FIXED INVESTMENT ANALYSIS IN ALUMINIUM INDUSTRY

Dr. S. L. Tulasi Devi
Assistant Professor, School of Management, NIT Warangal.
Dr. K Padma
Associate Professor, School of Management, NIT Warangal.
Sri R Mohan
Associate Professor, School of Management, NIT Warangal.

Abstract
This paper focuses attention on specific aspects of entrepreneurial decisions relating to investment, both in the total fixed investments and plant & machinery (separately).Demand and financial factors, internal and external, are considered in the investment analysis. Finally the influence of determinants of fixed investment and investment plans are examined in Aluminium industry in India.

Keywords—Determinants, Aluminum Industry, Fixed Assets, Econometric Analysis.

I. Introduction and Literature Review

The fixed investment decision is an important decision in the valuation of the firm attempts were made previously to understand the factors that influence the fixed investment decision of the firm. Such studies have identified different factors which play an important role in the determination of the fixed investment of the companies and the studies made by some of the researchers [1]-[8]. Some of the studies have added significant contributions to this important area of Business Finance [9]-[15].Though some attempts were made earlier to find out the validity of such contributions in the Indian context, there are very few studies, which tested their applicability at the micro level units on a more comprehensive basis.Hence an attempt is made in this study to understand the different economic variables which influenced the fixed investment of some sample companies in Aluminium industry in India.

II. Objectives, Methodology and Limitations

Being exploratory in character, the present study aims at understanding the fixed investment behavior of some sample companies in Aluminium Industry. This study is undertaken:

1. To analyze the investment pattern in Gross Fixed Assets of some selected companies in the Aluminum Industry in India.
2. To analyze the determinants of investment in Gross Fixed assets i.e.,Gross Block and plant & Machinery in Aluminium Industry.
3. To analyze the best models, which determine the investment behavior in fixed assets through Stepwise Multiple Regression Analysis and Econometric Analysis?

Source of Data

The data relating to the different economic variables of companies have been collected from various issues of the Bombay Stock Exchange Official Directory. The source of data for the fixed investment policy of Aluminium Industry is the data relating to the individual sample companies in Aluminium Industry. The industry, for the purpose of the study, means the aggregate of sample units in the industry. Thus the cross section data of micro level economic variables is added to make up the industry data.

Period of Study

The present study covers a period of 10 years from 2000 to 2009. Since the fixed investment policy is a long-term policy, a period of 10 years is considered to be long enough to study the Fixed Investment policy of companies/Industries.

The Sample Selection

The selection criteria of the companies for inclusion in the sample of the study have been that

1. Companies must have been incorporated on or before 1975, i.e.,25 years before the period for which analysis has been started here so that a minimum period of at least 25 years must have been elapsed for them to establish themselves and invest in fixed assets.
2. Companies must have had a paid-up capital of more than Rs 10 lakhs in 1975 so that only medium and large companies as per the classification of the Reserve Bank of India are included in the sample.
3. Companies must be continuously profit making companies in all 10 years (which is the study period here) so as to ensure that only which made profits on consistent basis are included.

Based upon the above selection criteria a total of the following three firms constitute the size of the sample for the purpose of the study.

1. Hindalco Industries Ltd.
2. Indian Aluminium Co. Ltd.
3. National Aluminium Ltd.

Variables

A list of the variables – both dependent and independent – that are used in this study is presented.

Dependent Variables

1. $GB_{t-(t-1)}$ = Change in Gross Block
2. $Pm_{t-(t-1)}$ = Change in Plant & Machinery

Independent Variables

1. $S_{t-(t-1)}$ = Change in sales
2. GIF_t = Gross Internal Funds
3. NL_t = Stock of Net Liquidity
4. D_t =Dividends
5. $EC_{t-(t-1)}$ =Growth of equity capital
6. $DETOUT_t$ =Debt outstanding
7. T_t = Provision for taxes
8. I_t =Interest on borrowed funds

Stepwise Regression

The present study is mainly based on stepwise multiple regression analysis. This technique begins with the simple correlation matrix and enters into regression of the independent variables most highly correlated with the dependent variable. Using the partial coefficients generated with respect to the other variables, the computer programme then selects the next variable to enter the model.

