2.1 A Review of the Western Literature

A considerable volume of theoretical and empirical literature on the determinants of business investment has appeared over the last few decades. A number of important advancements have been made with respect to both theory and measurement. Inspite of the vast volume of existing literature, there still exists a lack of consensus regarding the relative importance of the explanatory variables. In this chapter an attempt has been made to briefly review the existing literature, with a view to achieving a better insight into the problem.

The starting point for all discussions relating to investment demand is the hypothesis that net additions to capital stock would be decided in relation with the desired level of capital stock. The specification of the factors that determine the desired level of capital stock has occupied the core of all analytical discussions. Of the early works that have dealt with this question, the most systematic is that of Clark (1917)\(^1\). Working under the assumption that the desired capital stock is a constant proportion of output, Clark hypothesized that the investment expenditure over a period

will be a simple linear function of the output. That is if \( I, K, K^* \), and \( O \) represent net investment, observed capital stock, desired capital stock and observed output levels respectively,

\[
I_t = K^*_t - K^*_{t-1} = K_t - K_{t-1} = b \left( O_t - O_{t-1} \right)
\]

where \( b \) is a positive constant.

Underlying the above exposition, which is generally referred to as the Naive or Rigid Acceleration theory, are the two assumptions viz: (i) the firms are always in equilibrium, (that is, there is no excess capacity), and (ii) the supply of capital goods is infinitely elastic so that adjustment is possible without lags. In reality neither of these assumptions can be considered reasonable. The technological, administrative and other similar constraints often suggest the occurrence of some delays in the capital stock adjustment process. These delays suggest that the investment expenditure of a period is dependent not only on the relationship between desired and actual stock, but also on the time pattern and speed of adjustment of desired to actual stock.

If \( b \) represents the speed of adjustment, \( I_t, K^*_t \) and \( K_t \) represent respectively the net investment expenditure, desired capital stock and realised capital stock, the flexible accelerator model can be presented mathematically as:

\[
I_t = b \left( K^*_t - K_{t-1} \right); \quad 0 \leq b \leq 1
\]

where \( t \) represents the time parameter.
If $b$ is equal to one, the entire gap between desired and actual stock will be eliminated within year $t$. However, if $b$ is less than one, only a fraction of the adjustment will be completed during the year. In the latter case, a once-for-all increase in desired capital will result in a gradual approach of capital stock to the new long-run equilibrium level. That is, the investment response will be distributed over a number of years.

The unobservable nature of $K^*$ suggests that the empirical estimation of $b^*$ is feasible if and only if the determinants of $K^*$ are known a priori. It is on the specification of these determinants that researchers have been debating since the publication of the celebrated work of Chenery (1952)$^2$.

Chenery assumed the desired level of capital stock to be a function of capacity utilisation. He compared these results with those obtained when capital stock is assumed to be proportional to output. Koyck (1954)$^3$ while introducing the concept of distributed lags, also assumes the level of desired capital stock to be proportional to output. From his results Koyck infers that the reaction of capital stock to output is

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clearly present, and the speed of reaction is greater in more rapidly growing industries, and is more rapid in years of expansion, than in years of contraction.

In his studies, Eisner (1960\(^4\), 1967\(^5\), 1977\(^6\)) assumes desired capital stock to be a function of sales. Eisner includes both sales and output under the accelerator theory, but he finds that the sales variable is a better explainer of investment behaviour. Eisner estimates output as the sum of sales and the change in inventory. Eisner's analysis is based on the assumption that for a firm initially in equilibrium, it pays to increase the stock of capital for permanent increases in sales. From his analysis, Eisner (1977) finds that the bulk of net investment in plant and machinery is accountable to sales. He concludes that changes in sales and expected changes in sales prove to be the major determinants of capital expenditure and investment.

Within the accelerator theory therefore, while Chenery employs the capacity utilisation and output variables, Koyck employs only the

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output variable. Eisner compares the output, capacity utilisation, and sales variables, and finds that among the three alternates the sales variable gives the best results.

