CHAPTER - V :

PROFITABILITY AND GROWTH

I. NEED FOR EXPLORING THE RELATIONSHIP :

Rate of investment is one of the dominant factors affecting the business activities in any economy. Capital accumulation has long been considered to be a determinant factor in the growth process of the economy. Though the emphasis has now been shifted in favour of technological development, the rate of investment still is considered an important factor influencing economic growth. Moreover, technological development is simply an investment in knowledge.

However, the rate of investment in a particular industry is governed by the rate of profit prevailing in the same and other industries. This implies that there exists some relationship between profitability and growth of any industry.

The classical economists, as well as their famous critic, Karl Marx and even Prof. Marshall, all had separately developed the theories giving negative relationship between profitability and growth of the industries. As has been observed in Section V of Chapter III, all these writers formulated this

negative association on the basis of either of the following reasons viz., free competition among businessmen, their craze for capital accumulation, application of law of diminishing returns, rising organic composition of capital, principle of factor substitution through competitive forces etc. The negative relation thus formulated, received high popularity in those times due to their strong beliefs in free competition, leading to stationery state and static conditions. However, the economic history of many developed countries over last 200 years has proved that this fear of static state is baseless. The economic environment prevailing at the time of classicals or neoclassicals was entirely different from what it is in modern times. The World War Ist and the following periods have created lots of imperfections in economic system. This implies that a number of dynamic factors are at work in modern economic system. Hence, it becomes inevitable to re-examine the relationship between profitability and growth.

II. SOME GENERAL CONSIDERATIONS AND HYPOTHESIS ABOUT THE PROFITABILITY AND GROWTH RELATIONSHIP :

The orthodox neoclassical theories asserted that the growth of the firm was the outcome of profit maximizing function of the firm. Hence, firms would grow till they reached equilibrium, i.e. would have achieved maximum profits.

Having reached this stage, there would be left no incentive for the firms to grow and the relationship between profitability and growth would vanish. However, the character, strength and the nature of relationship is, in general, indeterminate, depending as it does, on the causes of disequilibrium and the speed of adjustment. However, since last three decades, some important developments in the functioning of the business activities have altered this view. Hence, the firm is viewed not merely as a profit maximising abstraction but as a unique administrative and social organisation, possessing the capacity for initiating its own biological growth.[1]

In a modern capitalist economy, the chief object of a typical firm is to increase its sales. This makes the expansion of the firm's productive capacity inevitable. Hence arises the need for investing in fixed assets and stock. This implies that a firm having an objective of expansion, i.e. growth, should give more importance to raising funds.

However, the level of investment undertaken by any firm depends on two basic factors, viz., the ability of the firm to grow and its willingness to grow.

The ability to grow or invest reflects in firm's ability

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1 Subrahmaniam, K.K. and Papola, T.S.: "Profitability and Growth of Firms: The Case of Indian Chemical Industry," in 'Anveshak', June 1971, pp.131-142.

to provide and acquire finance. The provision of finance can be made through internal as well as external sources.

The internal source of finance depends on the amount of retained profits and the depreciation fund. These, however, depend upon the level of realised rates of profit. In general, internal sources of funds are a preferred source of capital for financing investment though there is no iron clad rule about this. There are other sources of finance also (external sources), i.e. through borrowing bank loans etc. However, firms are reluctant to increase their debt or their outstanding issues of stock too rapidly. Hence C.L. Schultze comments, "And even when there are ample sources of funds available, firms will not invest if they do not foresee a profitable outcome to the venture. Nevertheless, this general preference for internal sources of funds does mean that an expanding level of profits is likely to be associated with an increase in investment, and vice-versa".[2] However, a word of caution is required here. Our study covers the growth of industry which is comprised of a number of companies. As has been observed, the companies covered in a particular industry may be involved in more than one activities and therefore they may create other small companies for their convenience. In such a situation high profits earned by parent company by its one

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2 Schultze, C.L. : National Income Analysis ,Foundations of Economic Series, Prentice-Hall of India Pvt.Ltd.,1976, p.92.

activity may reflect in high retained earnings but may not and necessarily be reinvested in the same company. Another important point to be remembered is that even though profits of any company in a particular year are high, they would not automatically generate a large increase in capital in the same year. Hence G.J. Stigler comments, "The main defect in this argument is that it views the surplus of earnings over dividends and interest payments as an end of year residual which increases the firms aggregate resources whether the firm wishes more capital or not. These earnings normally accrue over the year, not on December 31, and if the enterprise does not wish to increase (or decrease) dividends or investment commensurately, it can reduce its short term (or, to some extent, long term) liabilities.[3]

Hence, if the capital structure of a company is very rigid, thereby not allowing for any changes in debt position, and, if the capital markets prevailing in the economy also are very imperfect, then only the current profits would have a simple arithmetic effect upon total assets, otherwise it would be very weak.

However, it is generally accepted (remembering above constraints), that, the higher the profitability, higher will be the capacity to reinvest. Moreover, the second source of

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3 Stigler, G.J. : Capital and Rates of Return in Manufacturing Industries, A Study by the National Bureau of Economic Research, Princeton University Press, Princeton, New Jersey, 1963, pp.73-74.

finance, i.e. external source, also depends upon the level of achieved and prospective rates of return (profitability) of a firm. If realised rates of return can serve as a good indicator of prospective rates of return, which is true for Indian Manufacturing Industries (proved by Persistency of Profit Rates averaged over five year plans (see Section IX of Chapter III), then, the higher the profitability, brighter would be the prospects for attracting new potential investment through raising the borrowings as well as issuing new shares in the capital market. This implies that the level of achieved and prospective profitability determines the ability of a firm to grow and expand. Hence, Schultze comments, "Although expected profits are the major incentive for investment, current profits are an important source of funds out of which the firm finances its investment. Profits, therefore, play a dual role in the investment process as both an incentive and a source of funds."[4]

The second important factor that affects the growth of the firm is its willingness to grow. This factor does not depend much on profitability and is influenced by many other factors such as existence of competition, the state of demand, management's policy decisions regarding diversification, technological development etc. and, Government policies as

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4 Schultze, C.L.: op.cit., p.92.

in case of India etc. However, given the production technique and the internal efficiency, all these factors have contingent effect on profitability. Moreover, a feeling of adequate security that the management requires, as well as its reasonably fair attitude towards the share holders, also, dependsupon the relationship between the level of profitability and the maximum sustainable growth that a firm can attain. Hence Penrose argues, "It seems reasonable therefore, to assume that in general the financial and investment decisions of firms are controlled by a desire to increase long run profits.... firms will want to expand as fast as they can take advantage of opportunities for expansion that they consider profitable. This assumption has an interesting implication for the relation between the desire to grow and the desire to make profits. If the profits are a condition of successful growth but profits are sought primarily for the sake of the firm that is, to reinvest in the firm rather than to reimburse owners for the use of their capital or their risk bearing then, from the point of view of the investment policy growth of profits becomes equivalent as the criteria for the selection of investment programmes."[5]

One important point to be noticed here is that the willingness of a firm to grow may differ from industry to

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5 Penrose, E.T. : 'The Theory of the Growth of the Firm'. Basil Blackwell, Oxford, 1972), Chapter I.

industry, from period to period and from size to size. However, given the ability to grow, the rationality on the part of entrepreneur in an expanding economy like ours, assumes that business decisions would be growth oriented. This in turn implies that given the ability to grow, the firms in an expanding economy would also be willing to grow thereby resulting in the growth of the industry also. Hence, Hart comments, "This rate of return provides one source of further increases in capital stock and has some similarity with the harvest of corn in traditional capital theory which provides seed for next year's crop."[6]

Stigler, by adding to these possible reasons argues, "In an empirical study, therefore, we should not expect to find a high correlation between investment in year t and the realized rate of return in year t. If the anticipations were perfect and complete competitive adjustment could be made within a year (or other time period under study), the correlation would be zero. If anti-cipations were correct, but technological or other barriers prevented complete adjustment to the long-run competitive level, investment would be positively correlated with rate of return."[7] However, in the

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6 Hart, P.E. : Studies in Profit, Business Saving and Investment in the United Kingdom, 1920-62, Vol.II, George Allen & Unwin Ltd., London, 1968, p.223.

7 Stigler, G.J.: op.cit., p.73.

world of imperfection and under the dynamic situations, perfect anticipations as well as perfect competitive adjustments are very difficult to attain. Considering these views, we feel that in a developing economy the policies adopted would be growth oriented. However, in a mixed economy like India, the growth of the industries is affected by the government policies regarding Five Year Plans, Industrial and Licensing Policies etc. Though the Government policies also weigh profitability as an indicator of financial performance of firms, it has to consider other important factors like priority areas etc. while framing the policies. On above mentioned grounds we pastulate a hypothesis that, a positive correlation exists between profitability and growth of an industry in developing country like India. However, it would be difficult on a priori basis to predict the nature of this relationship precisely.

III CONCEPTS :

(A) Growth Rate :

The growth of an industry can be measured in terms of employment, sales, output, turnover or capital. However, as far as this study is concerned, we have chosen capital as the concept for growth. This is so, because, in an expansion of an industry it is the addition to capital that is affected

by the earning power of the firms in the industry.[8] The additions to capital are available in financial terms. However, it is the physical assets which measure the productive capacity of the industry. It is the latter concept, real growth of the industry, that is more important from the national point of view. This is so because, this concept enables the government authorities to trace and foster the growth of those industries which are important from national point of view, and, to utilize the scarce resources more efficiently. Hence, Parker holds, "But from a national point of view it is desirable that growth in productive capacity should be fostered where it is most needed and where the use of sacrce resources is at its most efficient."[9] Comsidering this view, we have measured the growth of capital in real terms.

