Chapter 3

Capital Market Imperfections and Investment

In this chapter I shall attempt to extend the analysis of firm level investment decisions to incorporate the consequences of capital market imperfections.

Asymmetry of information between lenders and borrowers of funds makes the capital market one of the most imperfect markets. This imperfection engenders problems of both adverse selection and moral hazard. Adverse selection arises when a lender provides funds to borrowers who are actually less creditworthy. Moral hazard, on the other hand, is manifested by the opportunistic behaviour of the borrowers who often take actions that are harmful to the lenders.

Real word experience suggests that both the problems create significant impact on financial market activities. Their importance is highlighted by the various preventive measures undertaken by the borrowers to tackle the problems. Though researchers in this particular field considered both the problems to be important, their theoretical developments were partial in the sense that all the models were built taking into consideration either of the problems not a combination of two. Therefore, my first task will be to develop a model that will take into account both the problems of financial market imperfection and find their impact on the cost of funds.

My next task will be to incorporate these findings directly in a value-maximizing framework of a firm and analyze the impact of capital market imperfections on the investment behaviour of firms. Though a handful of papers have devoted their attention to highlight the consequences of capital market
imperfections on cost of funds and gave an implicit idea about the investment behavior of firms, no paper to date has attempted to incorporate the findings in a value-maximizing frame to provide an explicit analysis of capital market imperfections-investment relationship. The only exception is a paper by Kaplan and Zingales (1997). But this was done in a two period framework. My analysis is more general in the sense that it is developed on a multi period framework. Another important feature of the model is that it is able to solve the inconsistency between the empirical explanation and theoretical explanation of investment-cash flow relationship.

3.1 Survey of Literature:

Though the emphasis on capital market imperfections appears as a new line of thought, its origin dates back to the 1950s. The publication of 'The Investment Decision: An Empirical Study' by John Meyer and Edwin Kuh (1957) is regarded as the pioneer in this field. In fact, in the early post-war periods, serious attention was devoted to financial considerations on several aspects of real economic activity. The sudden disappearance of this literature can be attributed to the seminal paper of Franco Modigliani and Merton Miller (1958). The key insight of the Modigliani–Miller theorem is that in a frictionless capital market the financial structure of a firm will not influence its real investment decisions. The wide acceptance of this theorem nullified the role of financial structure in determining ‘real’ firm decisions. How much a firm would invest depends only on its (shareholder's) value maximizing exercise. Financial factors such as liquidity, leverage and dividend payments play no role.

1 Contemporary contributors in this line include Duesenberry (1958), Kuh and Meyer (1963) and Gianber (1964)
The Modigliani–Miller approach laid the foundation of the neo-classical theory of investment. In the neo-classical approach firm's intertemporal optimizing problem is solved without any reference to financial factors. A detailed discussion of this theory has been done in Chapter 2.

From the late 1960s attempt has been made to find out which of the two alternative specifications is closer to reality. Using data on 15 large manufacturing firms Jorgenson and Siebert (1968) found the neo-classical model superior to the internal funds theory of investment. With a larger sample of 184 firms, J.W.Elliot (1973) reversed the Jorgenson–Siebert ranking and assigned superiority to the liquidity model. Bernanke, Bohn and Reiss (1988) examined all the alternative specifications empirically. They found all the standard models are outperformed by at least one other model under certain circumstances. Thus, the empirical literature, more or less continuously, persisted in its effort to incorporate the financial structure in (real) investment decision-making problem of the firm. Paradoxically, till the early 80s, no significant effort was made to provide the theoretical background of the consequences of capital market imperfections in real firm activity.

From the early 1980s economists began to devote significant effort to find a way out from the world of frictionless capital market of the neo-classical theory. According to them the representative firm paradigm, common to the neo-classical theory, assumes the same empirical model can be applied to all firms regardless of their characteristics. This has limited the scope to highlight the role of financial factors, which often become the dominant force in determining the investment level of the firms. Therefore, studies started to move beyond the assumption of representative firm to find out the link between firm specific features and real decisions.
Interest of contemporary researches in this particular field reflects two major concerns, one 'macro' and one 'micro'. According to Hubbard (1998) "The macro concern is that cyclical movements in investment appear too large to be explained by market indicators of expected future profitability or the user cost of capital. This has led some macroeconomists to identify financial factors in propagating relatively small shocks, factors that correspond to 'accelerator' models that explain investment data relatively well.