Stepwise regression permits the analyst to start with a large number of variables that might have predictive values and then use the model to select the particular variables that appear to provide the prediction.

Statistical Analysis

The data used in this study was processed by using computer packages, they are Statistical and Limdep. The multiple linear stepwise regressions were run in order of importance in terms of explanatory powers of different variables influencing the dependent variable in the study. In other words, which independent variable has the greatest effect in determination of the dependent variable? How sensitive is dependent variable to fluctuations in independent variables? This technique is adopted in order to obtain a realistic picture of the importance of the various independent variables, which influence financing investment in the Electric Power Industry in India.

Models Built

This study is conducted on the basis of three models. These three models have been tested in the case of each company. They are;

A. Adding Model B. Constant Model C. Elimination Model

The above three models have been tested in each case with the intercept term. Thus altogether 15+ equations are estimated in each case.

A. Adding Model

It may be noted that in this model, an independent variable has been entered into the model at an earlier step, and then another independent variable is added to the first one and then another variable etc. So ultimately all the independent variables are added and tested under this model.

The following are the equations, which are estimated under this model.

1. $GB_{t-(t-1)}$ or $PM_{t-(t-1)} = b_0 + b_1 S_{t-(t-1)}$
2. $GB_{t-(t-1)}$ or $PM_{t-(t-1)} = b_0 + b_1 S_{t-(t-1)} + b_2 GIF_t$
3. $GB_{t-(t-1)}$ or $PM_{t-(t-1)} = b_0 + b_1 S_{t-(t-1)} + b_2 GIF_t + b_3 NL_t$
4. $GB_{t-(t-1)}$ or $PM_{t-(t-1)} = b_0 + b_1 S_{t-(t-1)} + b_2 GIF_t + b_3 NL_t + b_4 D_t$
5. $GB_{t-(t-1)}$ or $PM_{t-(t-1)} = b_0 + b_1 S_{t-(t-1)} + b_2 GIF_t + b_3 NL_t + b_4 D_t + b_5 EC_{t-(t-1)}$
6. $GB_{t-(t-1)}$ or $PM_{t-(t-1)} = b_0 + b_1 S_{t-(t-1)} + b_2 GIF_t + b_3 NL_t + b_4 D_t + b_5 EC_{t-(t-1)} + b_6 DBTOUT_t$
7. $GB_{t-(t-1)}$ or $PM_{t-(t-1)} = b_0 + b_1 S_{t-(t-1)} + b_2 GIF_t + b_3 NL_t + b_4 D_t + b_5 EC_{t-(t-1)} + b_6 DBTOUT_t + b_7 T_t$
8. $GB_{t-(t-1)}$ or $PM_{t-(t-1)} = b_0 + b_1 S_{t-(t-1)} + b_2 GIF_t + b_3 NL_t + b_4 D_t + b_5 EC_{t-(t-1)} + b_6 DBTOUT_t + b_7 T_t + b_8 I_t$.

B. Constant Model

In this model the first two independent variables (change in sales and gross internal funds) are kept as constant variables because these two are very closely related to the dependent variables, and the third variable is changed in each model.

The following are the equations, which are estimated under this model.

1. $GB_{t-(t-1)}$ or $PM_{t-(t-1)} = b_0 + b_1 S_{t-(t-1)} + b_2 GIF_t + b_3 NL_t$
2. $GB_{t-(t-1)}$ or $PM_{t-(t-1)} = b_0 + b_1 S_{t-(t-1)} + b_2 GIF_t + b_3 D_t$
3. $GB_{t-(t-1)}$ or $PM_{t-(t-1)} = b_0 + b_1 S_{t-(t-1)} + b_2 GIF_t + b_3 EC_{t-(t-1)}$
4. $GB_{t-(t-1)}$ or $PM_{t-(t-1)} = b_0 + b_1 S_{t-(t-1)} + b_2 GIF_t + b_3 DBTOUT_t$
5. $GB_{t-(t-1)}$ or $PM_{t-(t-1)} = b_0 + b_1 S_{t-(t-1)} + b_2 GIF_t + b_3 T_t$
6. $GB_{t-(t-1)}$ or $PM_{t-(t-1)} = b_0 + b_1 S_{t-(t-1)} + b_2 GIF_t + b_3 I_t$

C. Elimination Model

In elimination model, the estimated equations are not constant but the number of equations depends on the significance of the variables which proved to be significant.