This implies that our definition of growth of industry relates to the growth of physical assets. The non-availability of data on physical assets and, the difficulties involved in aggregating them even if data are available, has led us to use the value concept of physical assets for this purpose.

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8 See for example : (i) Stigler, G.J. Ibid. (ii) Singh, A. and Whittington G.: Growth Profitability and Valuation, A Study of U.K.Quoted companies', Cambridge Univ.Press, Cambridge, 1968. (iii) Hart, P.E.: op.cit. (iv) Mayer, J. and Kuh, E.: Investment Decisions", H.U.P. Cambridge, Mass., 1958.

9 Parker, J.E.S. : Profitability and Growth of British Industrial Firms. Manchester School of Economics & Social Studies, May, 1964, p.40.

The value concept of capital assets enables us to aggregate different types of capital assets (e.g. plant, machinery, buildings, etc.) As has been discussed in Chapter IV and presented in Table 4.5 and 4.6, it is possible to formulate the capital series (value of physical assets) on consistent basis by adjusting the price variations overtime. The value measure of capital is further preferred because it incorporates the changes in quality of capital indirectly. An assumption, that higher quality capital assets are relatively costlier than the lower ones, is incorporated in value measure of capital[10] (when expressed at constant prices). Considering all these points we have defined growth in terms of value of capital expressed at constant (1950-51) prices. We have estimated the growth rates for each of the 21 manufacturing industries over the whole period under study. Hence, growth rate for every industry is calculated by taking yearly changes[11] in value of capital and re expressed in percentage terms. In short, yearly growth rates for each of 21 industries as well as for each of the sectors mentioned earlier are thus worked out and are presented in Table 5.1. These are then related to profit rates of respective industries over time.

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10 Hart, P.E.: op.cit., pp.223-224.

11 See Stigler, G.J., op. cit., Mayer, J. and Kuh, E.: Investment Decision, H.U.P. Cambridge, Mass., 1958.

TABLE 5.1 : Yearly Rate of Growth of Physical Assets at Constant (1950-51) Prices (Per cent per annum): By Industry

Industry	1951-1952	1952-1953	1953-1954
CONSUMERS GOODS SECTOR			
1. Grains & Pulses	1.1	-5.9	11.9
2. Edible Vegetable & Hydrogenated Oils	-4.8	5.1	-1.7
3. Sugar	11.8	11.4	-12.4
4. Tobacco	6.1	4.2	-11.0
5. Cotton Textiles	1.5	5.1	0.7
6. Silk-Rayon & Woollen Textiles	15.7	12.4	9.3
7. Medicines & Pharmaceutical Preparations	3.9	8.2	2.7
8. Matches	12.1	9.5	3.5
9. Pottery China Earthernware & Structural Clay.	-0.7	11.3	2.5
10. Paper & Paper Products	5.4	10.5	1.9
Total	3.1	6.6	-0.7
BASIC GOODS SECTORS			
11. Iron & Steel	1.8	7.8	4.3
12. Aluminium	8.4	19.0	4.5
13. Basic Industrial Chemicals	0.6	13.6	-0.2
14. Cement	2.5	12.5	2.2
Total	2.1	10.0	3.3
CAPITAL GOODS SECTOR			
15. Transport Equipment	4.6	13.4	9.9
16. Electrical Machinery, Apparatus & Appliances	6.0	36.6	-13.0
17. Machinery (Other than Transport etc.)	7.9	13.8	6.8
18. Ferrous/Non-Ferrous Metal Products.	5.7	-9.1	1.5
Total	6.9	15.5	4.5
INTERMEDIARY GOODS SECTOR			
19. Jute Textiles	4.0	-3.2	0.8
20. Other Chemical Products	30.7	5.1	-2.7
21. Rubber & Rubber Products	18.0	18.9	-4.5
Total	4.9	-2.0	0.4
WHOLE MANUFACTURING SECTOR	3.5	6.3	0.6

Table 5.1 (contd.)

Industry	1954-1955	1955-1956	1956-1957	1957-1958	1958-1959	1959-1960
CONSUMERS GOODS SECTOR						
1.	0.0	18.4	9.6	4.3	-3.1	5.0
2.	-1.4	11.3	0.8	-.6	7.7	3.4
3.	13.7	33.9	9.4	3.9	-1.5	5.1
4.	-5.1	202.8	0.5	4.2	6.7	-4.3
5.	1.9	7.9	6.7	4.7	0.3	0.5
6.	10.1	24.3	19.8	7.1	2.2	4.0
7.	3.7	13.2	3.0	7.2	9.5	7.3
8.	3.5	-1.1	1.4	9.0	4.6	1.0
9.	5.4	29.7	13.7	8.7	6.9	3.4
10.	7.2	21.7	7.2	17.6	10.0	4.8
Total	3.6	14.7	7.3	5.4	1.2	1.6
BASIC GOODS SECTORS						
11.	6.1	11.0	17.2	33.6	15.8	5.1
12.	8.2	17.5	5.5	24.6	11.5	7.0
13.	2.8	-5.9	5.9	11.1	24.6	13.1
14.	3.3	18.0	11.9	16.3	11.6	2.0
Total	5.2	11.4	14.3	27.0	15.2	5.0
CAPITAL GOODS SECTOR						
15.	13.5	155.6	39.3	4.8	2.5	4.5
16.	11.6	57.2	12.5	7.5	12.5	10.7
17.	7.8	1.9	10.1	17.0	9.2	8.5
18.	13.1	-1.0	7.1	1.2	10.2	6.3
Total	9.5	40.9	21.6	10.2	6.8	7.1
INTERMEDIARY GOODS SECTOR						
19.	-0.9	10.7	1.5	-40.8	71.0	-0.8
20.	9.9	171.1	16.7	11.6	2.3	7.7
21.	7.6	5.9	6.9	8.1	15.8	4.7
Total	-0.3	13.0	2.4	-35.7	60.3	0.0
WHOLE MANUFACTURING SECTOR						
	3.7	16.0	9.3	4.3	10.3	2.9

Table 5.1 (contd.)

Industry	1960-1961	1961-1962	1962-1963	1963-1964	1964-1965	1965-1966	1966-1967	1967-1968	1968-1969
CONSUMERS GOODS SECTOR									
1.	-29.1	-1.6	6.5	2.0	-6.0	7.1	-5.3	7.9	4.3
2.	16.2	3.8	1.1	1.8	1.7	-17.0	6.0	-0.2	7.2
3.	20.1	11.1	-7.2	-10.8	6.9	-3.8	8.5	-9.1	8.1
4.	-3.1	10.3	10.3	-0.5	-6.1	-2.2	5.2	15.8	7.2
5.	14.5	5.1	6.3	4.8	4.9	-11.8	1.1	6.7	2.6
6.	21.8	25.1	16.3	9.4	6.6	48.1	5.9	9.1	4.0
7.	160.1	17.5	12.2	11.8	5.5	51.6	8.6	11.6	5.1
8.	-0.4	0.4	6.5	2.7	-3.4	3.6	-2.4	9.7	2.4
9.	26.5	7.2	7.6	6.1	-0.3	43.3	-5.6	3.4	2.4
10.	15.3	7.8	12.6	18.1	7.1	17.9	5.9	4.9	3.8
Total	16.2	7.3	5.3	3.9	4.9	-2.1	3.1	5.1	3.7
BASIC GOODS SECTOR									
11.	2.8	2.0	2.1	1.7	0.4	2.2	5.3	3.8	-0.1
12.	-7.6	34.6	9.7	9.1	7.9	91.5	19.7	8.1	7.6
13.	68.1	25.2	22.1	13.8	9.8	21.9	16.9	13.1	11.9
14.	4.8	5.4	6.0	8.2	4.3	3.8	3.6	12.1	7.2
Total	7.8	6.7	6.1	5.4	3.3	10.9	8.6	7.9	4.9
CAPITAL GOODS SECTOR									
15.	28.6	15.5	9.6	20.1	9.2	16.1	15.8	5.9	0.3
16.	81.1	13.9	11.2	15.5	11.5	57.0	14.4	11.0	-0.9
17.	-32.9	14.7	20.4	8.3	8.6	29.5	9.7	11.5	0.1
18.	1278.3	8.7	16.8	5.3	5.1	31.7	10.3	7.0	0.8
Total	28.6	13.8	13.8	13.6	8.8	29.3	13.1	8.5	-0.1
INTERMEDIARY GOODS SECTOR									
19.	-1.9	2.7	9.1	5.1	0.8	-24.3	2.4	-0.1	1.9
20.	3.1	11.4	5.5	6.1	7.1	183.9	4.8	10.7	10.1
21.	29.9	19.2	10.9	2.6	3.7	35.3	7.2	5.5	10.2
Total	0.7	4.7	9.1	4.9	1.5	-5.4	3.6	2.7	4.9
WHOLE MANUFACTURING SECTOR									
	13.7	7.8	7.1	5.8	4.8	5.9	6.6	6.3	3.3

Table 5.1 (contd.)

