4.1 About the Analysis

In this chapter the results obtained from the industry level analysis are presented. The Ordinary Least Square estimates obtained for the alternative specifications for the aggregate manufacturing sector, and the seven individual industries that have been taken for examination, constitute the theme of this chapter.

The list of industries included in this chapter, is given in Table 4.1. The summary statistics and measures of predictive capacity obtained for the alternative specifications (given in Table 4.0), for data pertaining to the above industries, are presented in Table 4.2 to 4.10. Appendix A contains Table 4.0 to 4.10.

The Ordinary Least Squares (OLS) estimates obtained for the parameter coefficients of the alternative specifications for the various industries given in Table 4.1 are presented in Tables 4.11 to 4.21. Appendix B contains these tables.
4.2 The Aggregate Manufacturing Sector

The Ordinary Least Squares (OLS) estimates obtained for alternate specifications for the data representing the investment behaviour of the aggregate manufacturing sector are presented in Appendix B. For ready reference, the summary measures ($R^2$, SEE and DW statistic) attained by each one of the alternate specifications, along with statistics indicative of their predictive capacities, are presented in Table 4.2.

An examination of the first two lines of Table 4.2 reveals that of the two alternative specifications that have been taken to represent the accelerator theory, the specific form that approximates desired sales with constant change gives a better explanation. This specification accounts for 50 percent explanation in the investment indicated for the sample period, whereas the alternate 4.2.(i) accounts for 43 percent. This better performance of 4.2.(ii) is also indicated by its lower SEE estimate value, which is of the order of 0.0214, whereas the SEE estimate of the alternate 4.2.(i) is 0.0222. Regarding the autocorrelated nature of the error terms, the magnitude of the DW statistic of 4.2.(ii) indicates that the error terms are not serially correlated. Turning to their predictive capacities, while the $U$ coefficient of 4.2.(ii) is 0.976, in the case of 4.2.(i) it is of the order of 0.884. However, 4.2.(ii)
tracks eight of the fourteen turning points correctly, whereas 4.2.(i) tracks only three turning points correctly.

Line 3 represents the estimates given by the specification that follows from the theoretical framework of the residual funds theory, to the sample data. Compared to 4.2.(iii), equation 4.2.(ii) offers a better explanation. 4.2.(ii) accounts for 50 percent explanation in the investment for the sample period, whereas 4.2.(iii) accounts for only 20 percent explanation. This better performance of 4.2.(ii) is also indicated by their respective SEE estimates, the estimates being of the order of 0.0213 and 0.0262 respectively. Regarding the error terms, the error terms of 4.2.(ii) are not serially correlated, whereas those of 4.2.(iii) are serially correlated, as is indicated by their respective DW statistics of order 1.728 and 1.076. Turning to their predictive capacities, the U coefficient of 4.2.(ii) is 0.976, whereas it is of the order of 0.998 in the case of 4.2.(iii). Similarly, 4.2.(ii) tracks eight of the fourteen turning points correctly, whereas 4.2.(iii) tracks only two turning points correctly.

An examination of the next four lines of Table 4.2 reveals that of the four alternatives that have been taken to represent the relative price theory, the specific form that approximates expectations
with static expectations offers the best explanation. Relative prices in this equation are estimated excluding capital gains. This specification 4.2.(iv) accounts for 57 percent explanation. The three alternatives 4.2.(v), 4.2.(vi) and 4.2.(vii) account for 59 percent, 15 percent and 17 percent explanation respectively. The better performance of 4.2.(iv) is also indicated by their respective SEE estimates, the estimates being of the order of 0.0192, 0.0193, 0.0270 and 0.0273. The error terms of all four specifications are serially correlated as is indicated by their respective DW statistics; 1.047, 1.181, 1.007 and 0.968. Turning to their predictive capabilities, while the U coefficient of 4.2.(iv) is 0.761, that for the three alternatives is 0.807, 0.980 and 0.930 respectively. Similarly, both 4.2.(iv) and 4.2.(v) track nine of the fourteen turning points correctly, whereas 4.2.(vi) and 4.2.(vii) track only three and five turning points respectively. Compared to 4.2.(ii), equation 4.2.(iv) gives a better performance. This specification accounts for 57 percent variation, whereas 4.2.(ii) accounts for 50 percent. The SEE estimates of 4.2.(iv) and 4.2.(ii) are 0.0193 and 0.0214 respectively, indicating the superiority of 4.2.(iv). The error terms of 4.2.(ii) however are not serially correlated. In terms of their predictive capacities, while the U coefficient of 4.2.(iv) is 0.761, in the case of 4.2.(ii) it is 0.976. Equation 4.2.(iv) tracks nine of the fourteen turning points correctly, whereas 4.2.(ii) tracks eight turning points correctly.
In the last four lines of Table 4.2, the speed of adjustment is taken to be a function of the availability of finance, instead of being visualised as a constant, implicit in the estimates considered so far. In the first two equations desired level of capital stock is approximated by sales assuming static expectations, whereas the speed of adjustment is assumed to be a function of internal finance and external finance respectively. The latter two equations define desired level of capital in terms of relative prices, and the speed of adjustment is similarly assumed to be a function of internal finance and external finance respectively. Of the four alternatives considered, 4.2.(xi) offers the best explanation. This specification accounts for 60 percent explanation in investment indicated for the sample period, whereas the three alternatives 4.2.(viii), 4.2.(ix) and 4.2.(x) account for 47 percent, 49 percent and 59 percent respectively. This better performance of 4.2.(xi) is also indicated by their respective SEE estimates, the estimates being of the order of 0.0218, 0.0215, 0.0191 and 0.0189. Regarding their predictive capacities, while the U coefficient of 4.2.(xi) is 0.782, for the three alternatives 4.2.(viii), 4.2.(ix) and 4.2.(x) it is of the order of 0.899, 0.878 and 0.796 respectively. The four equations track six, six, nine and nine of the fourteen turning points correctly. Compared to 4.2.(iv), equation 4.2.(xi) gives a better performance. Besides having a higher explanatory power of 60 percent,
it also has a lower SēE estimate. Regarding their predictive capacities, both equations give an equally good quality of predictions.

A cross comparison of the results discussed so far indicates that of the alternative theoretical basis that have been identified as the plausible explanations of the observed behaviour, 4.2.(xi) is considered to be the best, in terms of both the explanatory power and predictive capacity. Such a comparison also reveals that if the behaviour undertaken by the aggregate manufacturing sector be taken as the basis, the alternate theoretical frameworks can be ranked in the following manner:

1) The theory which defines desired level of capital stock to be a function of relative prices (estimated excluding capital gains), and the speed of adjustment is assumed to be determined by external finance (4.2.(xi)).

2) The theory wherein desired level of relative prices (estimated excluding capital gains) is taken to determine the desired level of capital stock, wherein expectations are approximated by static expectations (4.2.(iv)).