*The micro concern relates to the consequences of informational imperfections in insurance and credit markets. In this line of inquiry, problems of asymmetric information between lenders and borrowers lead to a gap between the cost of external financing and internal financing. The notion of costly external financing stands in contrast to the more complete-market approach underlying conventional models of investment emphasizing expected future profitability and the user cost of capital as the determinants of investment."

### 3.1.1 Asymmetric Information and Incomplete Contract:

The theoretical developments, which acted as the central pillar of the new line of thinking, are the theories of asymmetric information and incomplete contracts. The theories on asymmetric information directly contradict the neo-classical assumption that all the relevant information is freely available to all the agents in the market. According to them whenever any contract takes place there exists an information asymmetry between the sides engaged in such contract. The financial market is a classic example in this regard. Whenever a firm goes to the financial market seeking external funds, the lenders (financial intermediaries and shareholders) are always less informed about the prospects of the firm than the insiders (managers). This informational asymmetry engenders the possibility of emergence of two problems - **adverse selection** and **moral hazard**.
selection problem arises when the lender, being unable to distinguish between the ‘good’ and the ‘bad’ borrowers lends its money to a less creditworthy borrower. The moral hazard problem arises when a creditworthy borrower, after taking any loan, behaves opportunistically, thereby raising the probability of default.

To get rid of the problem of adverse selection it was suggested to introduce an appropriate screening device. The moral hazard problem can be avoided by setting an incentive compatible contract. However, both the nature of screening device and the nature of contract depend on the nature of information asymmetry and hence are very subjective.

According to the theories of incomplete contract, the ability to enforce a costless and richly detailed contract is severely limited in real world. Hence, every contract is incomplete in the sense that at the time of making a contract it is impossible to incorporate all the state contingent actions. Practically, parties write a contract, which is incomplete, and revise and renegotiate it as the future unfolds. The problem of incomplete contract is quite similar to that of moral hazard. Hence while talking about the problem of asymmetric information I shall consider the problem of incomplete contract as well.

3.1.2 Asymmetric Information and the Cost of External Finance:

Most of the research on the impact of asymmetric information in financial market considers the typical debt contract between a firm and a financial intermediary. One of the early papers in this line is Stiglitz and Weiss (1981). In their model different borrowers have different probability of repaying their loans. But for a lender it is difficult to identify good borrowers from the bad. The lender, therefore, tries to develop a screening device to identify the borrower type.
Stiglitz and Weiss showed how the interest rate could act as an effective screening device.

The problem with the interest rate is that while higher rate of interest raises the rate of return of the financial intermediary, it also raises the probability of entry of borrowers with projects that have lower probability of success but higher payoff when the projects are successful. Thus there is a risk-return trade off reflecting the fact that expected return of the financial intermediary increases less rapidly than the interest rate and, beyond a point, may actually decrease. This is depicted in Figure 3.1

![Expected Return vs. Rate of Interest](image)

Figure 3.1
If $r$ be the rate of interest at which the expected return to the bank is maximized then the bank would not lend at rate of interest above $r$ even if there is an excess demand for funds. Stiglitz and Weiss also pointed out the role of collateral in determining the availability of funds. The central theme of their paper is – when a firm asks for funds externally, the informational asymmetry between them and the borrower rations the availability of funds, thereby creating a wedge between the costs of internal and external finance.

The common theme that emerges from subsequent research is the fact that in the presence of incentive problems and costly monitoring of managerial actions, external suppliers of funds require a higher return to compensate them for their monitoring actions and for risk associated with limited liability of borrowers. This makes external finance a costlier source of funds compared to the internal sources. The more imperfect the financial market, the greater is the wedge between the internal and external funds.

3.1.2 (a): Empirical Work:

Fazzari, Hubbard and Petersen (1988) [henceforth FHP] made the first attempt to examine the impact of financial factors on investment decisions in an imperfect capital market. Using the data on the sources and uses of funds by US firms during 1970-1984, they showed that the average retention ratio of the firm drops monotonically as firm size increases. According to them this retention ratio can be used to identify the financial condition of the firm. The firms who are severely constrained in the market for external finance give their greatest effort to retain most of their income. Therefore FHP classified the firms in accordance to their retention practices. The firms were divided into three groups. In the first group were the constrained firms with average retention ratio of 94%. Group 2
contained the less constrained firms with retention ratio about 83%. In group 3 were the non-constrained firms.