Industry	1969-1970	1970-1971	1971-1972	1972-1973	1973-1974	1974-1975
CONSUMERS GOODS SECTOR						
1.	5.5	-8.6	0.9	-1.9	-2.4	8.2
2.	7.0	-18.1	4.5	2.7	-2.9	6.0
3.	16.5	15.3	-4.2	-11.5	6.6	-0.2
4.	4.1	6.4	26.0	2.8	-8.6	4.0
5.	0.7	-3.8	4.0	3.8	2.0	2.5
6.	6.9	-7.8	5.9	7.9	7.6	18.5
7.	3.5	18.0	9.8	7.3	-1.9	6.0
8.	0.6	NA	NA	NA	NA	NA
9.	2.2	-8.8	-7.6	5.7	4.2	3.9
10.	2.6	5.7	5.7	6.4	3.7	6.6
Total	3.6	-0.7	3.9	2.6	2.7	4.7
BASIC GOODS SECTOR						
11.	0.9	3.5	3.4	2.9	3.6	1.1
12.	10.5	2.3	5.5	7.0	-3.2	4.9
13.	8.5	61.2	8.4	6.1	4.2	8.0
14.	4.3	6.3	2.6	2.0	-0.3	1.2
Total	4.5	18.7	5.2	4.3	2.5	4.0
CAPITAL GOODS SECTOR						
15.	3.7	-3.5	7.2	4.3	2.1	7.3
16.	0.1	27.8	7.0	2.3	0.4	10.0
17.	1.1	31.8	10.1	2.4	-0.2	7.8
18.	0.4	-11.2	10.6	3.9	1.9	7.9
Total	1.7	10.8	8.4	3.2	1.0	8.2
INTERMEDIARY GOODS SECTOR						
19.	3.8	4.8	2.8	0.5	1.7	0.8
20.	0.8	22.4	8.0	12.4	0.0	15.8
21.	8.5	8.1	21.2	5.9	-3.7	13.5
Total	4.0	8.9	7.3	4.3	0.2	6.9
WHOLE MANUFACTURING SECTOR						
	3.4	7.5	5.6	3.4	2.0	5.5

Source : Tables: 4.5 and 4.6

Note: NA= Not Available.

The relationship between rate of growth of capital and rate of profit is also examined for inter-industry variations in growth of capital and rate of profit. For this, continuously compounded rate of growth of capital and average rate of profit are calculated, so as to get the cross-section or inter-industry variations for each plan period, sub-period and the whole period under examination. With the help of the above inter-industry analysis, we will be in a position to compare our time series results with those of inter-industry results.

The whole economic system and mainly the industries in India are influenced by policies adopted in five year plans, as well as the Industrial Policy Resolutions. Considering this, the whole period under study has been divided plan-wise viz., First Plan period : 1951-52 to 1955-56, Second Plan Period : 1956-57 to 1960-61; Third Plan period: 1961-62 to 1965-66; Annual Plan period (1966-67 to 1968-69); Fourth Plan period: 1969-70 to 1973-74. However, following other studies, we have divided the whole period from 1950-51 to 1973-74 into two sub periods also viz., 1950-51 to 1960-61 being termed as Ist sub period and 1961-62 to 1973-74 being termed as IInd sub period. The reason for dividing the period like this is the industrial progress in India which took momentum from the beginning of Third Five Year Plan.

Having determined about the relevant periods, we have estimated the growth rates for each of the above mentioned periods for each industry in the following way.

As has been observed earlier we have estimated the growth rate of capital using continuous compounding formula. In other words, we have regressed value of capital (see Chapter IV, Table 4.5 and 4.6, pp. 212-219) on time over the above mentioned periods. The growth rate formula for continuous compounding is expressed as follows :

$$K = ae^{gt}$$

where K is the total value of capital (at constant prices)

g is the growth rate

t the time factor,

a is constant and e is the base of natural logarithm.

This formula can be used in logarithmic form for simple regression purposes, as

$$\text{Log}_e K = \log_e a + gt.$$

When we regress this, we get the value for regression coefficient g, i.e. growth rate. Thus by applying the continuous compounding formula for estimating growth rates over relevant time periods, we can estimate the rate of growth through regressing $\log_e K$ on time. The regression coefficient 'g' gives us the rate of growth of capital stock over the relevant period. The continuously compounded growth rates

over relevant periods for each industry are presented in Table 5.2.

(B) Profit Rate :

The two concepts of profit rate defined in Chapter II, viz., gross profit rate and net profit rate each separately have been taken for explaining growth of industries over time. However, in case of cross-section analysis the profit rates are simply averaged over the relevant time periods. In other words, for plan-wise relationship between profitability and growth, the profit rates are averaged over 5 years (over Ist, IInd, IIIrd and IVth plan years' period) or 3 years (Annual plan period).

IV. THEORETICAL RELATIONS :

Our discussion on the general considerations about growth profitability relationship has led us to postulate a positive association between growth and profitability. Thus we intend to examine whether the rate of profit has any influence on the growth of the industry. In other words, we intend to examine the extent of explanation of growth of the industry provided through its profitability.

On the basis of the arguments forwarded earlier, we postulate that rate of profit affects the growth of the industry positively. Having formulated this hypothesis,

TABLE 5.2 : Growth of Physical Assets (at 1950-51 Prices) During Relevant Periods : By Industry

(Per cent per annum)

Ind. Sl. No.	Industry	Ist Plan 1951-52 to 1955-56	2nd Plan 1956-57 to 1960-61	3rd Plan 1961-62 to 1965-66	Annual 1966-67 to 1968-69	4th Plan 1969-70 to 1973-74	Sub-period I 1950-51 to 1960-61	Sub-period II 1961-62 to 1973-74	Whole period 1950-51 to 1973-74
1	2	3	4	5	6	7	8	9	10
1.	Grains & Pulses	5.6	-5.6	1.3	5.9	-2.6	3.4	0.8	0.1
2.	Edible Vegetables & Hydrogenated Oils	2.2	6.0	2.5	3.4	-2.0	3.1	-1.0	1.7
3.	Sugar	7.9	5.5	3.1	-0.9	-0.8	8.4	2.1	4.4
4.	Tobacco	22.8	0.8	-0.5	10.8	7.2	16.6	5.4	7.8
5.	Cotton Textiles	3.3	3.9	1.5	4.6	1.9	4.0	1.1	3.1
6.	Silk-Rayon & Woollen Textiles	12.2	7.1	15.5	6.3	3.9	11.5	8.6	11.5
7.	Medicines & Pharmaceutical Preparations.	6.1	25.3	15.2	8.0	7.9	10.5	11.5	15.7
9.	Pottery, China Earthern Ware and Structural Clay Products	9.7	9.4	10.4	2.8	-1.7	10.2	3.3	7.6
10.	Paper & Paper Products	8.6	10.4	12.7	4.2	5.4	9.9	7.0	9.1
11.	Iron & Steel	6.6	12.2	14.7	1.8	3.3	11.3	2.4	5.7
12.	Aluminium	10.4	8.1	19.7	7.5	3.5	10.4	13.7	13.1
13.	Basic Industrial Chemicals	2.1	22.8	14.6	11.8	14.5	8.4	15.4	31.2

cont...

Table 5.2 (contd.)

1	2	3	4	5	6	7	8	9	10
14.	Cement	7.3	7.8	5.6	9.2	2.5	9.0	5.3	6.7
15.	Transport & Equipment	27.9	8.2	12.9	2.7	3.1	23.5	6.8	14.0
16.	Electrical Machinery, Apparatus & Appliances	14.4	19.9	18.7	4.8	7.7	16.2	12.3	16.3
17.	Machinery (Other than Transport, etc.)	7.2	0.3	13.8	5.5	9.1	6.5	10.4	7.6
18.	Ferrous/Non-ferrous Metal products	2.0	57.4	11.6	3.8	2.2	15.6	5.9	22.1
19.	Jute Textiles	1.3	5.0	-2.1	0.9	2.2	0.5	-0.5	0.6
20.	Other Chemical Products	22.9	5.7	25.8	9.9	9.9	20.6	17.1	17.1
21.	Rubber & Rubber Products	5.4	12.5	10.0	6.5	8.3	8.4	9.7	10.4

Source: Table 4.5.

Notes: 1. Growth rate for each industry is estimated by using the formulae for continuously compound growth rate viz: $K_t = ae^{gt}$ where K is capital stock at constant prices; t is time, ; g is growth rate; e is base of natural logarithm.
This exponential function has then been reduced to log-log one as $\log_e K_t = \log_e a + gt \log_e e$ & the regression is fitted to find out the values of regression coefficient g i.e. growth rate.

2. $\text{Log}_e K = \log_{10} K \times \log_e 10$ where $\log_e 10 = 2.30258$.

3. For details, please see the text.

we have endeavoured to establish this relationship by extending the excersie to both time series and cross-section studies. Thus to examine the above hypothesis, the following relations have been considered.