3) The theory wherein sales determine the desired level of capital stock, and expectations are approximated by constant change (4.2.(ii)).
4) The theory wherein the desired level of capital stock is determined by residual funds (4.2.(iii)), and

5) The theory wherein relative prices estimated including capital gains, determine the desired level of capital stock. (4.2.(vi)).

This ranking is obtained by the summary measures, ex ante forecast measures, as well as the ex post forecast measures.

The OLS estimates obtained for the parameter coefficients of the specification that has been identified as the best, namely the one labelled as 4.2.(xi), are presented below, along with the t-statistics.

\[
I_t = 56.0469 + 0.0325 \left( P_{Q/C_{t-1}} \right) + 0.0204 K_{t-1}
\]
\[
+ 0.2113 \Delta E_{t-1}
\]
\[
(2.5663) (3.3328) (1.2144) (1.3292)
\]

\[
R^2 = 0.6026 ; \quad \text{SEE} = 0.0120 ; \quad DW = 1.2625
\]

Only the coefficient of the capital stock variable, \( K_{t-1} \), takes on the opposite sign, i.e. a positive sign. The aggregation of data over the individual industries, in order to obtain data for the manufacturing sector could be the reason for the capital stock coefficient taking on the opposite sign.
The results obtained in the present study differ from those arrived at by the study group for financing of the Private Corporate Sector.\(^1\) In an attempt to examine the factors influencing corporate investment, and to assess the sources of funds in the private corporate sector, the study group bases their analysis on the assumption that on the demand side, the major determinants are expanding output. They further assume that there exists sufficient demand, and the constraining factor is the supply side variable, namely the availability of funds. Major emphasis in the study is on the issue of how the needed resources for the desired levels of investment as contemplated in the Sixth Plan, can be achieved.

In the present study, an analysis of the investment behaviour of the manufacturing sector reveals that of the two sources of finance, namely internal and external sources, external finance is more important. More so, external finance is found to be a significant determinant not of corporate investment itself, but of the speed of adjustment, i.e. the speed at which the gap between the desired and actual levels of capital stock is bridged. Availability of finance is therefore found to influence only the speed of adjustment. Relative prices are found to be the most important determinant of

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\(^{1}\) Study Group on Financing of the Private Corporate Sector in the Sixth Five Year Plan, Government of India, Planning Commission, 1983.
corporate investment, with sales being the next in importance. Internal funds do not play any role in the determination of corporate investment.

As the behavior of the individual industries which comprise the manufacturing sector may be different from that of the aggregate manufacturing sector, due to aggregation problems in the present study the analysis is extended to cover individual industries also. In his attempt to test the variables that determine investment behavior, Evans takes the viewpoint that these variables differ from industry to industry. He concludes that there do exist interindustry differences, which emphasizes the need for disaggregation. On the basis of a similar study, Resek also arrives at similar conclusions. He emphasizes that it is difficult to identify any one particular specification and generalize it as the best explanator of investment behaviour, both of aggregate manufacturing, and of each individual industry.

In the present study, the analysis is extended to seven individual industries, namely, Engineering, Chemicals, Paper and Paper Products, Cement, Sugar, Rubber and Rubber Products, and Cotton Textiles, with a view to overcoming the limitations of the aggregation problem.

2 Op. cit
3 Op. cit
4.3 The Engineering Industry

The Ordinary Least Squares estimates obtained for alternate specifications for the data representing the behaviour of the Engineering industry, are presented in Appendix B. The summary measures along with measures of the predictive capacities of the alternative specifications, are presented in Table 4.3.

An examination of the first two lines of Table 4.3 reveals that of the two alternatives that have been taken to represent the accelerator theory, the specific form that approximates expectations with static expectations, gives better results. Insignificant difference in the $R^2$ of these two equations 4.3.(i) and 4.3.(ii), as well as in the dimensions of their respective DW statistics, makes it difficult to choose between these two alternatives. Turning to their predictive capacities, the $U$ coefficient of 4.3.(i) is 0.932, whereas it is of the order of 0.878 in the case of 4.3.(ii). 4.3.(i) tracks five of the thirteen turning points correctly, whereas 4.3.(ii) tracks only three turning points correctly.

Line 3 represents the estimates given by the application of the residual funds specification, to the data. Compared to this specification, 4.3.(i) offers a better explanation of investment
behaviour. 4.3.(i) accounts for 63 percent explanation of investment indicated for the sample period, whereas 4.3.(iii) accounts for 57 percent. 4.3.(i) also has a lower SEE estimate of 0.0281. The error terms of both the specifications are serially correlated, the DW statistics being 1.189 and 1.321 respectively. In terms of their predictive capacities, while the U coefficient of 4.3.(i) is 0.932, in the case of 4.3.(iii) it is of the order of 1.517. Also, 4.3.(i) tracks five of the thirteen turning points correctly, compared to the four correctly tracked by 4.3.(iii).

The next four lines of Table 4.3 represent the relative price theory of investment behaviour. Of the four alternative specifications considered under this theory, 4.3.(iv) gives the best explanation. Insignificant difference in the magnitude of their respective $R^2$ values, and the dimension of their DW statistics, makes it difficult to choose between 4.3.(iv) and 4.3.(v). Both the equations track six of the thirteen turning points correctly, and their respective U coefficients are of similar magnitudes. Equation 4.3.(iv) is however preferred to 4.3.(v) since the inclusion of the change variable in 4.3.(v) has not improved either the summary measures, on the forecast measures. Compared to both equations 4.3.(vi) and 4.3.(vii), 4.3.(iv) offers a better explanation. 4.3.(iv) accounts for 59 percent explanation, whereas
the two alternates account for only 7 percent and 11 percent respectively. The error terms of all the three specifications are serially correlated, with the DW statistic being of the order of 1.085, 0.688 and 0.752 respectively. Turning to their predictive capacities, the U coefficients of the three equations 4.3.(iv), 4.3.(vi) and 4.3.(vii) are of the order of 0.981, 1.073 and 1.078 respectively. 4.3.(iv) tracks six of the thirteen turning points correctly, whereas the latter equations track only two and four turning points respectively.

In the last four equations of Table 4.3, the speed of adjustment is taken to be a function of finance variables. Insignificant differences in the magnitudes of their respective R² and SEE estimates, makes it difficult to choose between these four alternatives. The error terms of 4.3.(viii) and 4.3.(x) are not serially correlated, the DW statistics being 1.604 and 1.521 respectively. The DW statistics in the case of 4.3.(ix) and 4.3.(xi) is of the order of 1.118 and 1.117 respectively, implying that the error terms of both the equations are serially correlated. Regarding their predictive capacities, the U coefficients of the four equations are of the order of 1.069, 0.844, 1.060 and 0.867 respectively. The four equations correctly track four, six, five and seven turning points respectively. Though in terms of predictive
measures, 4.3(ix) and 4.3(xi) give better performance, 4.3(viii) and 4.3(x) are preferable in terms of the summary measures. Equation 4.3(x) is finally selected. Compared to 4.3(i), 4.3(x) gives a better performance. This specification accounts for 70 percent explanation, whereas 4.3(i) accounts for 62.5 percent. The error terms of 4.3(x) are not serially correlated, whereas those of 4.3(i) are serially correlated, as is apparent from their respective DW statistics; 1.521 and 1.189. Regarding their predictive capacities, both equations track five of the thirteen turning points correctly.

