Chapter 5

Investment Decisions of Firms: An Empirical Analysis in the context of India for the Post Liberalization Period

CHAPTER 5: INVESTMENT DECISIONS OF FIRMS: AN EMPIRICAL ANALYSIS IN THE CONTEXT OF INDIA FOR THE POST LIBERALIZATION PERIOD

5.1: DEFINITION OF INVESTMENT

John Maynard Keynes and Michael Kalecki, the founding fathers of the theory of effective demand, were the first to emphasize within a coherent analytical framework the centrality of investment in determining aggregate demand and output and the course of the business cycle. At any point of time, a firm is eager to explore various investment opportunities which would be profitable for the firm. This issue has been dealt with by both Keynes and Kalecki, though in different ways. Keynes defines the rate of investment as "*the net increment during a period of time of the capital of the community.*" (Keynes, 1935, p. 126). It describes the behaviour of firms with respect to the accumulation of capital.

Before we embark on a discussion on the investment decisions of firms, it is essential we make a clear distinction between capital and investment. Strictly speaking investment is the change in capital stock during a period. Consequently, unlike capital, investment is a flow term and not a stock concept. In other words, while capital is measured at a point in time, investment can only be measured over a period of time. Thus the investment flow in a period is measured as the difference between the capital stock at the end of the previous period and the capital stock at the beginning of the next period. Symbolically, the investment flow at time period, 't' can be defined as:

$$I_t = K_t - K_{t-1}$$

where K_t is the stock of capital at the end of period 't' and K_{t-1} is the stock of capital at the end of period 't-1' (and thus at the beginning of period t).

5.2: KEYNESIAN THEORY OF INVESTMENT

Keynes states that, "*There will be an inducement to push the rate of new investment to the point which forces the supply-price of each type of capital-asset to a figure which, taken in conjunction with its prospective yield, brings the marginal efficiency of capital in general to approximate equality with the rate of interest. That is to say, the physical conditions of supply in the capital-goods industries, the state of confidence concerning the prospective yield, the psychological attitude to liquidity and the quantity of money (preferably calculated in terms of wage-units) determine, between them, the rate of new investment.*" (The General Theory, Chapter 18, page 182).

Keynes has pointed out in Chapter 11 of The General Theory that the actual rate of current investment occurs at the point where there is no longer any class of capital-asset of which the marginal efficiency exceeds the current rate of interest. In other words, the rate of investment will be pushed to the point on the investment demand-schedule where the marginal efficiency of capital (MEC) in general is equal to the market rate of interest. If at a given period of time, there is a gap between the marginal efficiency of the various assets and the rate of interest, the investment per unit of time will increase until the increase of the prices of the investment goods caused by this will reduce the marginal efficiency of all assets to the level of interest.

However, Kalecki (1937) points out that this conception is inadequate in the sense that it tells us nothing about the rate of investment decisions taken by the entrepreneurs, faced with a situation of given prices of investment goods. It indicates only that unless marginal efficiency of all assets calculated on the basis of this level of prices of the investment goods is equal to the rate of interest, a change of investment will take place which will transform the given

situation into a new one, in which the marginal efficiency of the various assets is equal to the rate of interest.

Keynes has stressed the importance of the long term expectations, explained in terms of the state of confidence of the investor. According to Keynes, it is not a separate factor from the schedule of the MEC, which affects the rate of investment. He further maintains that the state of confidence is relevant because it is in fact, one of the major factors determining the schedule of the MEC. This leads to the potential speculation and volatility in the MEC schedule, particularly when we have a liquid securities market.

Kalecki however, maintains that this is flawed. Keynes assumes that the rate of investment has increased so much that the new level of investment prices and the initial state of expectations give a MEC equal to the rate of interest. However according to Kalecki, with the increase in investment, not only the prices of investment goods will rise, but also the state of expectations will improve, which will lead to a situation where marginal efficiency of assets may exceed the market rate of interest. Consequently, investment may continue to rise, and we will not reach a finite level of investment. Kalecki develops a model, where a finite level of investment does take place, once the principle of increasing risk is incorporated in the analysis, which Keynes did not consider. We will look into this aspect when we discuss Kalecki's theory of investment in the next section.