1. In an expanding economy like ours, where there is no market constraint on the demand for final product, current rates of profit are expected to affect the current investment decisions. Moreover, the imperfectness in the capital market, the high cost of borrowed capital and the difficulties involved in acquiring it result in raising the opportunity cost of capital high, consequently making profits cheaper and easily approachable (internal) source of finance. Here, an existence of positive association between current rate of growth as well as profitability is assumed and the following model of equation (1) is fitted for individual industries over time as well as for cross section of industries over the relevant periods. The model being,

$$G_t = \alpha + \beta P_t + e \qquad \ldots\ (1)$$

1. Though current events play an important role in shaping the future expectations, these can not be based on pure imagination. Experiences of recent past are a good guide for future expectations and predictions. A firm, while undertaking new investment would always consider whether it would be sufficiently profitable in the future or not. A firm having

lower rates of profit with existing capital may wish to make larger investments if it expects excellent profitable opportunities to be made through an access to new production technique or raw material etc. On the other hand, a firm enjoying very large profits in the boom period may seem tobe unwilling to expand its capacity if it predicts an end to the boom conditions. Thus predictions about future profitability enable the firms to take decisions about current levels of investments. However, our examination of persistency of profit rates averaged over 5 years period (see Chapter III, Section IX, Table 3.7) has proved that profits have a tendency to persist over a small period i.e. in the near future only i.e. 5 years here, and hence past rates of profits can be taken as good reflectors of profit rates in the near future. This implies that past performance of the industry can be treated as guide for undertaking investments in the industry. Secondly, as has been pointed out earlier, retained earnings of the current year are normally utilized as internal source of finance for the next year, rather than for the same year. This implies that last year's retained profits go for this years investment. Hence, past profitability plays dual role in investment process. On one hand, it acts as a predictor of future prospects about profitability, and on the other as an internal source of finance for undertaking investment in

future. Considering these points we have taken one year time lag in profit rates and fitted equation (2), the moderl fitted is given below :

$$G_t = \alpha + \beta P_{t-1} + e \qquad \ldots (2)$$

However, we are aware of the fact that one year time lag is very small. In a mixed economy like India, where the economic activities are greatly affected by the government policies, the private industries also are no exceptions. Normally, there is a loss of at least two to three years for getting the work done with respect to licensing, expansion of the existing units etc. Moreover, the time required for ploughing back the profits varies from industry to industry as it depends upon the differences involved in gestation period. This implies that not only should the time lag be longer than 2-3 years, but it should be different for different industries e.g. a longer time lag is necessary in case of Iron & Steel Industry compared to Grains and Pulses. However, different time lags for different industries could have been made arbitrarily which could have been objectionable. Though, the growth: profitability relationship for each industry with different time lag in profit rates would have been more meaningful, our physical capacity to work, as well as the limitation of time, have forced us to confine our analysis to one year time lag in profit rate.

3. The (1)st and (2)nd equations deal with simple linear relationship between growth and profitability. However, it is possible that this relationship may be lag-log linear one. Hence the following equation (3) is fitted to meet the above requirement.[12]

$$\text{Log } G_t = \alpha + \beta \log P_t + e \qquad \ldots(3)$$

However, the limitation faced while fitting log-log model is that only positive values for growth and profit rates can be included in the observations. This implies that industry-wise relationship includes only those years for which both profitability and growth rates have positive signs. Similarly, a cross-section analysis for industries over relevant period also includes those industries for which both these rates are positive.

V. METHODOLOGY :

The above mentioned hypothesis about the relationship between profitability and growth are empirically tested for each of the 21 Indian Manufacturing industries[13] over 24 years' as well as for 21 industries for given points of time

12 Similar type of study has been undertaken by Singh, A. and Whittington, G. for U.K. Quoted Companies in their work. (See Singh, A. and Whittington, G.: op.cit., pp.148-158) However, their study relates to inter-company analysis while ours deals with inter-industry as well as industry-wise (over-time) analysis.

13 Since data on Match industry are not available for the whole period i.e. 25 years, and since the total amount of capital stock possessed by this industry is very small, we have omitted it from cross section analysis for relevant periods.

(averaged over the relevant period). The relationship (time series for every industry and cross-section of industries over relevant period) has been examined by means of regression analysis. Following models as mentioned above are fitted for both the time series analysis of industries.

1. $G_t = \alpha + \beta P_t + e_t$ ... (1)

2. $G_t = \alpha + \beta P_{t-1} + e_t$ ... (2)

3. $\text{Log}_{10} G_t = \alpha + \beta \log_{10} P_t + e_t$ ... (3)

Where G = yearly rate of growth

P = Gross or Net profit rates

t = years

α & β are the parameters, while e is the error term.

Equation (1) tests the hypothesis that growth rate in period t is a linear function of profitability in period t. In other words, it tests the hypothesis that current rate of growth is a linear function of current rate of profit. Equation (2) tests the hypothesis that growth rate of period t is a linear function of rate of profit of t-1 period. In other words, it tests the hypothesis that current rate of growth depends upon the rate of profit with one year time lag.

Equation (3) is a log-log relation i.e. log of rate of growth regressed on log of profit rate. It tests the hypothesis that a given proportionate change in rate of profit

is associated with a proportionate change in rate of growth.

The above mentioned models are also fitted to inter-industry analysis with following interpretations of the variables, viz., rate of growth and rate of profit (gross or net).

Rate of growth in case of cross-section analysis (for all the three models) refers to the continuously compounded rate of growth over relevant periods. Rate of profit refers to average of profit rates (gross or net, each separately) over relevant periods and t refers to relevant time period.

VI MAIN FINDINGS :

We discuss below the main findings of fitting the three relations discussed in Section V, 'METHODOLOGY' of this chapter. We discuss the results of 'Time Series Analysis' first and then proceed with the results of "Cross Section Analysis".

A. (i) Time Series Analysis : Relation 1

Equation (1) is fitted to analyse the industry-wise and sector-wise relationship between growth and profitability over time. The results of equation (1) are presented in Table 5.3 and are summarised below :

TABLE 5.3 : Growth : Profitability Regression Results : Time Series Analysis. (Relation 1)

Ind. Sl. No.	Industry	Growth & Gross Profit Rate			Growth & Net Profit Rate		
		α	β	R^2	α	β	R^2
1	2	3	4	5	6	7	8
1.	Grains & Pulses	1.186 (4.962)	.087 (.359)	.0027	1.100 (3.365)	.022 (.305)	.0002
2.	Edible Vegetables & Hydrogenated Oils	0.460 (2.993)	0.159 (.329)	.0105	0.664 (2.006)	0.157 (.194)	.0287
3.	Sugar	22.470 (9.407)	-1.930 (1.015)	(-).1412	-5.347 (5.706)	1.229 (.619)	.1519
4.	Tobacco	1.578 (46.176)	.746 (3.414)	.0021	8.511 (31.384)	.369 (3.733)	.0004
5.	Cotton Textiles	-.576 (3.025)	.447 (.358)	.0662	.868 (1.694)	.328 (.211)	.0991
6.	Silk-Rayon & Woollen Textiles	14.878* (5.285)	-.224 (.386)	(-.0152	16.529 (4.766)	-.430 (.411)	(-).0475
7.	Medicines & Pharmaceuticals Preparations	8.632 (16.257)	.508 (1.007)	.0114	7.559 (16.155)	2.005 (1.259)	.1034
8.	Matches	5.974 (4.331)	-.187 (.277)	(-).0260	1.152 (1.929)	.262 (.182)	.1087
9.	Pottery, China Earthernware & Structural Clay Products	12.274 (9.504)	-.528 (.940)	(-).0141	6.861 (5.360)	.031 (.619)	.0001
10.	Paper & Paper Products	11.710** (3.533)	-.291 (.334)	(-).0333	12.890** (2.978)	-.401 (.272)	(-).0898
11.	Consumers Goods Sector	4.327 (3.485)	.018 (.351)	.0122	2.384 (2.255)	.249 (.247)	.0443
11.	Iron & Steel	5.893 (4.145)	-.010 (.427)	(-).0000	1.786 (3.304)	.386 (.284)	.0775
12.	Aluminium	9.124 (9.930)	.423 (.969)	.0086	5.776 (7.680)	.718 (.652)	.0523

...cont.

Table 5.3 (contd.)

1	2	3	4	5	6	7	8
13.	Basic Industrial Chemicals	2.375 (8.970)	1.350 (.875)	.0977	5.040 (7.314)	1.016 (.649)	.1001
14.	Cement	4.766 (3.451)	.165 (.354)	.0098	2.933 (2.401)	.387 (.252)	.0966
	Basic Goods Sector	20.503** (6.527)	-1.228* (.637)	(-).1444	9.164 (6.932)	-.095 (.609)	(-).0011
15.	Transport Equipment	23.860 (20.959)	-.945 (2.498)	(-).0065	3.680 (15.774)	1.558 (1.779)	.0337
16.	Electrical Machinery, Apparatus & Appliances	2.069 (12.643)	1.281 (1.035)	.0651	-13.530 (13.881)	2.708* (1.186)	.1917*
17.	Machinery (Other than Transportation)	18.392 (11.582)	-1.088 (1.260)	(-).0328	15.689* (7.485)	-.779 (.779)	(-).0457
18.	Ferrous/Nonferrous Metal Products	25.650 (113.624)	3.565 (10.543)	.0043	31.180 (74.287)	3.850 (7.085)	.0132
	Capital Goods Sector	3.683 (8.834)	.864 (.906)	.0398	-.974 (4.219)	1.341 (.693)	.1456
19.	Jute Textiles	-.595 (6.584)	1.358 (.919)	.0903	1.382 (4.077)	.248 (.487)	.0117
20.	Other Chemical Products	24.531 (20.662)	-.071 (1.753)	(-).0001	19.319 (14.285)	.582 (1.336)	.0085
21.	Rubber & Rubber Products	34.072* (12.835)	-1.847* (1.009)	(-).1321	7.815 (7.473)	.253 (.612)	.0077
	Intermediary Goods Sector	-3.095 (9.512)	.829 (1.021)	.0291	-.337 (6.876)	.597 (.809)	.0242
	Whole Manufacturing Sector	5.630 (4.100)	.049 (.420)	.0006	3.708 (3.061)	.260 (.323)	.0287

Note to Table 5.3

Source : Tables 3.1, 3.2 and 5.1.