In two of their works, Meyer and Kuh (1955\textsuperscript{7} and 1966\textsuperscript{8}), criticize the accelerator theory and argue for the overriding importance of profits as a determinant of investment. They emphasize that the accelerator theory is applicable only when there is plentiful liquidity, which is often not the case in reality. Their Profits/Liquidity theory assumes that the optimum stock of capital is some function of the level of expected profits, expected profits in turn being a function of past profits. Meyer and Kuh\textsuperscript{9} argue that their "empirical work suggests a variety of conclusions, but all converge in their emphasis upon the importance of internal liquidity." While criticizing the accelerator theory, Meyer and Kuh\textsuperscript{10} conclude that "the absolute sales variable appears to be something of a hybrid, measuring both accelerator and liquidity concepts, and on the whole doing an inferior job in both instances." Re-emphasizing the significance of the liquidity concept, vis-à-vis sales, Meyer and Kuh asset that plentiful liquidity of all the

\begin{itemize}
  \item \textsuperscript{8} J Meyer and E Kuh, "The Investment Decision: An Empirical Study" (Cambridge; Massachusetts: Harvard University Press, 1966)
  \item \textsuperscript{9} Ibid - p.190
  \item \textsuperscript{10} Op cit - p.225
\end{itemize}
basic assumptions seems most essential to the accelerator's effectiveness, and that once liquidity becomes somewhat pinched, the availability of funds becomes a crucially important determinant of investment outlay, in and of itself.

Irving Morrissett (1957) and later Eisner and Strotz (1965), in a critical analysis of the works of Meyer and Kuh, conclude their critique in favour of the accelerator theory, as against the profits theory. To quote Eisner and Strotz, "the higher relative correlation with accelerator variables in years of expansion, and higher correlation with 'liquidity' variables in years of decline are consistent with the accelerator theory which works best in times when there is little excess capacity."

Another attack on the profit theory is the study by Grunfeld (1960). What is required according to Grunfeld is a variable that can be objectively measured, and that will represent all the relevant information on beliefs and expectations about the future, and hence


provide a good explanation of investment behaviour. Grunfeld concludes from his analysis that his results do not confirm the hypothesis that profits are a good measure of those expected profits that will tend to induce investment expenditures. According to him, the variable termed as the "market value of the firm" meets the needed requirements.

In his subsequent studies, Kuh (1963 and 1971) supports the accelerator theory, vis-à-vis the profits theory. He concludes on the basis of his analysis that "received doctrine which emphasize the gradual adjustment of the capital stock to a desired level dependant on expected output levels and lagged capital stock provides the greater part of empirical substance. Nevertheless, internally generated funds or profits appear to have an observable effect on investment for given levels of output, capital stock and interest rates, though a subordinate one. On both prior and posterior grounds, both motivations seem relevant, acceleration being dominant, and expost profits on the whole secondary." While testing for the goodness of fit of alternate equations, Kuh states, "extremely little predictive power would be gained from including profits

16 Ibid - p. 266
with sales, and the remaining explanatory variables. Additional of sales, reduces the unexplained variance more frequently than the addition of profits."\(^{17}\)

The superiority of the accelerator model over the profits/liquidity model is further brought out in the works of Kopoke (1977)\(^ {17}\) and Smyth (1978)\(^ {19}\). In his survey of business fixed investment, Smyth supports the accelerator theory by stating that "Statistical studies unfavourable to the principle have typically used crude formulations and unsatisfactory methods of analysis, but more sophisticated models and analytical models have usually produced results favourable to the acceleration principle."

The studies considered so far have not considered the impact of relative prices on investment. Jorgenson introduces this concept in empirical analysis. To quote Jorgenson,\(^ {20}\) "the central feature of the Neo-classical in relative factor prices, or the ratio of factor prices to the price of output. This feature is entirely absent from the econometric literature

\(^{17}\) Opcit - p. 230


on investment." This emphasis on the importance of relative factor prices is the essence of all of Jorgenson's work (1963, 1967, February, April 1967, 1968, 1969, 1971). Among the major critics of Jorgenson's work are Eisner and Nadiri (1968) and Smyth (1968). To quote Smyth, "Jorgenson's approach is very popular and many economists would regard it as "the" theory of investment. However, it is subject to a number of major criticisms that seem strong enough to make it untenable." Both the studies of Eisner and Nadiri, and


28 Op cit - p.21-70.
Smyth emphasize the superiority of the accelerator principle over the Neo-classical principle. Smyth's conclusion is "we must have considerable reservations about the validity of the Jorgenson Neo-classical model."