According to Keynes, a finite level of investment will be reached as more investment takes place, the MEC falls as the supply price of capital goes up. While it is the supply price of capital that influences equilibrium level of

investment in the short run, in the long run it is the other factor that takes precedence. Moreover, Keynes does maintain that risk significantly affects the level of investment. If we consider individual investment then only the entrepreneur's or borrower's risk matters, which arises out of doubts in his own mind as to the probability of his actually earning the prospective yield for which he hopes. However, if we consider a system of borrowing and lending, a second type of risk is relevant which is called the lender's risk. This may be due either to moral hazard, i.e. voluntary default or other means of escape, possibly lawful, from the fulfillment of the obligation, or to the possible insufficiency of the margin of security, i.e. involuntary default due to the disappointment of expectation.

In an earlier argument, it has been maintained that a finite level of investment is reached only if MEC falls when capital exceeds a certain level. This can happen due to large scale diseconomies or imperfect competition. Kalceki (1937) however suggests that these two factors have nothing to do with determining the finite level of investment. Though it is true that every machine has an optimum size, Kalecki states that if we install more of such machines, then diseconomies of scale need not crop up. Moreover, to do away with the difficulties of management, instead of one, more factories could be set up, with independent directors in each place. As far as the factor of imperfect competition is concerned, while it may explain declining MEC, it obviously cannot explain why investment should be of finite size when all firms are price takers. So Kalecki identified some other factor, which he believed restricts the level of investment even when firms act as price takers in both the product and factor markets.

5.3: KALECKI'S THEORY OF INVESTMENT

Kalecki (1937) suggests that the crucial determinant of the level of investment is not the principle of falling MEC, as proposed by Keynes, but the principle of increasing risk, i.e., the increase of marginal risk with the amount invested. According to him the level of investment is determined at the point where the MEC is equal to the sum of the market rate of interest and the marginal risk premium. He puts forth two reasons for the increase in marginal risk premium with the amount investment.

The first is that as the entrepreneur puts in more investment, the ratio of debt to his own capital increases, and hence his wealth position is endangered, in the event when his business venture runs into losses. The second reason is the danger of illiquidity. At any moment of time, an entrepreneur has some reserves (consisting of deposits and securities). Suppose he invests that in a new business venture and at the same time takes credit from the market. In doing so, he exhausts his sources of capital. Now if he should need funds in the future, he may be obliged to borrow at a high rate of interest because he has already overdrawn the amount of credit considered by his creditors as normal.

Thus both these aspects of risk incurred by undertaking investment shows that the magnitude of risk increases as the amount of investment grow. Since the marginal risk premium is an increasing function of the magnitude of risk, this limits the level of investment.

5.4: NEO CLASSICAL THEORY OF INVESTMENT

Traditional neo-classical models of investment implicitly assume a world characterised by perfect capital markets. In this approach, the equilibrium capital stock is determined at the point where the demand schedule for capital intersects the supply schedule, where the expected marginal profitability of capital equals the interest rate. Consequently, financial factors are not determinants of the actual capital stock (which in fact would be equal to the optimal capital stock).

In the neo-classical theory once the equilibrium capital stock is determined then the level of investment is determined by change in the capital stock due to the imposition of some exogenous rate of technical change. Empirical representation of the neo-classical investment function generally has followed the premise that changes in investment opportunities surrounding a firm i.e., shifts in the demand schedule for capital) can be summarised by the market valuation of the firm's capital stock.

The neo-classical theories usually perform very poorly at the empirical level, the primary reason being the assumptions behind the theories are not quite plausible.

5.5: TOBIN's q THEORY OF INVESTMENT

Tobin (1969) in his q theory of investment, states that the rate of investment, i.e., the speed at which the investors wish to increase the capital stock should be related to q, the market value of equities relative to the replacement cost of the physical assets they represent. Investment is stimulated if q exceeds 1, i.e., when capital is valued more highly in the market than it costs to produce it. On the other hand if q is less than 1, investment is not undertaken as the valuation of capital is lower than its replacement cost and existing capital is reduced. The optimal rate of expansion and contraction is found by equating the marginal cost of adjustment to its benefit, which depends on the difference between q and 1.

