VI INVESTMENT BEHAVIOUR OF ALUMINIUM COMPANIES

In the last two Chapters, the profitability performance of aluminium producers and the incentive structure for the production of aluminium metal and semi-fabricated products were analysed. A related aspect is taken up for analysis in this Chapter, namely, investment behaviour of aluminium companies. The analysis is carried out for two major companies in the private sector, namely, HINDALCO and INDAL. Trends in investment are analysed first. This is followed by a more sophisticated analysis of investment behaviour based on investment functions.

Trends in Investment

Table 6.1 shows average annual rates of investment (at 1970-71 prices) of HINDALCO and INDAL for the periods 1965-69, 1970-77 and 1978-88.[1] As noted earlier, the Indian alumnium industry was brought under government control from 1970. It was under partial government control during 1970-77 and under much stricter government control during 1978-88.

Real rates of fixed and inventory investment shown in the table have been computed from company accounts data drawn from the Stock Exchange Official Directory, Bombay.[2] Gross fixed investment series has been derived from the gross fixed assets series (making adjustments for revaluation of assets), and it has been deflated by the wholesale price index for machinery and equipment.[3] A weighted average[4] of wholesale price indices of aluminium[5], bauxite, caustic soda, coal and mineral oil has been used to deflate the series on inventories, and from the deflated series so obtained, inventory investment has been worked out.

It is seen from Table 6.1 that in the five year period 1965 to 1969, HINDALCO's average annual rate of investment was Rs.764.6 lakh in

fixed assets and Rs.88.2 lakh in inventories. In this period, INDAL's average annual rate of investment was Rs.559.4 lakh in fixed assets. Thus, INDAL was investing relatively more in inventories. Considering fixed assets and inventories together, the average annual rates of investment of HINDALCO and INDAL were Rs.8.53 crore and Rs.7.03 crore, respectively. Corresponding figures for the period 1978-88 were Rs.4.06 crore for HINDALCO and Rs.3.05 crore for INDAL. Thus, compared to the period 1965-69, the rates of investment were much lower during 1978-88. This may be treated as an indication of the depressing effect of price and distribution control on investment activity in the aluminium industry.

The rate of investment of HINDALCO fell sharply in the period 1970-77 in relation to the period 1965-77 in relation to the period 1965-69. In the case of INDAL, the fall in the investment rate was relatively much smaller and there was a marginal increase in the rate of investment in fixed assets. This contrast between HINDALCO and INDAL may have an explanation in the differential profitability performance of the two companies. The average rate of profitability (net profits to net worth) of HINDALCO declined from 18.3 per cent during 1965-69 to 3.2 per cent during 1970-77. Retained profits per year came down from Rs.2.7 crore during 1965-69 to Rs.0.3 crore during 1970-77. Unlike the experience of HINDALCO, there was no marked deterioration in the profitability performance of INDAL after 1970. The average rate of profit during 1970-77 was 11.8 per cent as against 13.9 per cent during 1965-69. Also, retained profits per year was Rs.2.5 crore during 1970-77 as against Rs.1.5 crore during 1965-69. Another point to be noted in this connection is that HINDALCO substantially reduced its outstanding long-term debt between 1970 and 1977. By the end of 1969, deferred liabilities of HINDALCO stood at Rs.19.4 crore. This was reduced to Rs.0.5 crore by the end of 1977. In the next ten years, on the other hand, there was a large inflow of long-term debt, and deferred liabilities of the company stood at Rs.95.2 crore by the end of March 1989.

Investment Function Analysis

In empirical studies on investment behaviour, the use of the investment function methodology is quite common. A number of studies for Indian industries are available in which such analysis has been carried out. Mentionable among them is the study of Krishnamurthy and Sastry (1975) in which a systematic analysis of investment and financing decisions of Indian companies was undertaken for seven selected industries (cotton textiles, jute, sugar, paper and paper board, chemicals, engineering and cement), covering the decade 1960-70 for analysis of time series of cross-section of firms, and the period 1956-71 for time series analysis at the industry level.