The conclusions reached at by the two above studies have been substantiated by the works of Nelson, Neumann and Crandall (1980)\textsuperscript{30}, and Eaton and Boatwright (1973)\textsuperscript{31} who also emphasize the superiority of the accelerator model over the neo-classical model.

"A better explanation of fluctuations in manufacturing investment," according to Anderson (1964)\textsuperscript{32}, "can be obtained from a model which includes measures of financial risk and monetary tightness, than from a model which does not include these variables." Anderson tries specifically to show that there is strong evidence that investment expenditure is affected by interest rates and financial risk, as well

\textsuperscript{29} Op cit - p.21-73.
\textsuperscript{32} Locke Anderson, "Corporate Finance and Fixed Investment: An Econometric Approach," (Harvard University, Division of Research, Graduate School of Business Administration, 1964), p.62.
as by capacity utilisation and profits variables suggested in previous empirical studies. In his view one need not necessarily adopt an "either-or" position with respect to the acceleration-cost of funds controversy. Anderson\(^{33}\) concludes, "It is clear that a satisfactory explanation of fluctuations in manufacturing investment during the post-war period is given by a model which includes measures of capacity utilisation, funds flow, financial risk, and market cost of funds".

Other studies which include financial variables along with the list of possible explanatory variables are those of Resek (1966)\(^ {34}\), Bennett (1966)\(^ {35}\) and Evans (1967)\(^ {36}\). The results obtained by these three studies corroborate Anderson's (1964) findings.

All the studies discussed so far have assumed \( \lambda \), the speed of adjustment, to be a constant. This assumption of constancy has been questioned in recent years. To quote Smyth (1978)\(^ {37}\), "one possibility

\[33\] Ibid - p.88


\[37\] Op cit - p. 21-30.
is that liquidity does not directly influence the desired level of capital stock, but acts on the speed of adjustment of actual capital stock to the desired level. A measure of liquidity is thus generally viewed as a constraint on the volume of investment, rather than as a determinant of the optimum stock of capital.

Much emphasis has been laid in recent years on the question of \( \lambda \), the speed of adjustment, being a function of finance variables. Eisner and Strotz (1963)\(^{38}\) for example state that "one aspect of the cost of more or less rapid expansion will be the availability of funds. If the financial capital market is significantly imperfect, it may be more economical for the expanding firms to rely upon internal sources of funds, and the expansion will then be paced to some extent by the rate at which funds become available."

Coen (1971)\(^{39}\) states that "the role of cash flow would seem most important in determining the speed at which discrepancies between the desired and optimum stocks of capital are eliminated. What is suggested is that the speed of adjustment be taken not as a constant, but as a function of cash flow, which is assumed to measure the availability of internal funds."

\(^{38}\) Op cit - p.125

Thus a model might be written,

$$I_t = b_t (K_t^* - K_{t-1}) + \delta K_{t-1}$$

where $b_t = f(P_t)$

$P_t$ being the level of cash flow during period $t$. Alternatively, the model can be written as

$$I_t = b_t[K_t^* - (1 - \delta)K_{t-1}]$$

Harold Hochman (1966)\textsuperscript{40} has attempted to isolate the role of internal funds in this manner. Hochman estimates the following relationship,

$$I_t = b_0 + b_1 \frac{P_{t-1}}{K_t^* - (1 - \delta)K_{t-1}} [K_t^* - (1 - \delta)K_{t-1}]$$

The firm is assumed to adjust more rapidly the higher the ratio of cash flow to the desired expansion plus replacement. One of the major advantages of the Hochman specification is that it leads to an investment relation whose parameters are easily estimated:

$$I_t = b_0[K_t^* - (1 - \delta)K_{t-1}] + b_1P_{t-1}$$

The one criticism put forward by Coen (1971)\textsuperscript{41} against the Hochman treatment of the adjustment process is that "no constraints are imposed on the adjustment speed."

\textsuperscript{40} Harold Hochman, "Some Aggregative Implications of Depreciation Acceleration," \textit{Yale Economic Essays}, 6 (Spring, 1966), 217-274.\textsuperscript{41} Op cit - p.152
Any attempt to appraise alternative econometric models of investment behaviour on the basis of accepted standards of validity of specification, such as goodness of fit, and absence of autocorrelation in the underlying errors, reveals that the information already available is insufficient to provide a basis for comparison. Working under this presumption the alternative investment function have been fitted to different sub-periods within the post-war period. Some functions have been fitted to deflated data, others to unadjusted, and so on. None of the investment functions can be compared directly with the others for the same data on investment expenditures.