Notes : Regression equation = $G_t = \alpha + \beta P_t + e$ .... (1)

Where G_t = Yearly rate of growth of physical assets valued at constant (1950-51) prices.

P_t = Gross or Net Rate of Profit in year t

α & β are the parameters and e the error term.

1. Growth rate and Profit rates are in percentage terms.
2. Figures in brackets indicate the standard errors.
3. *, ** denote the 5% and 1% level of significance respectively.
4. t test is applied to α and β parameters.
5. F test is applied to R^2, with R^2 having following critical values.

Degree of freedom (df)	Level of significance 1%	5%
17	.331	.207
22	.265	.163

(a) Growth and Gross Profit Rate :

It can be noticed from Table 5.3 that growth-profitability relationship without any time lag in profitability shows no significant association for any of the industries over time when growth is related to gross profit rate. It can be observed from this Table that the value of R^2, the coefficient of determination, is very low for each of the 21 industries and is statistically non-significant.

Table 5.3 reveals the Sectoral relationship between growth and gross profit rate. It can be observed from this Table that equation (1) proves a "poor fit" when fitted to Sectors too.

(b) Growth and Net Profit Rate :

However, when growth rates are regressed on net profit rates fitting the same model (see Table 5.3), we observe a slight improvement in the value of R^2 for majority of the industries (particularly in case of Sugar, Electrical Machinery, Basic Industrial Chemicals, Medicines and Pharmaceuticals, and Matches). However, only in case of Electrical Machinery, Apparatus & Appliances is R^2 statistically significant with positive correlation coefficient, at 5% level, its value being .1917. It indicates that variations in net rate of profit explain variations in growth rates to the extent of 19.2% Over the period (1951-52 to 1974-75).

Further, β, the regression coefficient relating growth to profitability in the linear regression, assumes the value worth 2.708 for Electrical Machinery Industry. It implies that a one percentage point increase in the net profit rate of Electrical Machinery Industry, led, on an average, to 2.7 percentage point increase in its growth rate. In short, current rate of net profit in case of this industry has been found to be positively associated with the current rate of growth of the industry.

Table 5.3 also indicates the same linear regressions fitted to the Sector-wise data on growth and profitability. Similar type of results are derived. It can be seen from Table 5.3 that growth rates of sectors are not strongly associated with net profit rate implying thereby that equation(1) is unable to establish any relationship between these two variables.

One important point to be noticed further is that R^2 as well as β assume varying values for different industries over the same period. However, the results are significantly satisfying only for one industry. This leads us to say that a simple linear model without time lag in profit rate is not a good fit for establishing the relationship between real growth of the industry and its profitability over time. Same is true for sector-wise relationship.

A. (ii) Time Series Analysis : Relation 2

Since the equation (1) i.e. simple linear model without time lag, proved to be a poor fit, we attempted to explore the relationship by fitting equation (2) for each industry and sector over time. The results of equation (2) i.e. linear equation with one year time lag in profit rate, are briefed in Table 5.4. Following conclusions can be drawn.

(a) Growth and Gross Profit Rate :

Equation (2) is observed to be a good fit for only one industry i.e. Cement industry, when growth is regressed upon gross profit rate. This is obvious from the values of R^2, the coefficient of determination. The coefficient of correlation assumes significantly positive value indicating thereby that increase in past profitability of Cement industry over the said period resulted into the current real growth of the industry. The value of R^2 with one year time lag in gross profit rate is .2262 for Cement industry. This implies that variations in real growth of Cement industry are explained to the extent of 22.6% by variations on its gross profit rates with one year time lag, over the period.

Table 5.4 further reveals that equation (2) proves to be a poor fit when sectoral growth rate is regressed upon sectoral gross profit rate. The results are statistically found to be non significant.

TABLE 5.4 : Growth-Profitability Regression Results : Time Series Analysis. (Relation 2)

Ind. Sl. No.	Industry	Growth & Gross Profit Rate with one year log			Growth & Net Profit Rate with one year log		
		α	β	R^2	α	β	R^2
1	2	3	4	5	6	7	8
1.	Grains and Pulses	3.335 (4.933)	-.159 (.355)	(-).0090	1.148 (3.546)	.016 (.315)	.0001
2.	Edible Vegetables & Hydrogenated Oils	3.642 (2.841)	-.266 (.327)	(-).0292	2.666 (1.953)	-.161 (.200)	(-).0285
3.	Sugar	-5.099 (9.696)	1.146 (1.057)	.0507	-6.501 (5.821)	.1349* (.631)	.1722*
4.	Tobacco	20.421 (40.559)	-.681 (3.020)	(-).0002	-5.988 (30.565)	2.159 (3.623)	.0159
5.	Cotton Textiles	.886 (3.031)	.271 (.366)	.0242	1.797 (1.748)	.188 (.221)	.0319
6.	Silk-Rayon & Woollen Textiles	13.656* (5.158)	-.133 (.396)	(-).0051	15.357** (4.566)	-.389 (.403)	(-).0294
7.	Medicines & Pharmaceutical Preparations	20.431 (15.440)	-.305 (.978)	(-).0044	14.663 (16.177)	.125 (1.279)	.0004
8.	Matches	-3.205 (4.581)	.468 (.331)	.1051	1.364 (.617)	.259 (.169)	.1057
9.	Pottery, China Earthernware & Structural Clay Products	12.543 (9.199)	-.567 (.925)	(-).0168	5.900 (5.308)	.160 (.630)	.0029
10.	Paper & Paper Products	11.546* (5.197)	-.289 (.533)	(-).0132	13.049** (3.512)	-.438 (.344)	(-).0684
	Consumers Goods Sector	3.514 (3.535)	.106 (.368)	.0038	2.794 (2.322)	.208 (.264)	.0275
11.	Iron & Steel	-.725 (3.845)	.725 (.396)	.1323	-.388 (2.976)	.595* (.254)	.2004*

cont...

Table 5.4 (contd.)

1	2	3	4	5	6	7	8
12.	Aluminium	-.5034 (9.904)	1.889 (.962)	.1493	9.740 (8.712)	.314 (.777)	.0084
13.	Basic Industrial Chemicals	4.903 (9.336)	1.157 (.975)	.0601	11.575 (7.716)	.394 (.744)	.0126
14.	Cement	-2.186 (3.471)	.884* (.348)	.2262*	.072 (2.843)	.677* (.293)	.1963*
	Basic Goods Sector	3.625 (6.492)	.452 (.643)	.0219	-.403 (6.549)	.773 (.585)	.0746
15.	Transport & Equipment	30.269 (17.815)	-.1.838 (2.184)	(-).0312	22.265 (14.899)	-.755 (1.704)	(-).0088
16.	Electrical Machinery, Apparatus & Appliances	.235 (11.966)	1.479 (.998)	.0908	3.480 (14.811)	1.200 (1.277)	.0386
17.	Machinery (Other than Transportation)	1.648 (11.319)	.790 (1.258)	.0176	2.554 (7.231)	.687 (.773)	.0345
18.	Ferrous/Nonferrous Metal Products.	-30.007 (109.291)	9.770 (10.517)	.0377	-10.623 (71.272)	9.792 (6.878)	.0844
	Capital Goods Sector	9.250 (8.300)	.288 (.873)	.0049	6.357 (6.695)	.596 (.688)	.0331
19.	Jute Textiles	-4.484 (6.736)	1.114 (.944)	.0596	1.634 (4.077)	.177 (.491)	.0059
20.	Other ChemicalProducts	42.007* (19.338)	-1.877 (1.724)	(-).0511	12.582 (13.448)	1.558 (1.299)	(-).0613
21.	Rubber & Rubber Products	.493 (12.922)	.818 (1.014)	.0287	8.877 (7.340)	.163 (.599)	.0034
	Intermediary goods sector	-1.455 (10.405)	.650 (1.145)	.0144	.226 (7.021)	.537 (.851)	.0178
	Whole Manufacturing Sector	6.398 (4.393)	-.032 (.465)	(-).0002	3.652 (3.314)	.272 (.360)	.0254

Notes to Table 5.4

Source : Tables 3.1, 3.2 and 5.1.

Notes: Regression Equation: $G_t = \alpha + \beta P_{t-1} + e_t$ where G_t = Rate of Growth of Physical Assets at Constant Prices in t^{th} year. P_{t-1} = Gross or Net Profit rate in t-1 year. α & β are parameters and e the error term.

1. Growth rate and profit rates are in percentage terms.
2. Figures in brackets indicate the standard errors.
3. *, ** denote the 5% and 1% level of significance respectively.
4. t test is applied to α & β parameters.
5. F test is applied to R^2, with R^2 having following critical values :

df	Level of significance	
	1%	5%
16	.348	.219
21	.276	.171

(b) Growth and Net Profit Rate :

It is observed from Table 5.4 that regression results for equation (2) show slight improvement in the sense that the (2nd) model is capable of exploring the growth: profitability relationship in case of 3 industries (results are statistically significant at 5% level) when growth is regressed upon net profit rate with one year time lag. Table 5.4 reveals that growth is positively related to net profit rate over the period under study in case of 3 industries viz., Sugar, Iron & Steel and Cement. This is indicated by positive sign for coefficient of correlation. Variations in real growth of Sugar, Iron & Steel and Cement industries are explained by variations in net profit rates (with one year time lag) to the extent of 17%, 20% and 19.6% respectively. B, the linear regression coefficient also varies significantly for these industries and assumes values worth 1.349, .595 and .677 for Sugar, Iron & Steel and Cement industries respectively.