The following procedure is adopted while estimating the equations. Initially, all the independent variables are included in the model. Based upon the significance of 't' values, the variable with the least 't' value is dropped and then again the equation is estimated with the remaining independent variables. Again the variable with the least 't' value is dropped and the equation is again estimated. This process is continued till all the independent variables in the equation have proved to be significant either at 5% or at 10% level.So the number of equations varies depending upon the significance of variables in each case of companies.

The above 15+ equations are estimated for all the 3 companies and industry aggregate. The total numbers of estimated equations are as follows:

For 3 companies and industry aggregate in two cases (both gross block and plant and machinery):

In Adding Model	…….3×8×2	= 48
In Constant Model	..... 3×6×2	= 36
In Elimination Model	.....	= 28
	Total	**112**

Thus altogether 112 equations have been estimated with all the necessary tests, using the data for 10 years in each case.

To find out the effect of different independent economic variables on the fixed investment of the companies during the period of this study, the Multiple Linear Regression Analysis is used with all its limitations.

Selection of the Best Model

The following procedure is adopted to select the best model in each case from out of the 15+ estimated equations.

Step – I

Out of the 15+ estimated equations in each case, all those equations, whose Multiple Correlation Coefficients are found to be significant at 5% level based on their calculated 'F' values are picked up for further analysis.

Step – II

The equations thus picked up according to step-I above are further screened in the following way:

a)The values of intercept term (b_0) and other regression coefficients (b_1, b_2, b_3) are tested at 5% level of significance based on their calculated't' values. If only one equation is found in which all the explanatory variables are significant at 5% level, then that equation is taken as the best model to explain the fixed investment behavior of the company. If, on the other hand, there are two or more equations in which all the explanatory variables are found significant at 5% level, the procedure explained in step III is followed.

b) But if,in a company, there is not even a single equation in which all the independent variables show significant effect at 5% level, the significance level is relaxed and the impact of the variable is tested at 10% level wherever necessary. That is, the variables, which are not significant at 5% level, are tested at 10% level of significance. However, this has happened in a very few cases in this study. If only one equation is found in which the explanatory variables are significant at 5% level or 10% level, then that model is selected as the best model to describe the fixed investment behavior of the company. On the other hand, if there are two or more than two equations in which the independent variables are significant at 5% or 10% level, the procedure explained that in step III is followed to decide the best model.

Step – III

As stated in step II, if there are two or more equations in which all the explanatory variables are significant that particular equation whose R^2 is the highest is chosen as the best equation to explain the fixed investment behavior of the company.

Limitations of the Study

This study has the following limitations.

1. The accounting years of the sample companies are not common and the closing of the accounting years is spread over all the 12 months of the year. So for the industry aggregate data the accounting year is not uniform.

2. The Industry data, for the purpose of the study, comprise the aggregate of the data of the micro level sample units that are selected for this study.
3. The data for the study are taken in absolute values as given in the Bombay Stock Exchange Directory and no price deflator is used to adjust for the inflationary trends.
4. This study is only exploratory in its objectives and does not aim at recommending any policy measures either for the companies or for the government.

III. Analysis of the Regression results of firms in Aluminium Industry

This section deals with the study of investment behavior of sample firms taking into consideration two dependent variables namely Gross Block (Y_1) and Plant and Machinery (Y_2) in Aluminium Industry of India.

This study deals with eight explanatory variables, which influence the investment behavior in fixed assets (Y_1 and Y_2). This study is conducted on the basis of three models. They are Adding model, Constant model and Elimination model. In Adding model there are eight estimated equations. In Constant model there are six estimated equations and in Elimination model the estimated equations are not Constant but the number of equations depend on the significance of independent variables.