In order to facilitate a comparison between the alternate theories of investment behaviour, Jorgenson and Siebert (1968)\textsuperscript{42} compare five alternative theories of investment behaviour, namely Neo-classical I and II, Accelerator, Expected Profits, and Liquidity. The authors take the flexible accelerator model as the starting point for the study, assuming replacement is proportional to capital stock. The alternative theories of investment behaviour differ in the specification of the desired level of capital. Given a proper specification of the lag structure for each theory, Jorgenson and Siebert are able to discriminate among the alternative specifications of desired capital, and thereby among the alternate theories of investment behaviour.

For their study, Jorgenson and Siebert have chosen a sample of fifteen firms from the Fortune Directory's list of the 500 largest corporations. The firms are chosen from fourteen industry groups. All the firms included are large, but there is considerable variation among them as to size and rate of growth. The study is based on time-series data for the period 1946-1963.

For the accelerator theory, the independent variable chosen is the value of output, measured as sales plus change in inventory stock, deflated by wholesale price index, with 1954 as the base year. Internal funds measured as profits after tax plus depreciation less dividends paid is deflated to 1954 constant prices by dividing the current value of internal funds by the investment goods price index, $q_t$. The market value of the firm is measured as the market value of stocks outstanding plus the book value of debt including short-term liabilities, at the beginning of the period. This measure is reduced to constant 1954 prices by dividing the current market value of the firm by the implicit deflator for gross national product. In the neo-classical theory of investment behaviour, desired capital stock is taken to be equal to the value of output deflated by the price of capital services, $C_t$. The price of capital services depends on the price of investment goods, the cost of capital, and the tax structure.
To provide a basis for comparing alternate theories of investment behaviour, the authors first determine an appropriate specification of the lag between changes in desired capital and investment expenditure under each specification of desired capital. They choose the best lag distribution for each firm from among the general Pascal distributed lag functions. Given the best specification of the generalised accelerator mechanism for each alternative specification of desired capital, Jorgenson and Siebert compare alternative theories of investment behaviour with regards to their ability to explain the investment activity of corporations. The authors have determined the best specification of the distributed lag between changes in desired capital and investment expenditure for each of five alternate theories of investment behaviour, and for each of the fifteen corporations included in the sample. They then compare the alternative specification of desired capital with respect to the explanation of investment behaviour for the fifteen corporations. The relative performance of the alternative specifications provides the criterion for comparison of alternate theories of investment behaviour. The authors have measured relative performance in three different ways. As the first measure they have used the residual variance for the best fitted distributed lag function corresponding to each theory. The theory of investment behaviour that results in the least residual variance provides the best explanation of investment behaviour. This is supplemented by an analysis
of the fitted coefficients. Finally, an alternative measure of
goodness of fit based on the qualitative characteristics of the fitted
distributed lag function is the number of "right" and "wrong" changes
in direction for the fitted value of investment, by comparison with the
actual values.

From their analysis the authors conclude that although the relative
performance of the alternate theories may be measured in a number of
ways, the three measures of relative performance produce an almost
identical ordering of the alternative theories of investment behaviour.
(1) Neo-classical I, (2) Neo-classical II, (3) Expected Profits
(4) Accelerator, and (5) Liquidity.

Jorgenson and Siebert thus conclude emphasizing the overall superiority
of the neo-classical theory as compared to the other considered
alternates.

The limited sample size adopted by Jorgenson and Siebert has led to
some doubts about the reasonableness of their inferences. Elliot (1973)\(^43\)
has criticized the study by Jorgenson and Siebert (1968), with his
criticisms being directed mainly at their sample size. Criticising the

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\(^{43}\) JW Elliot, "Theories of Corporate Investment Behaviour Revisted,"  
sample size in the Jorgenson and Siebert (JS) study, Elliot states that greater meaning may be attached to the JS conclusions either by expanding their time-series to cover more firms, or to conduct their comparison of alternate investment models on a cross-sectional basis.