A further look into Table 5.4 indicates that equation (2) is unable to explain growth : profitability (net profit rate) relationship for different manufacturing sectors and the values of R^2 are statistically non-significant.

A. (iii) Time Series Analysis : Relation 3.

In short, the explanation of growth:profitability

relationship through simple linear models with or without lag has not proved to be satisfactory. Out of 21 manufacturing industries, the relationship is significantly proved only in case of 3 industries visz., Sugar, Iron & Steel and Cement, all having positive association between growth and profitability. To explore the relationship further, we have fitted log-log model as presented in equation (3). The results are summarised in Table 5.5.

(a) Growth and Gross Profit Rate :

It is obvious from Table 5.5 that the growth profitability relationship is not better explored even with the fitting of log-log equation (3) for gross profit rate. It is observed that there exists significantly positive association between these two variables only in case of one industry, i.e. Machinery (Other than Transport, etc.), while the results are statistically non-significant for other industries.

The correlation coefficient assumes positive value with R^2 valueing .2068 for this industry. It implies that 21% variations in log values of real growth of Machinery (Other than Transport, etc.) Industry are explained by variations in log values of gross profit rate.

TABLE 5.5 : Growth : Profitability Regression Results : Time Series Analysis. (Relation 3)

Ind. Sl. No.	Industry	No. of Obser-vations	Log of Growth & Log of Gross Profit Rate			No. of obser-vation	Log of Growth & Log of Net Profit Rate		
			α	β	R^2		α	β	R^2
1	2	3	4	5	6	7	8	9	10
1.	Grains & Pulses	14	.025 (.685)	.628 (.630)	.0765	14	.493 (.326)	.236 (.353)	.0359
2.	Edible Vegetables & Hydrogenated Oils	16	.429 (.295)	.207 (.323)	.0271	14	.439 (.425)	.1.076* (.431)	.3413*
3.	Sugar	15	2.105** (.591)	-1.169 (.635)	(-).2068	15	1.533** (.078)	-.580** (.083)	(-).7936**
4.	Tobacco	16	1.191** (.389)	-.308 (.344)	(-).0541	16	-.050 (.766)	1.004 (.845)	.0916
5.	Cotton Textiles	22	-.063 (.494)	.574 (.529)	.0557	20	.122 (.174)	.427 (.206)	.1929
6.	Silk-Rayon & Woollen Textiles	23	1.145** (.263)	-.138 (.251)	(-).0141	23	1.096** (.162)	-.104 (.165)	(-).0185
7.	Medicines & Pharmaceutical Preparations	23	.304 (.372)	.591 (.330)	.1330	23	.168 (.326)	.778* (.313)	.2270*
8.	Matches	15	2.100 (1.110)	-1.401 (.965)	(-).1395	15	1.415 (.795)	-.919 (.788)	(-).0948
9.	Pottery, China Earthern ware & Structural Clay Products	19	.222 (.816)	.573 (.825)	.0276	19	.630* (.287)	.183 (.320)	.0189
10.	Paper & Paper Products	24 255	1.255** (.437)	-.399 (.441)	(-).0358	24	1.207** (.309)	-.354 (.312)	(-).0552
11.	Iron & Steel	23	.595 (.427)	-.036 (.453)	(-).0003	22	.053 (.443)	.514 (.434)	.0656
12.	Aluminium	22	.784* (.279)	.242 (.294)	.0328	20	1.195** (.344)	-.153 (.331)	(-).0118

...cont.

Table 5.5 (contd.)

1	2	3	4	5	6	7	8	9	10
13.	Basic Industrial Chemicals	22	.356 (.480)	.723 (.470)	.1059	22	-.116 (.232)	1.220** (.234)	.5767**
14.	Cement	23	-.050 (.467)	.785 (.479)	.1135	22	.493 (.527)	.253 (.540)	.0109
15.	Transport & Equipment	22	.980* (.378)	.010 (.428)	.00003	21	.500 (.381)	.552 (.417)	.0846
16.	Electrical Machinery, Apparatus & Appliances	22	-.927 (2.146)	1.762 (1.966)	.0386	22	-1.549 (1.276)	2.394 (1.196)	.1670
17.	Machinary (Other than Transportation)	22	1.303 (0.951)	2.316* (1.014)	.2068*	22	-1.167* (0.437)	2.226** (0.472)	.5263**
18.	Ferrous/Non-ferrous Metal Products	22	.306 (.414)	.557 (.422)	.0840	22	.161 (.826)	.814 (.472)	.0561
19.	Jute Textiles	16	.288 (.327)	.263 (.419)	.0292	12	.393 (.247)	.206 (.296)	.0462
20.	Other ChemicalProducts	20	1.960* (.732)	-.888 (.698)	(-).0855	19	1.808 (1.362)	-.792 (1.266)	(-).0225
21.	Rubber & Rubber Products	22	.860 (.801)	.119 (.727)	.0013	22	.691 (.416)	.286 (.392)	.0260

Notes to Table 5.5

Source : Tables 3.1, 3.2 and 5.1.

Notes : Regression Equations = $\text{Log}_{10} G_t = \alpha + \beta \log_{10} P_t + e$

where $\log_{10} G_t$ = log of yearly rate of growth of physical assets valued at constant prices

$\log_{10} P_t$ = log of Gross Profit rate or Net Profit rate.

α & β are parameters and e is the error term.

1. Growth rate and Profit rate are in percentage terms.
2. Figures in brackets indicate the standard errors.
3. *, ** denote 5% and 1% level of significance respectively.
4. t test is applied to α & β parameters.
5. F test is applied to R^2, with R^2 having following critical values :

df	Level of significance 1%	5%
12	.437	.283
13	.430	.264
14	.388	.247
17	.331	.207
20	.288	.179
21	.276	.171
22	.265	.363

β, the regression coefficient assumes the value worth 2.316 which implies that an increase in gross profit rate by 1% led, on an average to 2.3% increase in its real growth rate. Thus, real growth of this industry can be said to be highly elastic to its gross profitability. This is so because β assumes value greater than unity which implies that the higher the profitability the more growth rises for any given rise in profitability. In other words, if we would plot this type of regression line, measuring growth on y axis and gross profit rate on x axis, we would get an upward sloping curve of increasing steepness. If β assumes value less than unity, it implies that growth does not increase so much in response to a change in profitability. However, this equation (equation 3) also has proved to be inadequate for explaining the industry-wise growth : profitability relationship with respect to gross profit rate over the time under study.

(b) Growth and Net Profit Rate :

However, as observed in earlier two models, when growth is regressed upon net profit rate, the log-log model proves a better fit. It is obvious from the results briefed in Table 5.5. The log-log model of growth and net profit rate relationship is a good fit in case of 5 industries viz., Edible Vegetable & Hydrogenated Oils, Sugar, Machinery

Other than Transport etc., Basic Industrial Chemicals, and Medicines and Pharmaceutical Preparations Industries, Out Machinery (Other than Transport etc.) & Basic Industrial Chemicals. Out of these five industries, four (except Sugar) indicate a strong positive correlationbetween real growth of the industries and net profit rates of respective industries (See Table 5.5).

β assumes negative value for Sugar Industry, β being -.586, indicates that proportionate change in growth rate of this industry is negatively related with proportionate change in its net profit rate overtime.[14]

The log-log model (with respect to net profit rate) is observed to be significant for Edible Veg. & Hydrogenated Oils and Medicines and Pharmaceutical Preparations at 5% level and Sugar, Machinery (Other than Transport etc.) and Basic Industrial Chemicals at 1% level.

B. (i) Cross Section Analysis : Relation 1

We have seen that time series analysis of industry and sector-wise growth profitability relationship indicated that these two do not seem to be associated over period for different industries and sectors. We now proceed to examine the hypothesis for cross section, also, with the help of the

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14 β, the regression coefficient in case of Sugar Industry assumes negative sign when log-log linear model is fitted . However, we have observed earlier that when equation (2) is fitted, taking one year lag in net profit rate, β, assumes significantly positive value (see Table 5.4). This might probably the result of dropping of negative observations in log-log model. Please see Sing, A. and Whittington, G. op.cit., p.158.

similar types of models fitted for the time series analysis in the earlier section. In other words, we want to examine that to what extent the growth of industry is influenced by the rate of profit when the latter is considered as gross and net. The rate of growth as per discussed earlier is taken as continuously compounded rate of growth of capital while profit rate has simply been averaged over the relevant periods (i.e. Ist, IInd, IIIrd, Annual, and IVth Plan periods and sub-period I(1950-51 to 1960-61) and II (1961-62 to 1973-74) and whole period (1950-51 to 1974-75).