The following abbreviations are used in the tables:
NF -The number of firms, where the explanatory variable has shown an impact.
5% -The number of equations in which the explanatory variable is significant at 5% level.
10% - The number of equations in which the explanatory variable is significant at 10% level.
AI - Aluminium Industry (The numbers indicate the number of equations that are estimated)
AM - Adding model
CM - Constant model
EM - Elimination model

Table 1, **ALUMINIUM (Total No. of firms: 3)**

Explanatory variable: ***CHANGE IN SALES (b_1)***							
Gross Block (Y_1)				Plant & Machinery (Y_2)			
	AM	CM	EM		AM	CM	EM
NF	--	--	--	NF	--	--	1
5%	--	--	--	5%	--	--	1
10%	--	--	--	10%	--	--	--
AI	8	6	8	AI	8	6	8
5%	--	--	--	5%	1	--	1
10%	--	--	--	10%	1	2	--

Table 2,**ALUMINIUM (Total No. of firms: 3)**

Explanatory variable: ***CHANGE IN SALES (b_1)***							
Gross Block (Y_1)				Plant & Machinery (Y_2)			
	AM	CM	EM		AM	CM	EM
NF	--	--	--	NF	--	--	1
5%	--	--	--	5%	--	--	1
10%	--	--	--	10%	--	--	--
AI	8	6	8	AI	8	6	8
5%	--	--	--	5%	1	--	1
10%	--	--	--	10%	1	2	--

Table 3,**ALUMINIUM (Total No. of firms: 3)**

Explanatory variable: ***STOCK OF NET LIQUIDITY (b_3)***							
Gross Block (Y_1)				Plant & Machinery (Y_2)			
	AM	CM	EM		AM	CM	EM
NF	2	--	3	NF	1	1	3
5%	1	--	7	5%	1	1	6
10%	4	--	1	10%	1	--	2
AI	8	6	8	AI	8	6	8
5%	4	1	2	5%	--	--	5
10%	--	--	2	10%	2	1	1

Table 4, **ALUMINIUM (Total No. of firms: 3)**

Explanatory variable: ***DIVIDENDS (b_4)***							
Gross Block (Y_1)				Plant & Machinery (Y_2)			
	AM	CM	EM		AM	CM	EM
SF	2	1	3	SF	2	1	2
5%	3	1	7	5%	1	1	6
10%	1	--	10	10%	1	--	1
AI	8	6	8	AI	8	6	8
5%	--	--	--	5%	--	--	--
10%	--	--	--	10%	--	--	--

Table 5,**ALUMINIUM (Total No. of firms: 3)**

Explanatory variable: ***GROWTH OF EQUITY CAPITAL (b_5)***							
Gross Block (Y_1)				Plant & Machinery (Y_2)			
	AM	CM	EM		AM	CM	EM
NF	1	--	2	NF	3	--	2
5%	1	--	3	5%	3	--	3
10%	1	--	1	10%	--	--	1
AI	8	6	8	AI	8	6	8
5%	--	--	--	5%	--	--	--
10%	--	--	--	10%	--	--	--

Table 6,**ALUMINIUM (Total No. of firms: 3)**

Explanatory variable: ***DEBT OUTSTANDING (b_6)***							
Gross Block (Y_1)				Plant & Machinery (Y_2)			
	AM	CM	EM		AM	CM	EM
NF	1	--	1	NF	1	--	2
5%	2	--	2	5%	1	--	1
10%	1	--	--	10%	1	--	1
AI	8	6	8	AI	8	6	8
5%	--	--	--	5%	--	--	--
10%	--	--	--	10%	--	--	--

Table 7,**ALUMINIUM (Total No. of firms: 3)**

Explanatory variable: ***PROVISION FOR TAXES (b_7)***							
Gross Block (Y_1)				Plant & Machinery (Y_2)			
	AM	CM	EM		AM	CM	EM
NF	1	--	2	NF	--	1	2
5%	1	--	4	5%	--	--	3
10%	--	--	--	10%	--	1	1
AI	8	6	8	AI	8	6	8
5%	--	--	--	5%	--	--	--
10%	--	--	--	10%	--	--	--