Data on the JS variables were developed for 184 firms both inside and outside manufacturing. Data on the variables are obtained for the period 1953-1967. One definitional change is however made from the JS definitions relating to deflators. All variables which are not unit free in the JS model are deflated by the firm's total assets. This makes the investment measure a representation of capital intensity rather than direct volume of spending.

The enlarged comparisons reveal that only small differences can be identified in the overall relative importance of the liquidity, accelerator and neo-classical models, while a slight inferiority of the expected profits model to the other three is revealed.

"Thus, the major conclusion of the JS study that the neo-classical model of investment is more effective than the other alternatives, simply does not stand up to the enlarged test, and must now be interpreted as having no general implications beyond their sample. The most relevant explanatory model for individual corporate investment behaviour is not
the neo-classical framework of JS, but an open question in need of more enquiry.44

It can thus be seen that econometric studies in the west have been varied in their approach to the problem of investment behaviour. As can be surmised from the review of western literature, there exists much controversy among the studies, regarding the determinants of investment behaviour, and a consensus is yet to be arrived at.

2.2 Review of Indian Studies:

Existing investment theory has been developed in the context of the United States, and other advanced industrialised countries. Virtually all existing empirical work on investment determinants at the firm or industry level has been based on data from the same countries. Since the social and institutional environment in developing countries differs from that of the industrialised countries in many respects, it is desirable to broaden the examination of investment theory to a developing country like India. An indepth review of the existing literature on investment behaviour in the Indian context is now undertaken to facilitate empirical analysis later in this study.

There have been some attempts in recent years to study the determinants of fixed capital formation in India. These studies can be broadly classified into two groups, namely(i) those based on time-series data

and (ii) those based on cross-section data. In this section an attempt is made to analyse in detail, the time-series studies attempted in the Indian context. The time-series studies include those of Sarkar (1970), Krishnamurthy and Sastry (1975), Swamy and Rao (1975), Sastry (1975), Ram Mohan Rao and Mishra (1976), Johar (1976), Tanwar (1978), Lahiri, Khanna and Vaidyanathan (1978), Rai (1981), and Dixit and Prasad (1981).

Alternate methods of estimation have been used by the studies to carry out the empirical estimation. The studies by Krishnamurthy and Sastry, and Swamy and Rao are based on the simultaneous equations method of estimation. A majority of the studies namely those of Sastry, Tanwar, Rai and Dixit and Prasad use the Ordinary Least Squares Method of Estimation. Rao and Mishra base their analysis on step-wise Regression Analysis, whereas Lahiri, Khanna and Vaidyanathan employ the method of Reduced Form Equations. Both the Ordinary Least Squares Method and a comparison of the correlation coefficients are used by Sarkar, in his analysis. For all the studies, the Reserve Bank of India (RBI) Bulletins and the Bombay Stock Exchange Directory are the two basic sources of data. All the data in the studies of Krishnamurthy and Sastry, Sastry, Tanwar and Rai are at constant prices, whereas Swamy and Rao, and Lahiri, Khanna and Vaidyanathan use the data at current prices.

The study by Sarkar (1970) covers the period 1950-1965 and is based on data from the RBI Bulletins. The study considers the impact of sales,

profits and rate of interest on investment. Sarkar has used the linking-up technique to overcome the problem of changing sample size inherent in the RBI data. In the linking-up technique employed the ratio of the figures on the different variables of the common year in two samples is used to extend the series backwards. Sarkar's analysis is based on the simple correlation coefficients of a simple bivariate relationship. From this analysis he concludes that the profit-investment relationship is more pronounced than the sales-investment relationship for all the industries studied over the period under purview. Sarkar extends his empirical analysis to include distributed lag models for profits and sales change. The results obtained through this analysis further substantiate his previous conclusions. As the distributed lag specifications do not include capital stock as a variable, the basic specification on which the equations are based, is not known. This gives rise to the problem of interpretation of the coefficients. The linking-up technique for overcoming the data predicament makes the questionable assumption that the same ratio holds throughout the time segment.