A cross comparison of the results discussed so far indicates that of the alternative theoretical basis that have been identified as the plausible explanations of investment behaviour, 4.3(x) could be considered to be the best. This comparison also reveals that for the Engineering industry, the alternate theoretical frameworks could be ranked in the following order:

1) The theory in which desired capital stock is taken to be a function of relative prices (estimated excluding capital gains), and the speed of adjustment is assumed to be a function of retained earnings.

2) The Accelerator Theory.

3) The Neo-Classical Theory, wherein relative prices are estimated excluding capital gains.
4) The Residual Funds Theory, and

5) The theory wherein Relative Prices are estimated including capital gains.

The OLS estimates obtained for the parameter coefficients of the specification that has been identified as the best, namely $4.3(x)$, are presented below along with the t-statistics.

$$
I_t = -1.4098 + 0.0155(P_{t+1}/C_{t1}) - 0.0017 K_{t-1} + 1.6091 \text{rt-1}
$$

$$
(1.1860) (3.1325) (0.0879) (2.8165)
$$

$$
R^2 = 0.7002 ; \text{ SEE } = 0.0257 ; \text{ DW } = 1.5210
$$

All the coefficients in this specification have attained the right signs. The capital variables has also obtained the right negative sign.

For the engineering industry, relative prices followed by sales, are the two important determinants of corporate investment. Between the two finance variables, retained earnings prove to be more important in determining the speed of adjustment. Internal funds namely retained earnings do not determine the investment behaviour itself of the engineering industry.
Krishnamurthy and Sastry\textsuperscript{4} in their analysis of the investment behaviour of the engineering industry obtain results which differ from those obtained in the present study. In their study, the authors find the sales variable and external finance to be insignificant, and only the internal finance variable is found to be a significant determinant of investment.

Rao and Misra\textsuperscript{5} find both the retained earnings variable and debt flow to be significant determinants of corporate investment, but the sales variable proves to be insignificant. In both the studies, the sales variable proves to be insignificant and retained earnings are found to be significant determinants.

In the present study too retained earnings are found to be significant, but as a determinant of the speed of adjustment, and not of the level of investment itself. Also, the sales variable is a significant determinant of investment, but second only to relative prices.

As in the case of the aggregate manufacturing sector, in the case of the engineering industry too, relative prices followed by sales are the two significant determinants of investment. However, internal finance rather than external finance is found to be the more important determinant of the speed of adjustment.

\textsuperscript{4} Op.cit
\textsuperscript{5} Op.cit
4.4 The Chemical Industry

The OLS estimates obtained for the alternate specifications for the data representing the behaviour of the Chemical industry are presented in Appendix B. The summary measures attained by each one of the alternative specifications, along with statistics indicative of their predictive capacities are presented in Table 4.4.

The insignificant differences in the $R^2$ and SEE estimates and in the dimension of their respective DW statistics, makes it difficult to choose between the first two equations presented in Table 4.4, on the basis of their summary measures. Turning to their predictive capacities, while the U coefficient of 4.4.(i) is 0.669, in the case of 4.4.(ii) it is of the order of 0.662. Both equations correctly track six of the ten turning points. Equation 4.4.(i) is however preferred to 4.4.(ii) since the inclusion of the change variable in 4.4.(ii) has not led to an improvement in either the summary measures, or the forecast measures.

Equation 4.4.(i) offers a better explanation compared to 4.4.(iii), in which the residual funds theory is applied to the sample data. 4.4.(i) accounts for 29 percent explanation of investment, whereas 4.4.(iii) accounts for only 0.03 percent explanation. The better performance of 4.4.(i) is also indicated by their respective SEE.
estimates, which are 0.060 and 0.071. The error terms of both the
equations are autocorrelated. Turning to their predictive
capacities, while the U coefficient of 4.4.(i) is 0.669, in the
case of 4.4.(iii) it is of the order of 0.987. Further 4.4.(i)
tracks six of the ten turning points correctly, whereas 4.4.(iii)
tracks only two turning points correctly.

An examination of the next four lines reveals that of the four
alternatives taken to represent the relative price theory,
equation 4.4.(iv) gives the best explanation of investment for the
sample period. 4.4.(iv) accounts for 38.2 percent explanation of
investment, whereas 4.4.(v), 4.4.(vi) and 4.4.(vii) account for
40.6 percent, 3 percent and 8 percent respectively. The superiority
of 4.4.(iv) is also indicated by their respective SEE estimates
which are 0.0559, 0.0561, 0.0699 and 0.0699. The error terms of
all the four equations are serially correlated as is indicated by
their DW statistics which are 0.732, 0.775, 1.182 and 1.188
respectively. In the context of their predictive capacities, the
U coefficient in the case of 4.4.(iv) is 0.839, whereas in the
case of the three alternates it is 1.015, 1.069 and 1.005
respectively. Both equations 4.4.(iv) and 4.4.(v) track six of the
ten turning points correctly, whereas 4.4.(vi) and 4.4.(vii) track
one and two turning points respectively. Compared to 4.4.(i),
equation 4.4.(iv) offers a better explanation. 4.4.(iv) accounts for 38.2 percent explanation, compared to the 29.1 percent explained by 4.4.(i). The error terms of both the equations are serially correlated as is apparent from their respective DW statistics. Both equations track six of the ten turning points correctly. The U coefficients of the two equations 4.4.(i) and 4.4.(iv) are of the order of 0.669 and 0.839 respectively.

In the last four lines of Table 4.4, the speed of adjustment is assumed to be a function of finance variables. An examination of these four alternate specifications reveals that 4.4.(xi) is the best. This specification accounts for 60 percent explanation of investment for the sample period, whereas the three alternates 4.4.(viii), 4.4.(ix) and 4.4.(x) account for 29 percent, 51 percent and 39 percent respectively. The better performance of 4.4.(xi) is also indicated by the SEE estimates, which are of the order of 0.0611, 0.0508, 0.0571 and 0.0462 respectively. The error terms of all the four equations are serially correlated. Turning to their predictive capacities, while 4.4.(xi) has a U coefficient of 0.764, and tracks five of the ten turning points correctly the three alternates 4.4.(viii), 4.4.(ix) and 4.4.(x) track six, five and five turning points respectively, and their respective U coefficients are 0.689, 0.700 and 0.872. Compared to 4.4.(iv),
equation 4.4.\((xi)\) offers a better explanation. 4.4.\((xi)\) accounts for 60 percent explanation, whereas 4.4.\((iv)\) accounts for only 38 percent. The SEE estimate of 4.4.\((xi)\) is lower than that of 4.4.\((iv)\). The error terms of both the equations are serially correlated. Both the equations given an equally good quality of predictions.