So far as Relation 1 is concerned, subscript 't' given in the model discussed earlier[15] indicates the relevant time period (i.e. different plan and sub-periods). The results of fitting Relation (1) to data for cross-section of industries are presented in Table 5.6 and the findings are summarised below :

(a) Growth and Gross Profit Rate :

Table 5.6 reveals that Relation 1 (equation (1)) proved to be a 'poor fit' for the periods of Ist, IInd, IIIrd and IVth plans, while, it proved to be a 'good fit' for the period of Annual Plans (i.e. 1966-67 to 1968-69), thereby establishing strong positive association between growth and

15 The model of equation (1) fitted to time series data is as follows :

$$G_t = \alpha + \beta P_t + e \qquad \ldots\ldots(1)$$

TABLE 5.6 : Growth:Profitability Regression Results : Cross-Section of Industries. (Relation 1)

Period	Growth and Gross Profit Rate			Growth and Net Profit Rate		
	α	β	R^2	α	β	R^2
First Plan (1951-52 to 1955-56)	10.694* (3.643)	-.191 (.440)	(-).0104	10.861** (2.765)	-.233 (.327)	(-).0274
Second Plan (1956-57 to 1960-61)	19.165 (10.980)	-.823 (1.081)	(-).0312	16.486 (11.755)	-.561 (1.185)	(-).0123
Third Plan (1961-62 to 1965-66)	-1.194 (7.376)	1.017 (.631)	.1262	-11.043* (4.778)	2.166** (.469)	.5426**
Annual Plans (1966-67, 1967-68, 1968-69)	1.111 (1.672)	.418* (.147)	.3094*	2.458 (1.222)	.371** (.127)	.3205*
Fourth Plan (1969-70 to 1973-74)	-.503 (2.830)	.425 (.236)	.1533	-1.096 (2.111)	.568* (.203)	.3029*
Sub-Period I (1950-51 to 1960-61)	13.494** (4.395)	-.361 (.494)	(-).0293	12.975** (3.550)	-.326 (.417)	(-).0327
Sub-Period II (1961-62 to 1973-74)	-3.423 (3.820)	.930* (.331)	.3049*	-.5771* (2.536)	1.348** (.257)	.6048**
Whole period (1950-51 to 1973-74)	3.311 (6.400)	.706 (.631)	.0650	3.896 (3.179)	.720 (.356)	.1854

Source: Tables 3.1, 3.2 and 5.2.

Notes: Regression Equation = $G_t = \alpha + \beta P_t + e$. Where G_t = Rate of growth of capital at constant prices during relevant periods, i.e. Ist, IInd, IIIrd, Annual, IVth plan periods and sub-period I, II and whole period. For details please refer to the text.
P_t = Gross or Net Profit Rates over plan period or sub-periods.

1. Growth & Profit Rates are both measured in percentage terms. 2. Figures in Brackets indicate the standard errors. 3. *,** denote 5% and 1% level of significance respectively. 4. F test is applied to R^2, with R^2 having following critical values:

df	Level of signi. 1%	5%
18	.315	.197

5. 't' test is applied to parameters α and β.

profitability for Annual Plan Period. R^2, the coefficient of determination is observed to be around .3094, while, β, the regression coefficient assumes value around .418. The results are found to be statistically significant at 5% level. (See Table 5.6).

Similarly, when the same relation is fitted to Sub-period I (1950-51 to 1960-61), and the whole Period (1950-51 to 1974-75), the results are found to be statistically non-significant while in case of sub-period II (1961-62 to 1973-74) we observe a strong positive association between growth and gross profit rate. R^2 and β are observed to be having values around .3049 and .930 respectively. The results are statistically found to be significant at 5% level (See Table 5.6).

(b) Growth and Net Profit Rate :

Table 5.6 further reveals the results of the relationship between rate of growth and net profit rate for the same periods, when Relation 1 is fitted. It can be observed from Table 5.6 that equation (1) proved to be a 'poor fit' for the periods of Ist and IInd Five Year Plans (results are statistically non-significant) while it is found to be a 'good fit' for the periods of IIIrd, Annual and IVth Plans. However, the extent of explanation provided by net

profit rate differs widely. This is obvious from the values of R^2 being .5426, .3205 and .3029 for IIIrd, Annual and IVth Plan periods respectively. Similarly β, the regression coefficient also varies for the three periods, having values around 2.166, .371 and .568 for IIIrd, Annual and IVth Plan periods respectively. The results are found to be statistically significant at 1% level for the first two periods and at 5% level for IVth plan period.

Table 5.6 further reveals the results of relationship between growth and net profit rate when Relation 1 is fitted for Sub-period I (1950-51 to 1960-61), Sub-period II (1961-62 to 1973-74) and the Whole Period (1950-51 to 1974-75). It can be observed from Table 5.6 that equation (1) proved to be a 'good fit' for Sub-period II (1961-62 to 1973-74) only while for Sub-period I (1950-51 to 1960-61) and for the Whole Period (1950-51 to 1974-75) it proved to be a 'poor fit'. Hence, a strong positive association is established between growth and net profit rate for the period 1961-62 to 1973-74. R^2, the coefficient of determination, assumes value around .6048 while β is found to be 1.348. The results are statistically observed to be significant at 1% level (see Table 5.6).

In short, as far as the Indian Manufacturing Industries are concerned, we can trace a strong positive association

between growth and profitability from the beginning of IIIrd Plan onwards i.e. from 1961-62 onwards. Our conclusion gets confirmed as the results of fitting equation (1) to plan periods and subperiods are tallying.

B. (ii) Cross Section Analysis : Relation 2.

So far as Relation 2 (Equation -2) fitted in the time series analysis earlier[16] is concerned, where t-1 subscript indicated one year time lag, is now taken as one-period time lag so far as the present analysis is concerned. Thus, the rate of profit with t-1 indicates one plan or sub-period time lag while rate of growth indicates the continuously compounded rate of growth as discussed earlier. The relation is fitted taking different industries into account for both gross and net concepts of rate of profit.

(a) Growth and Gross Profit Rate :

The results of fitting equation, (2) in order to explore the relationship between growth and gross profit rate, are presented in Table 5.7 and the findings are briefed below :

Equation (2) has proved to be a 'poor fit' for all the Plan Periods, except, the Annual Plan Period (i.e. 1966-67 to

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16 The model of equation (2) fitted to time series data is as follows :

$$G_t = \alpha + \beta P_{t-1} + e \qquad \ldots(2)$$

TABLE 5.7 : Growth-Profitability (with one-period time lag) Regression Results : Cross Section of Industries (Relation 2)

Period	Growth & Gross Profit Rate			Growth and Net Profit Rate		
	α	β	R^2	α	β	R^2
II Plan Period 1956-57 to 1960-61	17.210* (6.244)	-.837 (.754)	(-).064	17.003* (4.619)	-.881 (.547)	(-).126
III Plan Period 1961-62 to 1965-66	8.420 (6.637)	.202 (.623)	.006	.186 (6.257)	1.064 (.631)	.137
Annual Plan Period 1966-67 to 1968-69	-2.366 (2.948)	.690* (.252)	.294*	2.035 (3.028)	.350 (.297)	.072
IV Plan Period 1969-70 to 1973-74	1.381 (2.581)	.278 (.227)	.077	-.948 (1.348)	.640** (.140)	.535**
Subperiod II 1961-62 to 1973-74	9.952* (4.088)	-.359 (.455)	(-).033	9.365* (3.274)	-.312 (.384)	(-).035

Source : Tables 3.1, 3.2 and 5.2.

Notes: Regression Equation= $G_t = \alpha + \beta P_{t-1} + e_t$

where G_t is continuously compounded rate of growth of capital at constant (1950-51) prices.

P_{t-1} = Gross or Net Profit Rate with one-period lag,

t refers to relevant periods i.e. Ist, IInd, IIIrd Annual, IVth Plan periods and sub-period I, II and whole period.

1. Growth and Profit rate are both measure in percentage terms.
2. Figures in brackets indicate standard errors.
3. *, ** denote 5% and 1%, level of significance respectively.
4. 't' test is applied to α & β
5. F test is applied to R^2 with R^2 having following critical values.

df	Level of significance	
	1%	5%
18	.315	.197

1968-69), for which results are statistically observed to be significant at 5% level, with R^2 and β having values around .294 and .690 respectively. This implies that there existed strong positive correlation between growth of industries during Annual Plan Period and the gross profit rate earned by the same industries during IIIrd Five Year Plan period.

As far as fitting of this relation for sub-period II is concerned, the results are found to be statistically non-significant proving equation (2) as a 'poor fit'.

(b) Growth and Net Profit Rate :

When equation (2) is fitted to explore the relationship between growth and net profit rate, it is observed Relation 2 proved a 'poor fit' for the periods of Ist, IInd, and IIIrd and Annual Plans, while it proved to be a 'good fit' for the IVth Plan period. R^2 and β are found to be around .535 and .640 respectively. The results are observed to be statistically significant at 1% level (See Table 5.7).

When equation (2) is fitted for subperiod II, it proved to be a 'poor fit' as the results are statistically found to be non-significant.

B. (iii) Cross Section Analysis : Relation 3.

So far as Relation 3 (Equation-3) is concerned,

subscript 't' given in the model discussed earlier for time series data[17], indicates the relevant time periods (i.e. different plan periods and sub-periods etc.)

(a) Growth and Gross Profit Rate :

Table 5.8 presents the regression results of log-log model (equation-3) of growth and profitability. It can be observed from the table that except for the period of Annual Plans, the results are found to be statistically non-significant when growth is regressed upon gross profit rate. As far as the fitted relation of Annual Plan Period is concerned, we observe that R^2 and β have values around .656 and 1.125 respectively. The results are statistically significant at 1% level.

However, when we come to the results of sub-period I, II and whole period, we observe from Table 5.8 that equation (3) proves a poor fit for sub-period I and whole Period. While, the results of fitting equation (3) are found to be statistically significant for Sub-period II. It canbe observed from Table 5.8 that R^2 and β assume values around .237 and 1.781 respectively when log of growth rate is regressed upon log of gross profit rate for sub-period II.