The study by Krishnamurthy and Sastry (1975) is based on data obtained from the RBI Bulletins, for the period 1955-56 to 1970-71. Gross fixed investment is assumed to be a function of current change in sales, stock

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of gross fixed assets at the beginning of the period, gross retained earnings, the flow of external finance and inventory investment. All the data are expressed at constant 1960-61 prices. Sales is deflated by the output price index, whereas the other variables are deflated by the price index of plant and machinery. This study is based on the simultaneous equation method of estimation, and the investment equation is estimated by the method of the two-stage least squares. In order to overcome the problem of changing sample size inherent in the RBI data, the blow-up factor method is employed in this study.

The time-series results in the study by Krishnamurthy and Sastry suggest the absence of the impact of the accelerator on investment. The finance variables, both internal and external finance, are found to be significant.

As admitted by the authors themselves, the procedure of blowing-up the series by the sample coverage in terms of paid-up capital, imposes certain limitations on the data. Also, the variables included in the investment equations are all present values, implying that investment in year 't' is influenced by sales etc., in the same year 't' itself. How far this is applicable to reality is questionable.

The study by Sastry (1975) covers fifty nine firms from the capital goods industry, over the period 1957-1967. The Bombay Stock Exchange

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directory is the data source. In this study, three alternate specifications are tried. The three relationships are simple and bivariate, with gross investment being defined as a function of sales, gross retained earnings, and outside borrowings respectively. All variables are corrected for price changes. The index number of prices of finished products of machinery and transport equipment with 1952-53 as the base year is used to deflate all the variables. The Ordinary Least Squares method is used to estimate the equations.

The author himself concludes that in view of the short series, no firm conclusions can be drawn. All three considered independent variables prove to be significant determinants of fixed investment. The time-series results in the study by Sastry seem to be subject to the limitations of a short-series and oversimplified specifications.

The study by Swamy and Rao (1975)\(^{48}\) covers the period 1954-1970, the data for which are obtained from the RBI Bulletins. The study by Swamy and Rao attempts an integrated treatment of the flow of funds and their uses. They include both financial variables and stock adjustment variables in their function for fixed investment. The desired level of capital is assumed to be a function of sales, change in sales, and both internal and external finance. All the data are

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considered at current prices. The study is based on the simultaneous equations model, where each equation is estimated by the method of two-stage least squares.

The empirical results obtained by Swamy and Rao establish the usefulness of the accelerator principle, and the importance of both financial variables. Though the authors base their analysis on the stock adjustment model, in the final equation used to estimate fixed investment behaviour, the capital stock variable has been dropped. In this case, the basic specification on which the analysis is based is itself questionable. Also, since all the variable are at current prices, the method used to estimate the actual level of capital stock, $K_{t-1}$, is not known. Also, the RBI data have been adjusted for changing sample sizes by the questionable method of using a blow-up factor.

The study by Ram Mohan Rao and Mishra (1976)\textsuperscript{49} covers seven industries, the data for which are obtained from the RBI Bulletins, for the period 1950-1971. The objective of the study is to test the interdependence of the investment and financial decisions. Using step-wise regression analysis, the authors conclude that besides the accelerator variable

internal funds followed by debt flow are the most important determinants of investment in fixed assets.

The investment relationship in the study by Rao and Mishra does not appear to be based on the flexible accelerator specification, since the capital stock variable has not been included. Also, since the independent variables have not been uniformly deflated by the same variable, the interpretation of the coefficients becomes difficult. Another drawback of the study is that it is not known as to how the authors have adjusted for the changing sample size in the RBI data. Also, the study covers a period of only twenty years, and ten independent variables are included, along with a two-year lag for the sales variable. This would imply that finally there are only seven degrees of freedom, which makes the stability of the coefficients questionable.

The study by Tanwar (1978) covers the period 1956-1975, for nine industries. His study is based on data from the RBI Bulletins. Here too investment behaviour is analysed by considering the acceleration principle, with financial variables being included to improve the explanatory power of the model. Four alternate specifications are

formulated which are estimated by the Ordinary Least Squares Method.

In Tanwar's study, gross investment is taken to be a function of net sales, retained profits, depreciation provision, net worth and change in sales. Tanwar's conclusion is that the acceleration principle and flow of internal funds are important determinants of investment in the Indian context. In one of the specifications, Tanwar includes both retained earnings and retained earnings plus depreciation as two of the independent variables. This would imply double counting of the retained earnings variable. Also, though all the variables are taken as ratios of lagged capital stock, in order to overcome the problem of changing sample size inherent in the RBI data, all values included are present values.