A cross comparison of the results discussed so far indicates that based on observed behaviour, of the plausible alternate explanations of investment behaviour, 4.4.\((xi)\) could be considered as the best. Such a comparison also reveals that for the behaviour indicated by the Chemical industry, the alternative theoretical frameworks can be ranked in the following order:

1) The theory under which the speed of adjustment is a function of external finance, and relative prices estimated excluding capital gains, determine the desired level of capital stock.

2) The Relative Price Theory, wherein relative prices are estimated excluding capital gains.

3) The Accelerator Theory.

4) The Relative Price Theory wherein relative prices are estimated including capital gains, and finally,

5) The Residual Funds Theory.
The OLS estimates obtained for the parameter coefficients of the specification that has been identified as the best, namely 4.4, (xi), are presented below, along with the t-statistics.

\[ I_t = -1.6726 + 0.0528 \left( \frac{P_t Q_t}{C_{t-1}} \right) - 0.0775 \frac{K_t}{\tau} + 0.7202 \Delta EF_{t-1} \]

\[ \begin{align*} 
&= (2.8857) \quad (4.0652) \quad (1.6059) \\
&\text{SEE} = 0.0462 \quad \text{DW} = 1.1331 
\end{align*} \]

The signs of the estimates presented herewith indicate that all the coefficients have attained the expected signs.

In both the studies by Krishnamurthy and Sastry, and Rao and Mishra, the sales variable has proved to be an insignificant determinant of investment behaviour of the Chemicals industry. In both these studies, along with the study of Johar, Kumar and Singh, external finance is a significant determinant. While in the study by Krishnamurthy and Sastry, external finance rather than internal finance is the significant determinant, in the study by Rao and Mishra both the finance variables prove to be significant.
These results differ from the results obtained in the present study. For the Chemicals industry, in the present study, relative prices prove to be the most significant determinant of investment, with sales being the next important. Internal funds do not prove to be significant. The results differ further in that though external finance proves to be significant in the present study too, it determines the speed of adjustment, and not the corporate investment itself, as is the case in the other studies.

This industry exhibits a behaviour similar to the aggregate manufacturing sector. For the Chemical industry too, relative prices are the best determinant of investment behaviour, with external finance determining the speed of adjustment. Sales is the next most significant determinant of investment behaviour, and internal funds prove to be insignificant.

4.5 The Paper and Paper Products Industry

The OLS estimates obtained for alternate specifications for the data representing the behaviour of the Paper and Paper Products industry are presented in Appendix B. The summary measures obtained by each one of the alternative specifications, along with statistics indicative of their predictive capacities are presented in Table 4.5.
An examination of the first two lines of Table 4.5 reveals that both the equations representing the accelerator theory, offer a very poor explanation of investment, for the sample period, 4.5.(i) accounts for 5 percent explanation, whereas 4.5.(ii) accounts for 6 percent. Their respective DW statistics are 1.535 and 1.589, implying that the error terms of both the equations are not serially correlated. The Theil U coefficients of both the equations is greater than one, and 4.5.(i) tracks one of the thirteen turning points correctly, whereas 4.5.(ii) tracks two turning points correctly.

Line 3 represents the estimates given by the application of the residual funds specification to the sample data. This specification too, as was the case with the first two equations, gives a very poor explanation of investment. This specification accounts for only 8 percent of the explanation, and the S&E estimate is 0.0528. The DW statistic is 1.527, implying that the error terms are not serially correlated. Turning to this specifications predictive capacity, the U coefficient is of the order of 1.006, and it tracks four of the thirteen turning points correctly.

The next four lines of Table 4.5 represent the estimates obtained by the application of the relative price specification to the sample data. An examination of the four alternatives reveals that
4.5.(iv) offers the best explanation. This specification accounts for 16 percent explanation, whereas the three alternatives 4.5.(v), 4.5.(vi) and 4.5.(vii) account for 16 percent, 6 percent and 11 percent respectively. The better performance of 4.5.(iv) is also indicated by their respective SEE estimates, the estimates being 0.0503, 0.0515, 0.0532 and 0.0531. The error terms of all the four equations are not serially correlated, as is indicated by the values of their respective DW statistics. Regarding their predictive capacities, while the U coefficient of 4.5.(iv) is 0.959, in the case of the three alternatives, it is of the order of 0.957, 1.006 and 0.986 respectively. Similarly, while 4.5.(iv) tracks five of the thirteen turning points correctly, 4.5.(v), 4.5.(vi) and 4.5.(vii) track four, two and four turning points respectively. Compared to the first three equations considered in Table 4.5, 4.5.(iv) gives a better explanation, in terms of the summary measures and the forecast measures.

In the last four equations of Table 4.5, the speed of adjustment is taken to be a function of finance variables, instead of being visualised as a constant, implicit in the estimates discussed so far. Insignificant difference in their respective $R^2$ and SEE estimates, and in the dimension of their DW statistics, makes it difficult to choose between 4.5.(x) and 4.5.(xi). Both equations track six of
the thirteen turning points correctly, and their U coefficients are of similar magnitude. However, compared to 4.5.(viii) and 4.5.(ix), the two specifications 4.5.(x) and 4.5.(xi) offer a better explanation. 4.5.(viii) and 4.5.(ix) account for 8 percent and 6 percent explanation respectively. The error terms of both the specifications are not serially correlated, the DW statistics being 1.542 and 1.556 respectively. The U coefficients of both the equations 4.5.(viii) and 4.5.(ix) is greater than one, and both equations track three of the thirteen turning points correctly. Compared to both equations 4.5.(x) and 4.5.(xi), equation 4.5.(iv) is preferred. Though there is insignificant difference in the $R^2$, SEE estimates and in the magnitude of DW statistics of the three specifications, equation 4.5.(iv) is preferred. This is because the inclusion of the finance variable in equations 4.5.(x) and 4.5.(xi) has not led to an improvement of the results, and also in both cases, the finance variable obtains a negative sign.

A cross comparison of the results discussed so far reveals that of the alternative specifications considered, 4.5.(iv) could be considered to be the best. Also, for the behaviour undertaken by the Paper and Paper Products industry, the alternate theoretical frameworks can be ranked in the following order:
1) The Relative Price Theory, under which relative prices are estimated excluding capital gains.

2) The specification wherein the speed of adjustment is a function of finance, and the desired level of capital stock is determined by relative prices (excluding capital gains).

3) The Residual Funds Theory.

4) Both the Accelerator Theory and the Relative Price Theory (including capital gains).

The OLS estimates for the parameter coefficients of the specification that has been identified as the best, namely 4.5.(iv), are presented below, along with the t-statistics.

\[ I_t = -0.9022 + 0.0491 \left( \frac{P_t Q_t}{C_t} \right)_{t-1} + 0.0265 K_{t-1} \]

\[ (0.7972) \quad (1.6857) \quad (0.5903) \]

\[ R^2 = 0.1622; \quad \text{SEE} = 0.0503; \quad DW = 1.5756 \]

The signs of the coefficients presented herewith indicate that the coefficient of the capital stock variable has the opposite sign. This could be due to the problem of multicollinearity.