FHP showed that for the most constrained firms, the sensitivity of investment to internal cash flow is the lightest. The non-constrained firms do not face any significant wedge between internal and external funds. Hence for them the impact of cash flow is minimum. FHP also pointed out that big firms get most of their debt funding from non-banking sources while the smaller firms adhere more to long term bank debts. Moreover, the more constrained rely heavily on new share issues – a support to the pecking-order theory of investment.²

A similar study was conducted by Hoshi, Kashyap and Schrafenstein (1991) [hereafter HKS]. To find out the link between financial structure and investment decision they considered the case of Japanese industries. The Japanese industrial structure consists of two types of firms- the 'keiretsu' or large industrial groups and the other industrial firms. The 'keiretsu' or industrial groups are a bunch of diversified and vertically integrated firms doing most of their buying and selling within their groups. More important for the purpose is the fact that there are strong financial ties among the group firms. Affiliated firms do a significant fraction of their borrowing from the banks of their group. This contrasts with the unaffiliated independent firms that are much more inclined to spread their borrowing around. In addition, the group banks own as much as 10% of the equity of their member firms. Moreover, the group banks often appoint their employees in key managerial position of their member firms. This eases the flow of information between the banks and their client firms.

These close ties between the banks and firms under keiretsu reduce the cost of external finance of the member firms. Hence, as theory suggests, the non-
The empirical surveys were followed by a series of theoretical developments. To have a glimpse of these developments I shall start with a simple diagrammatic representation given by Hubbard (1998) and gradually move towards more complex representation.

$^2$ For a discussion on ‘pecking order theory’ see Myers and Majluf (1984), Greenwald, Stiglitz and Weiss (1984)
Hubbard used a simple demand-supply apparatus to highlight the role of internal funds in investment decision of firms. The diagram is shown in Figure 3.2. In the horizontal axis he measured the stock of capital. The cost of fund is shown on the vertical axis. The demand curve for capital is downward sloping; an increase in the cost of fund reduces the desired capital stock of the firm.

The neo-classical supply of fund curve is a horizontal line, implying unlimited supply of funds at a risk-weighted rate of interest \( r \). In this case the first best capital stock is \( K^* \). However, this is not the case for an imperfect capital market. Suppose an entrepreneur with internal net worth \( W_0 \) want to undertake a project that requires a stock of capital exceeding his internal resources. The firm goes to a financial intermediary seeking additional funds. Investing from internal funds has a cost, viz. the opportunity cost \( r \). However, lenders of the external fund
face some problem. It is not possible for them to monitor perfectly the utilization of the funds by the borrower. Nor can they observe the actual output level of the borrower correctly. Therefore, it is possible for the entrepreneur to direct resources for personal gains or under represent their output and avoid a part of their debt burden.

When the risk of such opportunistic behavior is present, uncollateralized lending requires that lenders need to be compensated for information cost. The higher the amount borrowed the higher would be the cost. Hence for the levels of capital greater than $W_0$, the supply schedule $S(W_0)$ is upward sloping. The slope of the supply curve reflects the information cost. This cost increases monotonically with the imperfection in the capital market. The equilibrium capital stock determined by the intersection of the demand and supply curves of capital is $K_0$. This capital stock is lower than the optional capital stock ($K^*$) of the frictionless market. Hence, imperfection in the capital market leads to an under investment equilibrium in the real sector. The extent of under investment depends on the amount of internal net worth of the borrower. An increase in internal net worth from $W_0$ to $W_1$ shifts the supply curve of the capital from $S(W_0)$ to $S(W_1)$. This raises the capital stock from $K_0$ to $K_1$. Hence in the an imperfect capital market there is a positive association between internal net worth and the level of investment. The empirical papers have used cash flow as proxy for net worth to test this very relationship. However, once investment reaches $K^*$, further increase in net worth has no effect on investment—the standard neo-classical theory operates. This relationship between internal net worth and investment is referred to in economic literature as the Theory of Financial Accelerator.
Theory of Financial Accelerator:

Though Hubbard’s presentation is only a partial analysis of the total picture, it helps us to understand three basic results of the Theory of Financial Accelerator:

First, external finance is more expensive than internal finance, unless it is fully collateralized. The higher cost of external finance reflects the agency cost of lending.

Second, given the total amount of finance required, the premium on external finance varies inversely with borrower’s net worth.