For Indian aluminium companies, investment function has been estimated by Gupta (1987). He has estimated two equations, one for fixed investment and the other for inventory investment, using pooled time-series and cross-section data, for the period 1966 to 1974 for HINDALCO, INDAL and MALCO. Alternative specifications of the fixed and inventory investment functions have been tried and dummy variables have been used to allow the intercept vary across firms picking up thereby the influence of firm specific factors. The results of the study indicate that current profits and external finance are important determinants of fixed investment, while the demand factor is not found to be as important. As regards the determinants of inventory investment, the demand factor and external finance are found to be significant. The results also suggest that fixed and inventory investments compete for investment funds.

The specifications of the fixed and inventory investment functions used for the present analysis are similar to those used by Krishnamurty and Sastry (1975) for time-series analysis. The equations have been specified in the following way :

$$I_t = f [DS_t, DS_{t-1}, DS_{t-2}, DS_{t-3}, P_t, FD_t]$$

$IN_t = g [DS_t, DS_{t-1}, P_t, I_t, INS_{t-1}]$

Where,

I_t = gross fixed investment in year t,

DS_t = change in sales in year t,

P_t = profits net of taxes but gross of depreciation in year t,

FD_t = net flow of long-term debt in year t,

IN_t = inventory investment in year t, and

INS_{t-1} = stock of inventories at the end of period t-1.

The investment model used for the analysis is based on the flexible accelerator hypothesis with profits and external finance. For convenience of estimation, the equations are taken as linear. These are estimated by the OLS method using data for the period 1968 to 1988.[6]

All the variables listed above have been deflated to correct for price changes. The deflators used for fixed investment and inventory investment have already been described above. A weighted average of these two deflators has been used to deflated gross profits and flow of long-term debt in order to express them in terms of the purchasing power of investment goods.[7] The time series on sales has been deflated by the wholesale price index for aluminium and changes in sales (DSt, etc) have been computed from the deflated sales series.

Regression results for the fixed and inventory investment equation are presented in Tables 6.2 and 6.3 respectively. The equations have been estimated first for HINDALCO and INDAL separately and then by pooling data for the two companies. While estimating the equations from pooled data, a dummy variable, taking value unity for HINDALCO and zero for INDAL, has been introduced to pick up the influence of firm specific factors (as Gupta 1987, Krishnamurty-Sastry 1975, and many others have done).

It is seen from Table 6.2 that the estimates of the fixed investment function for HINDALCO and INDAL are similar. In both cases, the coefficients of the sales-change variables are statistically insignificant while the coefficient of the debt- flow variable (FD) is positive and statistically significant. The coefficient of the profit variable (P) has the correct sign, but it is not statistically significant. Applying the Chow test, it is found that the hypothesis that the coefficients of the fixed investment function do not differ between HINDALCO and INDAL is not rejected by the data. The computed F-ratio is 1.07 which is lower than the tabulated F-value of 2.36 at 95 per cent level of confidence. This provides some justification for pooling data for the two companies.

When the fixed investment equation is estimated from pooled data, the coefficients of both profit and debt-flow variables are found to be positive and statistically significant. The coefficients of the sales-change variables are positive, as expected, but these are not statistically significant. When the four sales- change variables are replaced by their average, the coefficient is again found to be positive but statistically insignificant.

The regression results presented in Table 6.2 indicate that profitability and inflow of long term debt are important determinants of fixed investment in the two aluminium companies under study. The demand factor is found to be relatively unimportant. These results accord well with the results reported by Gupta for aluminium companies for the period 1966-74.

Turning now to inventory investment, it is seen from Table 6.3 that equations obtained for HINDALCO and INDAL are similar. The coefficients of the sales-change variables are wrongly signed and statistically insignificant for both companies. The coefficient of the inventory-stock variable (INSt-1) is statistically significant for both companies, which implies that the stock of inventories adjusts to its desired level with a lag. The coefficient of the profit variable (P) is positive, but not statistically

significant. The coefficient of the fixed investment variable (I) is positive for both companies, but statistically significant only for HINDALCO.