Krishnamurthy and Sastry in their study have found external finance to be a significant determinant of investment behaviour. Internal finance and sales do not prove to be significant. Both internal and
external finance are found to be significant determinants of investment, in the study by Rao and Mishra.

The results obtained for the paper industry, in the present study, are similar to the results obtained by Krishnamurthy and Sastry in that sales and internal finance do not prove to be significant. In the present study however, external finance does not prove to be a significant determinant of the speed of adjustment. Though both finance variables are significant determinants of investment behaviour in the study by Rao and Mishra, neither of the finance variables proves to be significant in the present study.

Compared to the aggregate manufacturing sector, for the Paper industry too, relative prices are the most important determinant of investment behaviour. Neither of the finance variables however, are found to be significant determinants of the speed of adjustment.
4.6 The Cement Industry

The OLS estimates obtained for alternate specifications for the data representing the behaviour of the Cement industry, are presented in Appendix B. Table 4.6 presents the summary measures attained by each of the alternative specifications, along with statistics indicative of their predictive capacities.

The first two lines of Table 4.6 represent the estimates given by the application of the accelerator theory to the sample data. Insignificant difference in their respective $R^2$ and SEE estimates, and in the dimension of their DW statistics, makes it difficult to choose between these two alternatives. The $U$ coefficients are also of similar dimensions and both equations track four of the fourteen turning points correctly. As the inclusion of the change variable in 4.6.(ii) does not improve either the summary measures, or the forecast error measures, 4.6.(i) is preferred.

Line 3 represents the estimates given by the application of the residual funds specification to the sample data. Compared to this specification, 4.6.(i) gives a better explanation of investment for the sample period. 4.6.(i) accounts for 32.5 percent explanation, whereas 4.6.(iii) accounts for only 24 percent explanation. This better performance of 4.6.(i) is also indicated by the SEE estimates.
of the two equations, which are 0.0412 and 0.0436 respectively.
The error terms of both the specifications are serially correlated.
Regarding their predictive capacities, the U coefficient of 4.6.(i)
is 1.049, whereas in the case of 4.6.(iii), it is of the order of
1.252. Both equations track four of the fourteen turning points
correctly.

The next four lines of Table 4.6 represent the estimates given by
the application of the relative price specification, to the sample
data. An examination of the four alternate equations reveals that
4.6.(v) gives the best results. This equation accounts for 46
percent explanation, whereas the three alternates, 4.6.(iv),
4.6.(vi) and 4.6.(vii) account for 29 percent, 24 percent and 37
percent respectively. The error terms of all the four equations
are serially correlated as is apparent from their respective DW
statistics. Turning to their predictive capacities, while the
U coefficient of 4.6.(v) is of the order of 0.967, in the case of
4.6.(iv), 4.6.(vi) and 4.6.(vii), it is 1.082, 1.142 and 1.030
respectively. Similarly, while 4.6.(v) tracks five of the fourteen
turning points correctly, the three alternatives track two, three
and four turning points respectively. This equation 4.6.(v) is
also preferable to 4.6.(i). Equation 4.6.(v) accounts for 46
percent explanation, and the SEE estimate is 0.0378, whereas 4.6.(i)
accounts for only 32 percent explanation, and the SEE estimate in this case is 0.0412. The error terms of both the equations are serially correlated. Regarding their predictive capacities, the U coefficient of 4.6.(v) is 0.967 and it tracks five of the fourteen turning points correctly, whereas 4.6.(i) tracks four turning points correctly, and the U coefficient is 1.049.

The speed of adjustment is not assumed to be a constant in the last four lines of this table. An examination of the four alternatives reveals that 4.6.(ix) is the best. This equation accounts for 62 percent explanation, whereas the three alternatives 4.6.(viii), 4.6.(x) and 4.6.(xi) account for 55 percent, 56 percent and 56 percent respectively. The SEE estimate in the case of 4.6.(ix) is of the order of 0.0318, it is of the order of 0.0414, 0.0410 and 0.0342 respectively, in the case of the three alternatives. The error terms of all the four equations are serially correlated.

Turning to their predictive capacities, while the U coefficient of 4.6.(ix) is 0.999, in the case of the alternatives it is 1.203, 1.197 and 1.158 respectively. Similarly, 4.6.(ix) tracks eight of the fourteen turning points correctly, whereas 4.6.(viii), 4.6.(x) and 4.6.(xi) track only four, five and three turning points respectively. Equation 4.6.(ix) is also preferable to 4.6.(v). The two equations account for 62 percent and 46 percent explanation respectively. The error terms of both the equations are serially
correlated. Turning to their predictive capacities, the U coefficient of 4.6.(ix) is 0.999, and it tracks eight of the fourteen turning points correctly, whereas 4.6.(v) tracks only five turning points correctly, and the U coefficient is 0.967.

A cross comparison of the results discussed so far indicates that of the alternative theoretical basis that have been identified as the plausible explanations of the observed behaviour, 4.6.(ix) is identified as the best. This comparison also reveals that for the Cement industry, the alternative theoretical frameworks of investment behaviour can be ranked in the following order:

1) The theory wherein the speed of adjustment is a function of external finance, and sales determine the desired level of capital stock.

2) The Relative Price Theory (excluding capital gains).

3) The Accelerator Theory.

4) The Residual Funds Theory, and the Relative Price Theory (including capital gains).

The OLS estimates for the parameter coefficients of the specification that has been identified as the best, namely 4.6.(ix), are presented below, along with the t-statistics.
\[ I_t = 0.0237 + 0.2470 S_{t-1} - 0.0982 K_{t-1} + 0.8239 \Delta EF_{t-1} \]
\[
\begin{array}{l}
(0.2226) (3.9521) (2.3101) (4.0002)
\end{array}
\]
\[ R^2 = 0.6166 ; \quad SEE = 0.0318 ; \quad DW = 1.1425 \]

The signs of the estimates presented herewith indicate that all four coefficients have attained the expected signs, with the coefficient of capital stock being negative, and the coefficients of sales and external finance having positive signs.

In their study of the investment behaviour of the Cement industry, Krishnamurthy and Sastry find only the flow of net external finance to be a significant determinant. The sales variable and retained earnings do not prove to be significant.

In the present study, the analysis of the Cement industry's investment behaviour brings out the importance of sales as a determinant of investment behaviour. In this respect the results of the present study differ from the results obtained by Krishnamurthy and Sastry, where sales do not prove to be significant.

Compared to the aggregate manufacturing sector, the Cement industry exhibits a different investment behaviour. While relative prices are the most important determinants with sales being secondary, for
the manufacturing sector, in the case of the Cement industry, it is
sales which is the most important determinant of investment
behaviour, with relative prices being next in importance. In the
case of both aggregate manufacturing and the Cement industry,
external finance rather than internal finance, determines the speed
of adjustment.