Tobin suggests that another way to state the same point is that investment is encouraged when the market yield on equity is low relative to the real returns to physical investment. Generally it is viewed that an increase in the market valuation of equities can occur as a result of an increase in the MEC, i.e. as a result of events exogenous to the financial sector, particularly the stock markets. But according to Tobin, it may also occur as a consequence of financial events that reduce the market yield on equity, the yield that investors require in order to hold on to their equity capital. Thus Tobin suggests that this is the sole linkage through which financial factors affect the real economy.

In the following sections we are now going to test whether an increase in stock market valuation does serve as an indicator for investment decisions of firms, in the context of India, as explained by the Tobin's q theory of investment.

5.6: EMPIRICAL ANALYSIS OF CORPORATE INVESTMENT DECISIONS IN THE CONTEXT OF INDIA

We have already presented a survey of the past studies on the q theory of investment, both for India as well as for other developing countries. The picture that has emerged is a mixed one, while some studies did come up with encouraging results showing an increase in stock market valuation with concomitant rise in investment, other empirical studies results were not so encouraging for the q theory of investment.

In our study we have tried to empirically test whether an increase in stock market valuation has been associated with an increase in the level of investment in the economy (as predicted by the q theory of investment) in the Indian context. We have used the PROWESS Database published by the CMIE, which contains data for 9,600 firms listed in the BSE. In the last chapter, we have already shown the trend of Tobin's q for three different set of firms, viz., all the 9,600 firms listed in the BSE, top 100 firms listed in BSE based on their capital employed and the 30 Sensex firms, for the period 1990-91 to 2004-05. Now we will examine the hypothesis whether q serves as an indicator for firms' investment behaviour in the Indian context to any significant extent.

5.7: REGRESSION OF INVESTMENT OF FIRMS AS A RATIO OF THEIR CAPITAL EMPLOYED AND THE TOBIN's q RATIO

Our objective is to study whether the Tobin's q ratio serves as an indicator to the firms to implement their investment decisions. In this regard, we study whether the Investment of firms as a ratio of their capital employed is significantly affected by the Tobin's q ratio. For that we estimate the following equation:

$$(\frac{I}{K})_i = \alpha + \beta q_i \qquad \text{for all i = 1, 2,...9600}$$

where, I is the level of investment by the firm i, K is the capital employed by the firm i, and q_i is the Tobin's q ratio of firm i.

The estimated equation is

$$(I/K)_i = 0.107667 + (-0.0006) q_i$$
$$(0.074973) \quad (0.01139)$$

The results obtained from the above regression analysis are statistically insignificant. The figures in the parentheses in the above equation show the estimates of the Standard Error. The t-statistic measures the significance of the regression results, which is given by the relation, t-statistic = β/Standard error. In this case the t-statistic is very low at 95% level of confidence. Not only that the coefficient term (β), whose size and sign measures the economic significance of the variable, is negative and very low in our case. Hence the result of the regression analysis of the relation between Investment of the firm as a ratio of their capital employed and Tobin's q, is neither statistically nor economically

significant in the Indian context. Therefore, in the Indian context, Tobin's q cannot serve as an indicator for firms' investment behaviour. The regression results are shown in Table 5.1.

Table 5.1: Regression results for firms' investment decisions (all firms)

Number of observations						76693
F(1, 76691)						0.0000
Prob > F						0.9580
R-squared						0.0000
Adjusted R-squared						0.0000
Root MSE						20.516
C	Coeff.	Std. Error	t-statistic	P > |t|	[95% Confidence Interval]	
q	-0.0006	0.0114	-0.0530	0.9580	-0.02293	0.02173
constant	0.1077	0.0749	1.4360	0.1510	-0.03928	0.25462

5.8 REGRESSION ANALYSIS USING LAGGED VARIABLE

An analysis of the work on the Tobin's q theory of investment in the case of the UNITED STATES - von Furstenberg (1977), JAPAN - Hayashi (1982) and UNITED KINGDOM - Bruno & Sachs (1982) makes it clear that introduction of lagged values of Tobin's q in the empirical equations makes the estimation more robust, where in the ordinary q theory only current q is supposed to matter.