Third, a fall in borrower’s net worth raises the premium on external finance. This has an adverse impact on the level of investment. Hence, there is a positive association between the level of net worth and the level of investment of a firm.

A number of models have been formulated in the dynamic optimization framework to gain insight into the working of the financial accelerator mechanism. Bernanke and Gertler(1989) [henceforth BG] developed a model in Townsend(1979) type ‘costly state verification’ framework to show the relation between internal net worth and the level of investment. In their model the lender can verify the output level of the borrower only by incurring an auditing cost. This asymmetry of information motivates the borrowers, under certain conditions, to understate their actual output and get rid of a part of the debt. As a preventive device the lender introduces a system of random auditing whose entire cost is borne by the borrower. In this situation an optional financial contract indicates that, except for the case of full collateralization, the optimal auditing probability varies inversely with the level of borrower’s net worth. Hence an adverse exogenous stock that lowers current cash flows raises the expected total cost of
borrowing (cost of capital plus auditing cost), thereby reduces the level of investment.

In another paper (1990), BG developed a framework where the project outcome is common knowledge. However, when the entrepreneur asks for funds from the financial intermediary, the financial intermediary has no idea about the quality of the project undertaken. To prevent bad entrepreneurs from seeking funds, the financial intermediary enters into an ex-ante contract with the firms that specifies required payment contingent on the state of nature. An incentive compatible contract requires borrowers with low net worth to pay more compared to borrowers with higher net worth. This is because, when the internal net worth of the borrowers is very high, higher is his own stake invested in the project. This makes him more selective in choosing the investment project.

The Flight to Quality:

One extension of this line of literature relates the borrowing options to the quality of the project. To be more specific, following an adverse macroeconomic shock, the borrowers with weak balance sheets (low quality borrowers) experience reduced access to credit compared to other borrowers (high quality borrowers). As a result, these borrowers have to either reduce their economic activity or target alternative costly sources. Bernanke, Gertler and Gilchrist (1996) pointed out that following the tightening of monetary policy by the US Government there occurred a sharp increase in the issuance of commercial papers. This suggests that monetary tightening limits the supply of bank credit and the borrowers are forced to use commercial papers as an alternative.
A somewhat weak representation of this phenomenon is found in BG (1989). In their model the lenders have access to an alternative storage technology, which gives them a fixed and secured return. When the prospective agency cost of lending increases, lenders reduces their credit allocation to the firms that require monitoring and invest a greater share of their savings in the safe alternative.

A more detailed analysis of the Flight to Quality was provided by Calomiris and Hubbard (1990). They introduce a framework where there are entrepreneurs each with access to one of the three projects—1, 2 and W. The project outcome of W is observable. But the lenders cannot distinguish between type 1 and type 2 borrowers. Entrepreneurs can be divided into two parts depending on their net worth—'high net worth' borrowers and 'low net worth' borrowers. For simplicity they assume an economy-wide mutual fund as the sole lender of funds. They showed that, in a competitive equilibrium, there is a threshold level of net worth that can successfully sort out type 1 and type 2 borrowers. For significantly high level of net worth the mutual fund would always prefer the pooled group of 1 and 2 borrowers. However, any economic downturn, by reducing the level of net worth of the firms, would shift the mutual fund more towards the relatively safe borrower, i.e., borrower W_o.

3.2 Internal Net Worth, Economic Fluctuations and Investment Decision:

In this section I shall try to develop a model with the objective of throwing some light on the mechanism through which fluctuations in internal net worth affect the cost of external funds as well as the choice of project in an economy. My target is
two-fold. First, I shall show how the financial market imperfection amplifies and propagates the cyclical fluctuations in an economy (the Financial Accelerator) with special reference to the level of investment. Second, I shall analyze how this imperfection influences the choice of projects in an economy (the Flight to Quality).

Imperfections in the financial market create two types of problems —the problem of adverse selection and the problem of moral hazard. The problem of adverse selection appears when the financial intermediary, being unable to identify the type of borrowers, lends money to a less creditworthy firm. The moral hazard problem appears when a creditworthy borrower, after taking loan, performs some self-interest seeking action, which raises the risk of the lender. The major assumption responsible for the emergence of this problem is the assumption of Limited Liability on the part of the borrowers. This limited liability is manifested in the literature in two ways. Stiglitz and Weiss (1981) and Kiyotaki and Moore (1995) considered limited liability as a contract in which, at the time of default, the firm would surrender its collateral to the financial intermediary (whose value is taken to be less than or equal to the required repayment amount). Bernanke and Gertler (1989, 1990) and Calomiris and Hubbard (1990), on the other hand, considered limited liability as the contract which allows the defaulter firm to get rid of its liability only by paying its total return earned during that period. For our purpose, we shall stick to the second definition.