4.7 The Sugar Industry:
The summary measures and the forecast measures obtained for the
alternate specifications based on data pertaining to the sugar
industry, are presented in Table 4.7.

An examination of the first two lines of this table reveals that of
the two alternatives that have been taken to represent the
accelerator theory, 4.7.(ii) gives a better performance. This
specification accounts for 11.4 percent explanation and has an SEE
estimate of 0.0296, whereas 4.7.(i) accounts for 9.3 percent
explanation, and in this case, the SEE estimate is 0.0292. The
error terms of both the equations are serially correlated, their
DW statistics being 1.255 and 1.262 respectively. The U coefficient
of 4.7.(ii) is 1.014, and it tracks three of the thirteen turning
points correctly. In the case of 4.7.(i), the U coefficient is
1.005, and it does not track even one turning point correctly.
Line 3 represents the estimates given by the application of the residual funds specification to the sample data. This equation gives a better explanation compared to 4.7.(ii). 4.7.(iii) accounts for 13.7 percent explanation, whereas the alternative 4.7.(ii) accounts for 11.4 percent explanation. The error terms of both the equations are serially correlated. Regarding their predictive capacities, while the U coefficient of 4.7.(iii) is 0.898, it is of the order of 1.014 in the case of 4.7.(ii). The former equation tracks seven of the thirteen turning points correctly, whereas 4.7.(ii) tracks only three turning points.

The next four lines in this table present the estimates obtained by the application of the relative price specification to the sample data. Of the four alternatives considered, 4.7.(v) gives the best results. This specification accounts for 33.3 percent explanation, whereas the alternatives 4.7.(iv), 4.7.(vi) and 4.7.(vii) account for only 11.3 percent, 10.8 percent and 13.4 percent respectively. The error terms of all the four equations are serially correlated, as is indicated by their respective DW statistics. Regarding their predictive capacities, the U coefficient of 4.7.(v) is 0.925, and it tracks seven of the thirteen turning points correctly. The three alternatives 4.7.(iv), 4.7.(vi) and 4.7.(vii) track three, two and four turning points respectively, and their respective U coefficients
are 1.005, 1.019 and 1.015. Compared to 4.7.(iii), a better explanation is given by 4.7.(v). While the latter specification accounts for 33.3 percent explanation, the former accounts for only 13.7 percent explanation. This better performance of 4.7.(v) is further indicated by their respective SEE estimates, which are 0.0257 and 0.0286. The error terms of both the equations are serially correlated. Both the equations track seven of the thirteen turning points correctly, and while the U coefficient of 4.7.(v) is 0.924, it is of the order of 0.898 in the case of 4.7.(iii).

The last four equations of this table represent the estimates obtained by the application of the assumption that the speed of adjustment is a function of finance variables. An examination of the results given by the four alternatives indicates that 4.7.(xi) gives the best performance. This specification accounts for 26.8 percent explanation, whereas the first three alternatives 4.7.(viii), 4.7.(ix) and 4.7.(x) account for 15.8 percent, 22.2 percent, and 14.4 percent respectively. The SEE estimates of the four equations are 0.0292, 0.0277, 0.0291 and 0.0269 respectively. The error terms of 4.7.(ix) and 4.7.(xi) are not serially correlated, the DW statistics in the case of 4.7.(viii) and 4.7.(x) are 1.170 and 1.230 respectively, implying that the error terms are serially correlated. Turning to their predictive capacities, while the
U coefficient of 4.7.(xi) is 1.159, it is of the order of 0.882, 1.142 and 0.907 respectively, in the case of the three alternatives 4.7.(viii), 4.7.(ix) and 4.7.(x). The four equations track seven, six, seven and five turning points respectively. Equation 4.7.(v) gives a better explanation of investment for the sample period compared to 4.7.(xi). The former equation accounts for 3.33 percent explanation, whereas the latter accounts for only 26.8 percent. The error terms of 4.7.(v) are serially correlated, whereas those of 4.7.(xi) do not face the problem of serial correlation. In terms of their predictive capacities, the U coefficients of 4.7.(v) and 4.7.(xi) are 0.925 and 1.159, and they correctly track seven and five of the thirteen points respectively.

Of the alternative specifications that have been considered for the sugar industry, equation 4.7.(v) is found to be the best explanator of the investment behaviour of this industry. A cross comparison of the results also reveals that for the behaviour indicated by the Sugar industry, the alternative theoretical frameworks can be ranked in the following order:

1) The Relative Price Theory (excluding capital gains)

2) The theory wherein the speed of adjustment is a function of finance, and relative prices (excluding capital gains) determine the desired level of capital stock.
3) The Residual Funds Theory.
4) The Accelerator Theory.
5) The Relative Price Theory (including capital gains).

The OLS estimates obtained for the parameter coefficients of the specification that has been identified as the best, namely the one labelled as 4.7. (v), are presented below:

\[
I_t = 3.3622 - 0.0105 \left( \frac{P_t Q_t}{C_t} \right)_{t-1} + 0.0281 \Delta \left( \frac{P_t Q_t}{C_t} \right)_{t-1} + 0.0743 K_{t-1}
\]

\[(2.0995) (1.4840) (2.6369) (5.1997)\]

\[R^2 = 0.3334; \quad \text{SEE} = 0.0257; \quad DW = 1.0618\]

The signs of the parameter estimates presented above indicate that the coefficients of the relative price and capital stock variables have the opposite sign. The variable, change in relative prices, which proves to be a significant determinant of investment, has the right sign.

Krishnamurthy and Sastry in their study of the Sugar industry find both the finance variables to be significant determinants of investment, with sales proving to be insignificant. Rao and Mishra in their study, also arrive at similar conclusions.
In the present study too, the sales variable is not a significant determinant of the investment behaviour of the Sugar industry. Both the finance variables prove to be significant determinants, with external finance being the important determinant of the speed of adjustment.

The sugar industry exhibits an investment behaviour similar to the aggregate manufacturing sector in that relative prices are the most important determinants of investment behaviour. Also, external finance plays a significant role in determining the speed of adjustment.

4.8 The Rubber and Rubber Products Industry

The OLS estimates obtained for the alternate specifications for data representing the behaviour of the Rubber and Rubber Products industry, are presented in Appendix B. The summary measures, along with statistics indicative of their predictive capacities, are presented in Table 4.8.

An examination of the first two lines of Table 4.8 reveals that of the two alternative specifications that have been taken to represent the accelerator theory, equation 4.8.(i) gives better results. This equation accounts for 18.3 percent explanation,
compared to 19.2 percent accounted for by 4.8.(ii). The SEE estimates of the two equations are 0.0638 and 0.0649 respectively. The DW statistic for the two specifications is 1.708 and 1.653 respectively, implying that the error terms of both the equations are not serially correlated. Turning to their predictive capacities, while the U coefficient of 4.8.(i) is 0.888, and it tracks five of the eleven turning points correctly, 4.8.(ii) tracks four turning points correctly, and in this case, the U coefficient is 0.852.