Thus, the introduction of delivery lags for capital and differences in the time series properties of profit rates (which we will discuss in the next chapter) leads to a crucial modification of the standard q theory of investment. The existence of delivery lags results in investment equations that depend on

distributed lags of 'q'; investment orders depend on the expectation of a future 'q' rather than on the current 'q'. In fact Ueda and Yoshikawa (1986) in their empirical analysis showed that the regression analysis of investment on current 'q' only produces inconsistent results, while introducing lagged values of 'q' produces better results. Therefore we have introduced this modification in our analysis for the case of India, which is presented below.

Now we are going to study whether introducing lagged variables affect the firms' investment behaviour significantly. For this the relevant equation for estimation will be classified as one period lag, two period lag and so on.

One period lag

$$(\frac{I}{K})_i^{2004} = \alpha + \beta_1 q_i^{2004} + \beta_2 q_i^{2003} \qquad \text{for all i = 1, 2,...9600}$$

The regression results we obtain are insignificant, which are shown in Table 5.2 below.

Table 5.2: Regression results for one-period lag

Number of observations						6169
F(2,6166)						0.0300
Prob > F						0.9668
R-squared						0.0000
Adjusted R-squared						-0.0003
Root MSE						9.0488
C	Coeff.	Std. Error	t-statistic	P > |t|	[95% Confidence Interval]	
q2004	0.0089	0.0201	0.0450	0.9640	-0.0344	0.0402
q2003	-0.0075	0.0366	-0.2060	0.8370	-0.0793	0.0642
constant	0.1571	0.1175	1.3770	0.1810	-0.0732	0.3875

Two period lag

$$(\frac{I}{K})_i^{2004} = \alpha + \beta_1 q_i^{2004} + \beta_2 q_i^{2003} + \beta_3 q_i^{2002} \qquad \text{for all i = 1, 2,...9600}$$

The regression results we obtain have improved marginally, though not statistically significant. The results are shown in Table 5.3.

Table 5.3: Regression results for two-period lag

Number of observations						5321
F(3,5317)						1.8600
Prob > F						0.1345
R-squared						0.0010
Adjusted R-squared						0.0005
Root MSE						0.9990
C	Coeff.	Std. Error	t-statistic	P > |t|	[95% Confidence Interval]	
q2004	-0.0003	0.0022	-0.15700	0.87500	-0.0047	0.0040
q2003	-0.0001	0.0052	-0.02300	0.98200	-0.0103	0.0101
q2002	-0.0108	0.0073	-1.47900	0.13900	-0.0252	0.0035
Constant	0.25469	0.01437	17.72200	0.00000	0.22652	0.28287

Three period lag

$$(\frac{I}{K})_i^{2004} = \alpha + \beta_1 q_i^{2004} + \beta_2 q_i^{2003} + \beta_3 q_i^{2002} + \beta_4 q_i^{2001} \qquad \text{for all i=1, 2,...9600}$$

The regression results we obtain have improved over the last estimated investment function, though again not statistically significant. The results are however better than before, which is shown in Table 5.4.

Table 5.4: Regression results for three-period lag

Number of observations						4680
F(4,4675)						1.7700
Prob > F						0.1314
R-squared						0.0015
Adjusted R-squared						0.0007
Root MSE						0.9217
C	Coeff.	Std. Error	t-statistic	P > |t|	[95% Confidence Interval]	
q2004	-0.0009	0.0042	-0.2290	0.8190	-0.0091	0.0072
q2003	0.0012	0.0063	0.1920	0.8470	-0.0112	0.0136
q2002	-0.0036	0.0141	-0.2530	0.8000	-0.0312	0.0241
q2001	-0.0111	0.0154	-0.7220	0.4700	-0.0412	0.0190
constant	0.2433	0.0143	17.0340	0.0000	0.2153	0.2713

From the above analysis it is clear that the Tobin's q theory of investment is not applicable in the context of India. In other words, the Tobin's q ratio is not an important indicator for firms' to undertake their investment decisions. However, the results did improve once we incorporated lags in the analysis, but the results were still not statistically significant.

5.9: RELATION BETWEEN REAL INVESTMENT AND THE TOBIN's q RATIO OF THE FIRMS

From our regression analysis in the previous section, we have observed that the Tobin's q ratio cannot serve as an important indicator for firms' to undertake their investment decisions. So, now we are going to examine the hypothesis in a different manner. In this regard, we have taken the dependent

variable as the ratio of the Investment of the firms (in real terms) to the Gross Fixed Capital Stock (GFCS) of the firms. Before proceeding further we need to explain how we obtained the GFCS.