Table 8,**ALUMINIUM (Total No. of firms: 3)**

Explanatory variable : ***INTEREST ON BORROWED FUNDS (b_8)***							
Gross Block (Y_1)				Plant & Machinery (Y_2)			
	AM	CM	EM		AM	CM	EM
NF	1	--	2	NF	--	1	1
5%	1	--	3	5%	--	1	1
10%	--	--	--	10%	--	--	--
AI	8	6	8	AI	8	6	8
5%	--	--	--	5%	--	--	--
10%	--	--	--	10%	--	--	--

V. Findings and Conclusions

The Summary of the analysis is presented in the tables the following conclusions are drawn.

1. The major finding of the study is that, the elimination model is the most appropriate model in determining the behavior of investment in total fixed assets & plant and machinery separately.
2. 2. The results of this analysis suggest that gross internal funds (retained earnings + depreciation) are more important for the fixed investment in all the companies in the present study.
3. Change in sales (growth rate in sales), stock of net liquidity, debt outstanding dividends are also significant determinants of fixed investment.
4. 4. The study reveals that demand considerations in the long- run are of some importance in the entrepreneurial fixed investment decisions. Financial considerations seem to dominate over demand factors in fixed investment decisions.
5. The implication of the results of the present study is that profitability is an important consideration in entrepreneurial investment decisions. Profits influence dividend policies and hence retained earnings. Retained earnings in turn influence investment.
6. Profits influence dividends and dividends influence the flow of external finance. External finance in turn exerts its influence on investment. Thus profits both directly and indirectly influence investment, directly through retained earnings and indirectly through external finance.
7. As retained earnings is an important factor in the determination of investment, it is important to see that higher profitability is not dissipated through dividend disbursals. As self-financing is non-inflationary, it may be desirable to encourage asset expansion through internal savings rather than through borrowings.

References

1. Ashim Lal, R.,and Chakraborthy, Mrs. Sadhna Srivastava., March, Fall 1991 'Fixed Assets Acquisition & Their Management – A' Case Study, *Journal of Accounting & Finance*.
2. Bonton E. Gup., The financial Consequences of Corporate Growth; *The Journal of Finance,* Dec., 1980.
3. Durbin, J., "An Alternative to the Bounds Test for testing for Serial Correlation in Least Squares Regression", Econometrica, Vol.38, 1970, pp.422-429.
4. Gompers, Paul A., December 1995 Optimal Investment, Monitoring & the Stagging of Venture Capital, *Journal of Finance*.
5. Henshaw, R.C. (jr.), "Testing Single Equation Least Square Regression Models for Autocorrelated Distrurbences", Econometrica, Vol.34,1966, pp.646-60.
6. Gompers, Paul A., Optimal Investment, Monitoring & the Stagging of Venture Capital, *Journal of Finance*, December 1995.
7. Jorgenson, D.W.,The Theory of Investment Behaviour in determinants of Investement Behaviour, *NBER,* 1967.
8. Kuh, E., *Capital Stock Growth: A Micro Econometric Approach,* North Holland Publishing Company, 1963.
9. Krishna, K.L., and Krishnamurthy, K., *Investment Functions for the Corporate Sector, Towards An Econometric Model of Indian Economy* Part III, Report submitted to ICSSR, 1974.
10. Krishnamurthy, K.,*Investment and Financing in the Corporate Sector in* and Sastry, D.U., *India*, Tata McGraw Hill, Bombay, 1975.
11. Meyer, J., and Kuh, E.,*The Investment Decision,* Harvard, 1957.
12. C.J.Misra G.D., *Investment, Financing and Earnings in the Corporate Sector in India,* Allahabad, Kitabmahal, 1984.
13. Prem Kumar., *Growth of Industrial Corporations in India Structure, Strategy, Determinants,* Chandigarh: Deep & Deep Publications, 1985.
14. Prasant Kumar Sahoo., *Sources of Finance for Indian Corporate Sector,* Berhampur; Deep & Deep Publications, 1988.
15. Ranganadhan, M, &Madhumathi R., Market Price as an Influence of Investment Decisions, *Finance India*, March 1996.