Compared to equation 4.8.(iii) which considers the residual funds specification, 4.8.(i) gives better results. 4.8.(i) accounts for 18.3 percent explanation, whereas 4.8.(iii) accounts for only 6.8 percent. The error terms of both the equations are not serially correlated. Both equations track five of the eleven turning points correctly, and the U coefficient of 4.8.(iii) is greater than one.

The next four lines of Table 4.8 present the results obtained by the application of the relative price specification to the sample data. Insignificant difference in the magnitudes of their respective $R^2$ and SEE estimates, and in the dimension of their DW statistics, makes it difficult to choose between the four alternatives. Compared to these four alternative, 4.8.(i) gives a better explanation of investment for the sample period. The superiority
of 4.8.(i) is indicated in terms of both the summary measures and forecast error measures.

The last four lines of this table present the results obtained when the speed of adjustment is assumed to be a function of finance variables. Of the four alternatives considered, 4.8.(ix) gives the best results. This equation accounts for 19.2 percent explanation of investment for the sample period, whereas the three alternatives, 4.8.(viii), 4.8.(x) and 4.8.(xi) account for 18.8 percent, 7.8 percent and 5.1 percent respectively. The error terms of all the four equations are not serially correlated, the DW statistics being of the order of 1.759, 1.738, 1.920, and 1.810 respectively. Regarding their predictive capacities, 4.8.(ix) tracks six of the eleven turning points correctly, and the U coefficient is 0.872. The three alternatives 4.8.(viii), 4.8.(x) and 4.8.(xi) track four, five and seven turning points respectively, and their respective U coefficients are 0.899, 0.991 and 0.941. In terms of both the summary measures, and measures of predictive capacity, 4.8.(ix) is preferred to 4.8.(i).

A cross comparison of the results discussed so far indicates that of the alternative theoretical basis that have been identified as the plausible explanations of the observed behaviour, 4.8.(ix) is considered to be the best. This comparison also reveals that for
the behaviour undertaken by the Rubber and Rubber Products industry, the alternate theoretical frameworks can be ranked in the following order:

1) The specification wherein the speed of adjustment is a function of finance, and sales determine the desired level of capital stock.

2) The Accelerator Theory.

3) The Residual Funds Theory.

4) Both versions of the Relative Price Theory, i.e., both excluding and including capital gains in the estimation of relative prices.

The OLS estimates obtained for the parameter coefficients of the specification that has been identified as the best, i.e. 4.8(ix), are presented below:

\[ I_t = 0.1280 + 0.0448 S_{t-1} - 0.0351 K_{t-1} + 0.0664 \Delta EF_{t-1} \]

\[ (0.6298) \quad (2.0338) \quad (0.4555) \quad (0.4617) \]

\[ R^2 = 0.1916 ; \quad SEE = 0.0650 ; \quad DW = 1.7380 \]

The signs of the estimates presented herewith indicates that all the coefficients have obtained the right signs, with the capital stock variable having a negative sign, and both the sales and finance variables having a positive sign.
The investment behaviour of the Rubber industry differs significantly from the behaviour exhibited by the aggregate manufacturing sector. In the case of the rubber industry, sales is the most important determinant of investment behaviour with retained earnings being the next most important determinant. Relative prices prove to be insignificant. Neither of the finance variables determine the speed of adjustment in the case of the rubber industry. For the aggregate manufacturing sector, relative prices are the most important determinant of investment behaviour, and external finance determines the speed of adjustment.

4.9 The Cotton Textiles Industry

The OLS estimates obtained for alternate specifications for data representing the behaviour of the cotton textiles industry, are presented in Appendix B. Table 4.9 contains the summary measures and measures of predictive capacity, obtained for the alternate specifications.

The first two lines of Table 4.9 consider the accelerator theory of investment. Of the two alternatives considered to represent this theory, 4.9.(ii) offers a better explanation. This specification accounts for 44.3 percent explanation, and the $\text{SEE}$ estimate is 0.0171. The alternative 4.9.(i) accounts for 41.7 percent explanation,
and the SEE estimate in this case is 0.0172. The error terms of both 4.9.(i) and 4.9.(ii) are serially correlated, their respective DW statistics being 1.400 and 1.452. Regarding their predictive capacities, the U coefficient of 4.9.(i) is greater than one. Similarly, 4.9.(ii) tracks six of the fourteen turning points correctly, whereas 4.9.(i) tracks only four turning points correctly.

The estimates given by the application of the residual funds specification to the sample data, are presented in line 3 of this table. 4.9.(ii) gives a better explanation compared to 4.9.(iii). 4.9.(ii) accounts for 44.3 percent explanation, whereas 4.9.(iii) accounts for only 15.3 percent explanation. The error terms of both the equations are serially correlated. In terms of their predictive capacities, the U coefficient of 4.9.(iii) is greater than one, and this equation tracks only three turning points correctly.

The next four lines of Table 4.9 present the estimates obtained by the application of the relative price theory to the sample data. Of the four alternatives considered 4.9.(v) gives the best explanation. This equation accounts for 32.5 percent explanation of investment for the sample period, whereas the three alternatives 4.9.(iv), 4.9.(vi) and 4.9.(vii) account for 25.4 percent, 14.7 percent, and 19.1 percent respectively. The SEE estimate of 4.9.(v) is 0.0189, whereas it is of the order of 0.0194, 0.0208 and 0.0207 in the case
of the three alternatives. As indicated by their respective 
DW statistics, the error terms of all the four equations are 
serially correlated. Equation 4.9. (v) tracks five of the fourteen 
turning points correctly, and the three alternatives track five, 
eight and three turning points respectively. Compared to 4.9. (v), 
equation 4.9. (ii) offers a better explanation. The latter equation 
accounts for 44.2 percent explanation, whereas the former accounts 
for only 32.5 percent. The SEE estimate of 4.9. (ii) is 0.0171, 
whereas in the case of 4.9. (v) it is 0.0189. The error terms of 
both the equations are serially correlated. Regarding their 
predictive capacities, 4.9. (ii) tracks six of the fourteen turning 
points correctly, and the U coefficient is 0.986. In the case of 
4.9. (v), the U coefficient is greater than one, and this equation 
tacks five turning points correctly.

In the last four equations of Table 4.9, the speed of adjustment is 
assumed to be a function of finance variables. Of the four 
alternatives considered, 4.9. (viii) gives the best explanation. 
This equation accounts for 43.1 percent explanation, and the SEE 
estimate is 0.0176. The three alternatives 4.9. (ix), 49. (x) and 
4.9. (xi) account for 42.1 percent, 28.1 percent and 25.4 percent 
respectively, and their respective SEE estimates are 0.0175, 0.0195 
and 0.0199. The error terms of all the four equations are serially 
correlated. With the exception of equation 4.9. (ix), the U coefficient
of the three alternates is greater than one. Similarly, while 4.9.(viii) tracks five of the fourteen turning points correctly, the three alternates track four, four and five turning points respectively. Compared to 4.9.(viii), equation 4.9.(ii) is preferable. 4.9.(ii) accounts for 44.3 percent explanation and the SEE estimate is 0.0171, whereas 4.9.(viii) accounts for 43.1 percent explanation and the SEE estimate in this case is 0.0174. In the terms of their predictive capacities, the $U$ coefficient of 4.9.(viii) is greater than one.