Several papers have been developed in this particular field. A somewhat detailed discussion of them has been done in the previous section. However, none of them has tried to accommodate both the problems of adverse selection and moral hazard simultaneously in their model. For example, the paper of BG (1989), is considered as one of the most significant contributions in this field. In their model the target of the financial intermediary was to find out an optimal
financial contract to avoid the problem of moral hazard. The adverse selection problem never arose, as there was no choice between borrower types. This shortcoming was admitted by BG in their next paper. Moreover, they pointed out "the agency costs in the model are identified with monitoring costs, which empirically are too small to rationalize the first order effects of financial fragility."

In BG(1990), the adverse selection problem was taken care of by introducing a state contingent contract. But as the actual output was a common knowledge there is no scope for emergence of moral hazard. The problem of moral hazard has also been ignored by Calomiris and Hubbard (1990).

The present section integrates the frameworks of Bernanke and Gertler (1989) and Calomiris and Hubbard (1990) to incorporate both the problems of adverse selection and moral hazard within a single frame. We consider an economy in which the entrepreneurs can invest their capital in three types of project—two with certain and one with uncertain returns. However, their internal stock of capital is not sufficient to undertake a project. They ask a financial intermediary for additional funds. The financial intermediary’s information set is imperfect in the sense that it cannot distinguish between one of the certain projects and the uncertain project. This raises the possibility of adverse selection. Moreover, to highlight the problem of moral hazard a situation has been considered where it is possible for a particular type of firm to enjoy some additional gains by underreporting their output. The adverse selection problem is avoided by restricting credit to certain entrepreneurs under certain conditions. The problem of moral hazard is taken care of by introducing an appropriate auditing mechanism.
3.2.1 The Model:

Consider an economy with countably infinite number of agents in each generation. The word generation is used here in a particular sense. Each generation indicates the duration of a financial contract. A generation lives for two periods. In period 1 all agents are endowed with some amount of net worth. The level of net worth varies across agents. For agent i, the level of net worth is $W_i$. The agent can either become an entrepreneur by investing his net worth in a project or save his entire fund in a financial intermediary to earn a positive and certain rate of interest. This savings act as an additional source of fund to the other investors. The choice between savings and investment depends on the relative profitability of the two options. For simplicity, we make an additional assumption that only one financial intermediary exists in the economy.\(^3\)

There are three type of project in the economy $P_0$, $P_1$ and $P_2$. Each agent has access to only one of the projects. Taking any project requires a stock of capital $K^*$. But the returns from the projects are not the same. Project $P_0$ and $P_1$ provide certain returns of $R_0$ and $R_1$ respectively. However, the return from project $P_2$ is uncertain. It depends on the state of the economy.\(^4\) The state of the economy is captured by an exogenous shock parameter $A$. The movement of $A$ is assumed to follow a random walk. To be more specific, the production function of $P_2$ and the movement of $A$ at any particular period $t$ can respectively be presented as—

\[
R_{t2} = A_t K^* \tag{1}
\]

and \[A_t = A_{t-1} + \epsilon_t \tag{2}\]

\(^3\)This is because we are interested in differentiating w.r.t borrower types. Not with respect to financial intermediaries.
Thus the value of $A$ at any particular time period depends on its value of previous period and on the value of $s_t$, a random variable which is assumed to be an identical and independently distributed variable with mean zero and variance $\sigma^2$ for all $t$. We assume $A_t$ to have a positive association with the level of output of project $P_2$, i.e., $dR_2 \frac{1}{dA_t} > 0$. At any point of time $t$, $A_t$ can take any value from zero to infinity. For simplicity we assume that at any particular point of time, an economy can either be in 'good state' or in 'bad state'. In good state $A$ takes the value $A^s$ while in bad state it becomes $A^f$. Obviously $A^s > A^f$. We define the corresponding values of $R_2$ as $R^s$ and $R^f$ respectively. To ensure lending to all the projects we assume: $R^s > R_1 > R_0 > R^f$. These outputs are realized and debt repayments are made in period 2.