Investment is the rate of change in the capital stock, i.e., the net addition to the capital stock over a period of time. Now this accretion usually takes place in every period. So assuming that the firm adds the investment of the current period to its existing level of assets, then this new level of assets becomes the capital stock of the firm in the next period. This we have termed as GFCS. The real value of Investment of each firm is obtained by deflating the Investment value of the firms by the price index of capital goods[48] for each year. Now to obtain the GFCS, of firm i, say in period, 't', we find the sum of the Gross Fixed Assets[49] of the firm i, in period, 't-1' and the Real Investment in period, 't-1'. Symbolically,

$$GFCS_t^{\ i} = GFA_{t-1}^{\ i} + (I_{real})_{t-1}^{\ i}$$

$$(I_{real})_t^{\ i} = \frac{I_t^i}{p_t} \qquad \text{for all i = 1,2,...100.}$$

where, $GFCS_t^i$ is the Gross Fixed Capital Stock of firm i, in period 't',

GFA_t^i is the Gross Fixed assets of the firm i, in period, 't-1'

I_t^i is the value of investment in period, 't-1', and

P_{t-1} is the price index of capital goods in period, 't-1'.

[48] The price index of capital goods is obtained as the ratio of capital formation of the private corporate sector at current prices to the same at constant prices. (Source: RBI).
[49] The data for the GFA of the firms is obtained from the PROWESS Database of the CMIE.

Table 5.5: Regression results of GFCS and Tobin's q for Top 100 firms

Number of observations						1500
F(100, 1399)						2.73
Prob > F						0.0000
R-squared						0.1630
Adjusted R-squared						0.1032
Root MSE						46.43
C	Coeff.	Std. Error	t-statistic	P > |t|	[95% Confidence Interval]	
q	0.0001	0.0002	0.501	0.617	-0.0003	0.00051
Constant	0.0973	11.9882	0.008	0.994	-23.4198	23.6140

The t-statistic, which measures the significance of the regression results, is given by the relation, t-statistic = β/Standard error. In this case the t-statistic is very low at 95% level of confidence. In addition, even the coefficient term (β), whose size and sign measures the economic significance of the variable, is very low. Hence the regression result of the relation between Real Investment of the firm as a ratio of their GFCS and Tobin's q, is neither statistically nor economically significant in the Indian context.

From the above analysis it is clear that the increase in stock market valuation (as shown by a rise in the Tobin's q) does not seem to have any effect on the corresponding level of investment in the Indian economy. Thus the basic premise of the Tobin's q theory of investment that development of the stock market would attract more investment, both domestic as well as from foreign sources, which would then lead to a corresponding rise in the level of physical investment, is not applicable in the context of India. So if Tobin's q is not an indicator for the firms to undertake their investment decisions, there must be some other proximate determinants for the corporate investment in India.

In many countries investment is known to be highly correlated with current real variables, such as profits, profit rate or capacity utilization rate. Abel and Blanchard (1983) in their empirical analysis included the profit rate together with q in their investment equations and found that the profit rate is always quite significant and that in some cases 'q' even turns out to be insignificant. They suggested that this happens because of the existence of liquidity constraints including increasing costs of external borrowing.[50] With a constraint on external borrowing, a firm's investment decision would naturally be strongly influenced by the availability of funds or the state of profits.

In fact Schaller (1990) points out that q ratio only explains a small part of the variation in investment and variables which should not matter according to the standard q theory, such as profits and output, seems to affect investment significantly.

Therefore for our analysis in the context of India, we are going to examine whether investment is correlated with the two variables - the profits (profit after tax) and the retained earnings of the firms. However we will not undertake the analysis for the retained earnings of the firms mainly because if firms had to finance their investment through retained earnings, then it would imply that there was no need for the firms to go for external financing (equity finance through the stock market). Since our study focuses on the stock market of India, and whether it plays any role in affecting the level of investment in the economy, we will only look at the profits. In the next chapter we will look into the fact whether profits explain the corporate investment decisions of the firms.

[50] A theory of investment under liquidity constraints in the sense of increasing cost of external funds can be observed in Kalecki (1937).