The application of the Chow test to test for equality of coefficients yields the same result as obtained for the fixed investment equation. The computed F-ratio is 1.37 which is lower than the critical F-value of 2.42 at 95 per cent level of confidence. Thus, some justification is provided for pooling data for the two companies.

The results obtained from pooled data are not much different from those obtained for the companies separately. The coefficients of the current and one year lagged sales-change variables are negative and statistically insignificant. Replacing these two variables by their average makes little difference to the results. The coefficient of the profitability variable is positive, as one would expect, but it is not statistically significant. The coefficient of the fixed investment variable is positive and statistically significant, which indicates a complementary relationship between fixed and inventory investment.

The finding of a significant positive relationship between fixed and inventory investment is at variance with the results reported by Gupta (1987), who found an inverse relationship (fixed and inventory investment competing for investment funds). Also, Gupta found the demand factor important in determining inventory investment, while the results obtained for this study provide no such indication. The differences in the findings of the two studies may be due to differences in specification of investment functions and time-period covered.

The coefficient of the firm dummy variable is negative in the equation for fixed investment, and is both negative and statistically significant in the equation for inventory investment. From this, it may be inferred that given the values of the explanatory variables, the level of investment in HINDALCO is lower than that in INDAL.

Effect of Government Regulation

To study the effect of government regulation on investment behaviour, the fixed and inventory investment functions have been re-estimated with intercept and slope dummies for the period 1978-88 [8] during which there was strict government control on pricing and distribution of aluminium. The estimated regression equations are shown below. The figures in parentheses are t- values of the coefficients.

Fixed Investment

$$I = \text{Const} - \underset{(-1.1)}{0.45}\,AD + \underset{(1.6)}{0.72}\,(D^{*}\,AD) + \underset{(2.3)}{0.86}\,P - \underset{(-1.1)}{0.49}\,(D^{*}\,P)$$

$$+ \underset{(3.5)}{0.59}\,FD - \underset{(-1.7)}{0.37}\,(D^{*}\,FD) + \underset{(0.3)}{0.61}\,D - \underset{(-1.0)}{0.89}\,FIRM$$

$$n = 42 \qquad R^2 = 0.55$$

Inventory Investment

$$IN = \text{Const} - \underset{(-0.9)}{0.08}\,BD + \underset{(0.7)}{0.07}\,(D^{*}\,BD) + \underset{(1.3)}{0.18}\,P - \underset{(-0.7)}{0.12}\,(D^{*}\,P)$$

$$+ \underset{(2.3)}{0.18}\,I - \underset{(-4.0)}{0.48}\,INSL + \underset{(1.1)}{1.00}\,D - \underset{(-2.8)}{2.26}\,FIRM$$

$$n = 42 \qquad R^2 = 0.47$$

In these two equations, D is a dummy variable taking value unity for observations for the year 1978 to 1988 and zero otherwise, and (D* P), (D* FD), etc. are slope dummies. FIRM is a dummy variable taking value unity for HINDALCO and zero for INDAL. AD is the average of the four sales-change variables and BD is the average of current and one year lagged sales change variables. INSL denotes the stock of inventories with one year lag.

Comparing the two equations given above with the last equations of Tables 6.2 and 6.3, it would be realised that the inclusion of intercept and slope dummies for the period 1978-88 has not resulted in any large gain in the explanatory power of the model. It should also be noted that the coefficients of D and the slope dummies are not statistically significant at 5 per cent level. Yet, the signs of the slope dummies do show a pattern. It is seen that the slope dummy for the sales-change variables has a positive coefficient, while the slope dummy for the profitability variable has a negative coefficient in both fixed and inventory investment equations. Further the coefficient of the slope dummy for the debt-flow variable is negative. From this, it appears that, in the period 1978-88 (when government control on the aluminium industry became much stricter), investment became more responsive to changes in demand and less responsive to financial variables.