**Information Asymmetry:**

Information structure in this model is asymmetric. In the time of making a financial contract the financial intermediary cannot distinguish $P_1$ borrowers from $P_2$ borrowers. The only information available to them is, out of the total set of $P_1$ and $P_2$ borrowers $\alpha$ proportion belongs to $P_1$. The remaining $(1 - \alpha)$ proportion are $P_2$ firms. Hence, the lending contract to these pooled set is based on their expected return $\alpha R_1 + (1 - \alpha) R^j$ where $j = s, f$. To make state contingent lending feasible we further assume:

$$\{\alpha R_1 + (1 - \alpha) R^s\} > R_0 > \{\alpha R_1 + (1 - \alpha) R^f\}.$$

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*An alternative representation would be to assume $R_2$ vary w.r.t. managerial efficiency.*
Limited Liability:

The information asymmetry creates a credible problem in the financial market because of the limited liability on the part of the borrowers. The limited liability ensures that lower bound of the return to the entrepreneur is zero. This means, if the earning of the firm is not sufficient enough for full repayment of its loan, it can get rid of its entire liability by repaying only the value of its output. To be more precise, for a firm with internal net worth $W_i$, the required amount of loan is $(K^*-W_i)$. If the financial intermediary lends this amount at a rate of interest $r$, then in period 2, the entrepreneur's debt liability is $(1+r)(K^*-W_i)$. However, due to limited liability, the return schedule of the financial intermediary can be expressed as:

$$\rho = \min [(1+r)(K^*-W_i), R] \hspace{1cm} (3)$$

where $R$ is the realized return of the firm.

The information asymmetry along with limited liability engenders the problem of adverse selection when the financial intermediary, being unable to identify, provide funds to entrepreneurs with high chance of default. The moral hazard problem arises when, in the bad state, the $P_1$ firms pretend to be $P_2$ firms and avoid a part of their liability.

Thus our model is able to incorporate the consequences of information asymmetry on borrower type, borrower action and state of the economy. The problem of adverse selection is avoided by identifying an indicator of creditworthiness of the borrowers. The relevant indicator in our model is the level of net worth of the entrepreneur. The moral hazard problem, on the other hand, can be avoided by introducing a state contingent auditing scheme. The detailed discussion of these problems will be done in course of our analysis.
The Optimum Financial Contract:

In period 1, the entrepreneurs go to the financial intermediary seeking loans. For the ith entrepreneur the amount of loan is \((K^* - W_i)\). This lending is made at a fixed rate of interest or \(r\). To ensure that the limited liability does not create a problem, the financial intermediary release funds only after evaluating the repayment capacity of the firm. The repayment capacity depends on the expected output in period \(t+1\). For the \(P_0\) and \(P_1\) entrepreneurs the expected outputs are \(R_0\) and \(R_1\) respectively. However, for the \(P_2\) entrepreneurs the case is a bit complex.

In period 1, the expected output of \(P_2\) entrepreneurs in period 2 is:

\[
E_1 (R^2) = E_1[A_2 f(K^*)]
= E_1[A_2 f(K^*)]
= E_1 (A_1) f(K^*) \quad \text{[as } A_2 = A_1 + \varepsilon_2 \text{ and } E_2 (\varepsilon_2) = 0]\n= A_1 f(K^*)
\] (4)

Thus previous realization of \(A\) exhibits an important role in determination of \(R_2\).

If at period 1 the economy faces good state, the financial intermediary takes an optimistic view about its expected return in period 2. On the other hand a bad state reduces the expectation of the output about future. This state contingent expectation takes a major role in amplifying the real market fluctuations in the economy.

With limited liability, the expected returns to the entrepreneurs are as follows:

For \(P_0\) entrepreneurs \(\pi_0 = \max [R_0 - (1+r)(K^* - W_i), 0]\) \(\text{(5)}\)

For \(P_1\) entrepreneurs \(\pi_1 = \max [R_1 - (1+r)(K^* - W_i), 0]\) \(\text{(6)}\)

For \(P_2\) entrepreneurs, these are two possible cases. Under good state, the return is:

\(\pi_g = \max [R^3 - (1+r)(K^* - W_i), 0]\) \(\text{(7)}\)

On the other hand, the return in bad state is:
\[ \pi_t = \max \left[ R_f - (1+r)(K^* - W_t), 0 \right] \tag{8} \]

