Whatever the figures are but in case of available information, this empirical analysis would be of immense help for decision making. The same structure and exercise can be applied to any available data to reach specific results.

As stated earlier, these testing and analysis can be applied to any available data. The method and process of application is important and not the recency or authenticity of the data. If used in the demonstrated manner could facilitate managers in taking up decisions with more confidence and appropriateness. Decision making under this process should be taken as a compulsory exercise by the managers as without the knowledge of current financial position, any future projection regarding company's welfare will be the most difficult task.



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