Table 6.1

Average Annual Rates of Investment (at 1970-71 Prices), HINDALCO and INDAL

(Rs. lakh)

	Gross Fixed Investment	Inventory Investment	Total Investment
HINDALCO			
1965-69	764.6	88.2	852.8
1970-77	180.6-	-16.1	164.5
1978-88	374.4	31.8	406.2
INDAL			
1965-69	559.4	143.8	703.2
1970-77	562.6	-29.8	532.8
1978-88	297.3	7.3	304.6

Table 6.2

Determinants of Fixed Investment : Regression Results HINDALCO and INDAL

Period : 1968 to 1988 Dependent variable : I_t

	HINDALCO	INDAL	Pooled	
			(1)	(2)
Explanatory Variables				
DS_t	-0.048	0.156	0.010	
	(-0.89)	(0.84)	(0.18)	
DS_{t-1}	0.034	0.151	0.046	0.122
	(0.64)	(0.71)	(0.73)	(0.72)
DS_{t-2}	0.040	0.128	0.064	4-year
	(0.72)	(0.73)	(1.02)	average
DS_{t-3}	0.032	0.019	0.027	
	(0.60)	(0.15)	(0.48)	
P_t	0.240	0.556	0.425*	0.420*
	(1.59)	(1.17)	(2.53)	(2.65)
FD_t	0.389**	0.465*	0.348**	0.358**
	(3.26)	(2.16)	(3.21)	(3.43)
Firm Dummy (HINDALCO)			-1.054	-1.007
		(-1.26)	(-1.25)	
n	21	21	42	42
R^2	0.585	0.486	0.468	0.457
R^2	0.407	0.266	0.359	0.399

t-values in parentheses.

* significant at 5 per cent level.

** significant at 1 per cent level.

Table 6.3

Determinants of Inventory Investment : Regression Results HINDALCO and INDAL

Period : 1968 to 1988 Dependent variable : IN_t

	HINDALCO	INDAL	Pooled	
			(1)	(2)
Explanatory Variables				
DS_t	-0.020 (-0.91)	-0.016 (-0.18)	-0.018 (-0.63)	-0.023 (-0.50)
DS_{t-1} -	0.012 (-0.55)	-0.007 (-0.08)	-0.006 (-0.20)	2-year average
P_t	0.329 (0.47)	0.082 (0.35)	0.065 (0.77)	0.061 (0.73)
I_t	0.351** (3.43)	0.147 (1.12)	0.185* (2.44)	0.187* (2.51)
INS_{t-1}	-0.683* (-4.17)	-0.426* (-2.16)	0.451** (-3.90)	-0.452** (-3.94)
Firm Dummy (HINDALCO)			-2.133** (-2.73)	-2.138** (-2.77)
n	21	21	42	42
R^2	0.609	0.407	0.435	0.433
R^2	0.478	0.209	0.338	0.354

t-values in parentheses.

* significant at 5 per cent level.

** significant at 1 per cent level.

NOTES

1. Each period includes both the initial and the terminal year.

2. Both companies have been consistently closing their accounts on 31st December. However, for 1988, accounts were closed on 31st March 1989 for 15-month period. Thus, to compute the annual rate of investment and other variables of interest, proportional adjustments have been made.

3. The price indices used for deflating fixed and inventory investment have been taken from Revised Index Number of Wholesale Prices in India (CSO).

4. The weights are based on the composition of inventories in terms of materials and finished and semi-finished goods, and the pattern of consumption of raw materials and fuels.

5. The price index for aluminium includes both metal and semi- fabricated products.

6. For constructing some of the variables, e.g., DSt-4 data for years prior to 1968 are used.

7. Krishnamurty and Sastry (1975) used a similar deflator.

8. This is equivalent to estimating the functions separtely for the periods 1965-77 and 1978-88.