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17 The model of equation (3) fitted to time series data is as follows : $\log_{10} G_t = \alpha + \beta \log_{10} P_t + e$ ...(3)

TABLE 5.8 : Growth:profitability (log-log linear model)
Regression Results : Cross Section of Industries, (Relation 3)

Period	Log of Growth & Log of Gross Profit Rates			Log of Growth & Log of Net Profit Rate		
	α	β	R^2	α	β	R^2
Ist Plan Period						
1951-52 to	.789**	.055	.002	.517	.290	.044
1955-56	(.240)	(.286)		(.289)	(.337)	
IInd Plan Period						
1956-57 to	1.014	-.152	(-).0009	-.005	.918	.040
1960-61	(1.213)	(1.260)		(1.049)	(1.095)	
IIIrd PlanPeriod						
1961-62 to	-.660	1.533	.131	-1.184	2.139**	.340**
1965-66	(1.040)	(.989)		(.747)	(.746)	
Annual Plan Period						
1966-7 to	-.412	1.125**	.656**	.014	.798**	.759**
1968-69	(.198)	(.198)		(.105)	(.113)	
IVth Plan period						
1969-70 to	-.071	.726	.212	-.004	.701	.179
1973-74	(.368)	(.350)		(.426)	(.416)	
Sub-period I						
1950-51 to	.798	-.076	(-).0004	.874	-.009	(-).00002
1960-61	(.843)	(.921)		(.442)	(.503)	
Sub-period II						
1961-62 to	-1.102	1.781*	.237*	-2.143**	2.961**	.773**
1973-74	(.841)	(.799)		(.652)	(.660)	
Whole Period						
1950-51 to	-.268	1.074	.031	-.921	1.854	.177
1973-74	(1.396)	(1.407)		(.879)	(.942)	

Source: Tables 3.1, 3.2 and 5.2.

Notes: Regression Equation = $\text{Log}_{10} G_t = \alpha + \beta \log_{10} P_t + e_t$ where log G_t denotes log of rate of growth, compounded continuously for relevant periods (i.e. Ist, IInd, IIIrd, Annual & IV Plans, sub-period I, II and whole period); log P_t denotes log Gross or Net Profit Rate for the same relevant periods.
α & β are the parameters and e is the error term.

1. Figures in bracket indicate standard errors.
2. *,** denote 5% and 1% level of significance respectively.
3. t test is applied to α & β parameters.
4. F test is applied to R^2 , with R^2 having following critical values:

df	Level of significance	
	1%	5%
18	.315	.197

2 (b) Growth and Net Profit Rate :

Table 5.8 reveals the fitting of equation (3), relating log of growth rate to log of net profit rate for different industries. It can be observed from Table 5.8 that equation (3) proved to be a 'good fit' in case of the fitted relations for the periods of IIIrd and Annual Plans, while it proved to be a 'poor fit' for the periods of Ist and IInd and IVth Plans. It can further be observed from Table 5.8 that R^2 and β for the 'good fit' assumes values around .340 and .759, and 2.1 2.·3912.·798 respectively for IIIrd and Annual Plan periods. The results are statistically observed to be significant at 1% level

However, when we turn to the results for sub-periods we observe that equation (3) proved a 'good fit' for Sub-period II only while it proved to be a 'poor fit' for sub-period I and Whole Period. The fitted relation (3) of Sub-period II seem to be having R^2 and β around .773 and 2.961 respectively. The result are statistically found to be significant at 5% level.

Similar type of analysis has been undertaken by Singh, A. and Whittington G.[18] for U.K. Quoted Companies. However, their study relates to inter-firm analysis while ours relates to inter-industry analysis. Moreover, our concept of growth and its measurement differs from theirs. Singh, A. and

18 Singh, A. and Whittington, G.: op.cit., pp.148-158.

Whittington, G. in their study have measured growth by annually compounding the net assets of the firms (net assets are defined as total fixed assets plus current assets minus current liabilities). In other words, our concept of growth indicates real growth of the industry while theirs denotes monetary growth. Similarly the concept of profit rate used by them, Pre-Tax Rate of Return on Net Assets (Indicator 5) differs from our gross profit rate concept while our net profit rate concept tallies with their 'Post-Tax Rate of Return on Equity Assets (Indicator 6).

Moreover, the periods over which the growth and profit rates are averaged in their study, differ from ours. They have averaged the growth and profit rates over six or 12 years' period, the years for averaging being 1948-1954, 1954-1960 and 1948-1960 and have termed these periods as Sub-Period I, Sub-period II, and Whole Period respectively. However, we have considered the plan years for averaging growth and profit rate for the reasons explained earlier.

Inspite of these discrepencies, our results with respect to growth-profitability relationship tally to some extent with those derived by Singh, A. and Whittington, G. They have found that growth and profitability are positively associated with profitability explaining on an average about 50% of the variation of growth rates between firms.

A one percentage point increase in the firm's post-tax profitability on equity assets led on average to a .7 percentage point increase in its growth rate. The regression coefficient 'b', relating growth to profitability in the linear regression equation[19] varied significantly between industries and over time. The degree of explanation of growth (r^2) achieved in different industries and over different time periods, also varied to a considerable degree.

We have observed through our empirical findings the similar type of results for growth-profitability relationship at inter-industry level. We brief below the conclusions drawn from the regression results of time series and cross-section analysis.

VII. CONCLUSION :

So far as 'Time Series Analysis' of growth profitability relationship is concerned, we have found strong positive association in case of eight out of twenty-one industries, viz., Edible Vegetable and Hydrogenated Oils, Sugar, Medicines and Pharmaceutical Preparations, Iron and Steel, Basic Industrial Chemicals, Cement, Electrical Machinery, Apparatus and Appliances, Machinery (Other than Transport etc.).

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19 Singh, A. and Whittington, G. in their study have fitted models of our equations (1) and (3). The third one fitted by them is $G = a+b \log P+ e$. Instead of this we have fitted the equation with time lag i.e. our equation (2).

As far as Sugar industry is concerned, we have found that equation (2) indicates strong positive association between growth and net profit rate while log-log model (Equation-3) reveals strong negative association between the two. Hence, the results of the expected relation between growth and profit rate for 'Time series' are not very encouraging.

The log-log model has proved to be a better fit than the models of equation (1) and (2).

Growth Profitability relationship for different sectors could not be established.

Net profit rate has proved to be a better explanatory variable than gross profit rate while explaining the real growth of industries in India overtime.

In the case of Cross-section analysis, there existed a strong positive correlation between industry gross profit rates and real growth rates for the period of Annual Plans and sub-period II.

Similarly strong positive association among different industries is detected between real growth and net profitability for the periods of Third, Annual and Fourth Plans which coincides with the strong positive correlation of sub-period II. In other words, Indian Manufacturing Industries show positive correlation between growth and profitability for sub-period II i.e. 1961-62 to 1973-74.

Net profit rate explains growth variations better than the gross profit rate and hence is a better explanatory variable in growth process of the industries. Singh, A. and Whittington, G.[20] have also derived similar conclusion in their study.

The Ist and Second plans as well as sub-period I show a negative sign (statistically non-significant) for correlation coefficient. While sub-period Second and Third Annual and Fourth Plan Periods indicate strong positive correlation (statistically significant). This is as per our expectations because it was from the Third Plan period onwards that real expansion of manufacturing industries in India took place. The First and Second Plan period witnessed the beginning and establishment of majority of manufacturing industries. These manufacturing industries once having established could grow fast with the help of high levels of profitability in the latter period.

Moreover, the Indian Government, acknowledging the importance of speedy industrialisation, encouraged the industries through Second Plan and Industrial Policy Resolution of 1956, the results of which are reflected in the following period of expansion of the industries (i.e. 1961-62 onwards).

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20 Singh, A. and Whittington, G.: op.cit., p.158.
(b) The choice of indicators of profitability.

VIII.LIMITATIONS :

The fore-going analysis with respect to growth profitability relationship (Industry-wise overtime and Inter-industry) had been undertaken with the intention of exploring causal relationship between these two variables. Three different models which are applied had some limitations which have already been discussed. They may be briefed as follows :

Equation (1) relating growth to profitability, explains current growth rates with current profit rates assuming simple arithmetic relation between the two. However, the profits of current year are normally ploughed back in the industry in next year rather than in the current year and hence, the current year relationship happens to be weak. This is what has been observed in this study particularly in case of industry-wise regression analysis i.e. Time Series Analysis.

To avoid this limitation we tried to explore the relationship through taking one year time lag which as we have observed, is very short one. Moreover, due to the differences in the gestation period of different industries, the time lag involved in ploughing back profits also varies industry-wise. We have already mentioned earlier, that due to the arbitrariness involved in deciding the time lag, and trial

error method being physically beyond our reach, we stuck to one year time lag only. However, we sincerely feel that further exploration, applying different time lags for different industries would be more meaningful.

Thirdly, the growth profitability relationship has been examined through fitting and log-log model also. The results of this model (particularly industry-wise) also are misleading because the model is applied to restricted number of observations (as observations with negative values are dropped out).[21]

Since our intention is to examine growth profitability relationship, we have purposefully avoided to explain other factors influencing the growth of the industry through the regression model. Some of the other factors which affect the growth of the industry are retention ratio, liquidity ratio, gearing ratio, diversification, mergers, location etc.

While concluding we can say that due to limitations of time lag, we have not been able to give precise relationship between growth and profitability for each industry over time. However, we are happy to add at the same time that we have succeeded in establishing a close positive association between growth and profitability at inter-industry level from IIIrd Five Year Plan period (i.e. 1961-62 to 1973-74) and onwards.

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21 See Singh, A. and Whittington, G. : op.cit., p.158 for detail discussion on limitations of log-log model.