A cross comparison of the results discussed so far indicates that of the alternative theoretical basis that have been identified as the plausible explanations of the observed behaviour, 4.9.(ii) gives the best results.

This comparison also reveals that for the behaviour undertaken by the Cotton Textiles industry, the alternative theoretical frameworks could be ranked in the following order:

1) The Accelerator Theory.

2) The theory under which the speed of adjustment is taken to be a function of finance, and sales determine the desired level of capital stock.
3) The Relative Price Theory (excluding capital gains)

4) The Relative Price Theory (including capital gains).

5) The Residual Funds Theory.

The OLS estimates obtained for the parameter coefficients of the specification that has been identified as the best, namely, the one labelled as 4.9(iii), are presented below:

\[ I_t = -7.3574 + 0.0862 S_{t-1} + 0.0714 \Delta S_{t-1} - 0.0172 K_{t-1} \]

\[ (1.2058) \quad (2.8497) \quad (0.9850) \quad (0.6890) \]

\[ R^2 = 0.4429 \; ; \; \; \text{SEE} = 0.0172 \; ; \; \; \text{DW} = 1.4518 \]

The signs of the estimates presented herewith indicates that all the coefficients have attained the expected signs, with the capital stock variable being negatively related, and both the sales variables having a positive sign.

From their analysis of the investment behaviour of the Cotton Textiles industry, KrishnaMurthy and Sastry find both the finance variables to be significant determinants. The accelerator variable however proves to be insignificant. Rao and Mishra also arrive at similar results.
For the Cotton Textile industry, the results obtained by Krishnamurthy and Sastry, and Rao and Mishra differ greatly from those obtained in the present study. Sales is the most important determinant of investment behaviour in the present study. Internal funds do not prove to be a significant determinant of investment, and the speed of adjustment is not influenced by either of the finance variables.

The Cotton Textiles industry exhibits an investment behaviour very different from that of the aggregate manufacturing sector. While relative prices are the most important determinant in the case of aggregate manufacturing, in the case of the Cotton Textiles industry, sales are the most important. Also, for the Cotton Textile industry, neither of the finance variables influences the speed of adjustment.

4.10 The Expost Forecasts

In this section an attempt is made to test the validity of the models discussed so far. Data pertaining to the period 1950-51 to 1977-78 is used to identify the determinants of investment behaviour for the sample industries. Testing of the models obtained based on the above data is carried out by comparing the estimated value of investment, obtained for each of the alternative specifications, as against the actual value for the subsequent year 1978-79.
The results in a summary form, giving the percentage deviation of the estimated values from the actuals for each industry, and for aggregate manufacturing, are presented in Table 4.10 in Appendix A. This analysis is carried out for four industries, namely the Engineering, Chemicals, Cement and Cotton Textiles industries. The analysis is restricted to only these four industries because satisfactory results are obtained for these industries. The alternative specifications are unable to offer a good explanation of investment for the sample period in the case of the Sugar, Rubber and Paper industries.

For the manufacturing sector, as can be seen from Table 4.10, the ex post forecasts given by the alternative specifications deviate from the actual values by quite a large percentage. This could be due to the fact that the manufacturing sector is actually an aggregate of several individual industries. However, within the manufacturing sector, the ranking of the alternative theoretical frameworks is maintained. The theory wherein the speed of adjustment is a function of finance variables gives the best forecasts, with the lowest percentage deviation of the forecasts from the actuals. This theory is followed by the relative price theory (estimated excluding capital gains), with the accelerator theory being the third most important determinant of investment. The specifications which describe the residual funds theory and the relative price
theory (estimated including capital gains) give forecasts with the highest deviation of the forecast values from the actual.

The ex post forecast errors obtained for the engineering industry are presented in the second column of Table 4.10. For this industry too, as was the case for the manufacturing sector, the best forecasts are given by the specifications which are based on the theory wherein the speed of adjustment is assumed to be a function of finance variables. The relative price theory (excluding capital gains) and the accelerator theory rank next best, with the relative price theory (including capital gains) giving the poorest ex post forecast. In the case of the engineering industry, the percentage deviation of the estimated forecasts from the actual values, is however lower than the values obtained for the manufacturing sector.

For the Chemical industry, it is difficult to make a clear choice between the alternative specifications, based on ex post forecast errors alone. All the specifications based on the accelerator theory, the relative price theory (excluding capital gains), and the theory wherein the speed of adjustment is a function of finance variables, have similar magnitudes of ex post forecast errors. The percentage deviations of the estimated values from the actual value is however quite low on the whole, ranging between 10 percent and 12 percent.
In the case of the Cement industry, the best ex post forecast is given by the specifications based on the accelerator theory. The specifications which are based on the assumption that the speed of adjustment is a function of finance variables, and the desired level of capital stock is determined by sales, give equally good ex post forecasts. It is difficult to rank the forecasts obtained by the specifications based on the residual funds theory, and both versions of the relative price theory. They are however inferior to the forecasts given by the specifications based on the accelerator theory.

The specifications based on the accelerator theory, followed by the theory wherein the speed of adjustment, is a function of finance variables, give the best ex post forecasts in the case of the Cotton Textiles industry. These two theories are followed by the specifications based on both versions of the relative price theory. In the case of the specification based on the residual funds theory, the percentage deviation of the estimated values from the actual value is as high as 31 percent. For the specifications based on the accelerator theory, the percentage deviation is of the order of 18 percent and 16.8 percent respectively.
4.11 Some Inferences

From the analysis carried out so far, at the level of the aggregate manufacturing sector, and at the level of the seven industries considered in this study, one definite conclusion arrived at is that there do exist differences in investment behaviour between the industries, and also in comparison to the aggregate manufacturing sector. While relative prices are the most important determinant of investment behaviour in the case of aggregate manufacturing, Chemicals, Engineering, Paper and Sugar industries, it is sales which is the dominant determinant in the case of the Cement, Rubber and Cotton Textile industries. Also external finance influences the speed of adjustment in the case of aggregate manufacturing sector, Chemicals, Cement and Rubber industries. Both finance variables play a significant role in the case of the engineering industry. For the Sugar, Paper and Cotton Textiles industries, the speed of adjustment is not influenced by either of the finance variables.

Though no one single specification can be chosen as the best, and used for purposes of generalisation, the analysis brings out that relative prices are a significant determinant of investment behaviour. Another conclusion is that external finance proves to be the more important constraining factor regarding the speed of adjustment, as compared to the availability of internal finance.
The results obtained in this chapter substantiate the results obtained in the studies by Evans and Rosek that the variables determining investment behaviour differ between industries, and there is therefore a need for further disaggregated analysis.