The study by Lahiri, Khanna and Vaidyanathan (1978)\textsuperscript{51} is based on firm level data for five firms from the Indian cigarette industry during 1958-1973. Time-series data on all five firms are obtained from the Bombay Stock Exchange directory. The authors estimate a structural model of investment in order to disentangle the separate effects of two unobservable variables, namely expected sales and future profitability. All variables are taken as current values from the balance sheets for different years. The authors have attempted

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alternate reduced form equations, with lagged sales, lagged excise taxes paid, and two proxies for financial variables, namely profits after tax and retained earnings as the independent variables. Capital stock in period 't' is taken as the dependent variable. $R^2$ and the Durbin-Watson (DW) statistic are the two summary measures used for the empirical analysis. The use of the DW statistic is however inappropriate since the lagged dependent variable is included as an independent variable. The Durbin modification does not work. As confessed by the authors themselves, not much value can be attached to the reduced form parameter estimates, since autocorrelation in the residuals with the presence of the lagged endogenous explanatory variable, would produce inconsistent parameter estimates. From their analysis the authors conclude that with simple time-series data it is impossible to disentangle the separate effects of expected profits and sales, due to high multicollinearity between them. Between the five firms from the same industry, the authors find marked differences in investment behaviour. In the two dominating foreign firms expected sales play a more dominant role, whereas financial variables seem to have some impact in shaping the behaviour of the smaller firms.

The study by Rai (1981)\textsuperscript{52} considers the jute textile industry for the period 1955-56 to 1974-75. The data problems of differences in sample

coverage which besots the RBI data are overcome by using the "blow-up factor". The variables considered in this study are sales, net debt, gross retained earnings, inventory investment, gross profits, dividends and flow of external finance. Gross fixed assets is the dependent variable. All variables are price deflated at 1960-61 prices. Gross fixed assets and the financial variables are deflated by the output price index. Rai estimates two investment functions, one in which only changes in sales are considered, and another where finance variables are also included. Rai concludes that there is an absence of the impact of the accelerator. Both the finance variables play a significant role. The pure accelerator specification gives the impression of being ad hoc. In the eclectic specification, all the included variables are present values, which could be a questionable assumption. Finally, the blow-up factor method has been used to overcome the problem of changing sample size. This method itself has various shortcomings, and is based on questionable assumptions.

The study by Dixit and Prasad (1981) differs from the other Indian studies discussed so far in that this study emphasizes the Neo-classical theory of investment. The study is a firm level analysis, data for which are obtained from the Bombay Stock Exchange directory for the

period 1956-57 to 1973-74. The authors assume a Cobb-Douglas production function and a rational lag distribution, and arrive at a function in which investment is a function of the change in the neo-classical variable with two lags, investment with two lags, and capital stock with three lags. Total investment is measured as the difference between the gross value of plant and machinery, at two successive points in time. The authors use the Ordinary Least Square Method of estimation. Since the data covers only seventeen years, the included number of eight independent variables along with the three lags, leaves only six degrees of freedom. This would affect the stability of the coefficients. Also, the inclusion of \( I_{t-1} \) and \( I_{t-2} \) as independent variables could lead to multi-collinearity. In this study, no attempt is made to test for either autocorrelation or multicollinearity. The results arrived at by this study would therefore have to be considered in the context of these drawbacks. The study concludes that the neo-classical model does not provide a satisfactory explanation of the investment behaviour of the selected companies.

In all the time series studies discussed, capital formation is identified with gross fixed asset expansion. Though the original stock adjustment model applies to net rather than gross investment, due to data limitations, in the Indian context, gross rather than net values are used.
Earlier work in the field of corporate investment in India is thus limited, inadequate and unsatisfactory. In most cases, with a few exceptions, the basic specifications themselves are ad hoc and unsystematic. The conclusions are therefore not definitive. Though most studies use RBI data, and a few use Stock Exchange data, and are based on the flexible stock adjustment model with finance variables being included to improve the explanatory power of the model, there is as yet no consensus among the existing studies. Most studies use the "blow-up factor" method of overcoming the problem of changing sample size. This method is itself based on questionable assumptions, and therefore cannot be totally relied upon. The inadequacy of the existing literature thus re-emphasizes the need for a systematic and comprehensive study in this field.