We consider a critical level of net worth \( W^* \) such that
\[ W^* = \frac{[(1+r)(K^* - R_f)]}{(1+r)} \tag{9} \]

This particular level of net worth is very important from the point of view of financial contract. An entrepreneur with the level of net worth greater than or equal to \( W^* \) will always be able to repay their loan even if it is a \( P_2 \) firm and bad state occurs. This is the situation of full collateralization. The entrepreneurs with net worth greater than \( W^* \) will not face any agency cost of borrowing. There will be no wedge between the cost of external and internal finance. The investment decision of the entrepreneurs will be similar to that in the perfect information case.

The entrepreneurs with internal net worth less than \( W^* \) face positive agency cost of borrowing. The agency cost arises for two reasons. First, for entrepreneurs with net worth less than \( W^* \), the financial intermediary is uncertain about the full repayment of loan. Hence the entrepreneurs need to introduce an indicator to judge their worth. Second, while providing fund to the pooled group of \( P_1 \) and \( P_2 \) entrepreneurs, the financial intermediary knows that during bad state \( P_1 \) borrower can get rid of a part of their liability by representing themselves as \( P_2 \) firms. Hence, the financial contract should involve an auditing mechanism whose burdens have to be borne by the entrepreneurs.

Following Bernanke and Gertler (1989), we define **optimal financial contract** as a contract where-

i) Lenders receive a rate of return not less than \( r \)
ii) Entrepreneurs have no incentive to lie
iii) State contingent return and auditing possibilities are feasible.
To find out such an optional contract, suppose, before providing loan to the pooled group of $P_1$ and $P_2$ borrowers the financial intermediary enters into a contract with them. The contract states that with the announcement of bad state it will audit all the entrepreneurs who announce themselves as $P_2$. This audit is costless. However audits are not infallible. An audit can detect the actual state only with probability ‘$p$’. But if an entrepreneur is found misrepresenting, the financial intermediary charges a fine to it. The amount of fine differs from entrepreneur to entrepreneur. For the $i$th entrepreneur, we denote the fine as $F_i$. The fine can be monetary or it can alternatively be interpreted as a loss of goodwill that presents future availability of funds.

The financial intermediary uses the fine as a strategic variable. For the $i$th entrepreneur it sets the fine $F_i$ in such a way that the possible gain from misrepresenting does not exceed the return from telling truth. If, under bad state, a $P_1$ entrepreneur represent himself as $P_2$ then there are two possible situations –

a) There is probability $p$ that the entrepreneur gets caught

b) There is a probability $(1-p)$ that the entrepreneur does not get caught.

The respective returns can be written as –

$$\pi_c = R_i - (1+r)(K^* - W_i) - F_i \quad \text{(10)}$$

$$\pi_{nc} = R_i - R_f \quad \text{(11)}$$

On the other hand if the entrepreneur does not misrepresent, then it enjoys a return $\pi_f = R_i - (1+r)(K^* - W_i)$

To avoid the moral hazard, the financial intermediary sets $F_i$ in such a way that the expected gain from misrepresenting never exceeds the gain from telling the truth, i.e.,

$$\pi_i \geq p\pi_c + (1-p)\pi_{nc} \quad \text{(12)}$$

An optimal financial contract requires setting $F_i$ in such a way that
If \( F^*_f \) denotes the optimal fine then putting the values of \( \pi^*_y \) and \( \pi^*_\infty \) in (13) we obtain:

\[
R_1 - (1+r)(K^* - W_i) = p \left[ R_1 - (1+r) (K^* - W_i) - F^*_f \right] + (1-p) \left[ R_1 - R^f_i \right]
\]

\[
\Rightarrow F^*_f = \left[ \frac{(1-p)}{p} \right] \left[ (1+r)(K^* - W_i) - R^f_i \right]
\]  

(14)

Since, \((1+r)(K^* - W_i)\) is greater than \(R^f_i\), the value of \(F^*_f\) is always positive.

Moreover, this critical level of fine depends on the level of net worth of the firm. To find the relationship between the level of net worth and the level of fine we differentiate \(F^*_f\) partially with respect to \(W^*_i\) and get

\[
\frac{dF^*_f}{dW_i} = - \frac{(1-p)}{p} (1+r) < 0
\]  

(15)

Thus there is an inverse relationship between the level of net worth of the entrepreneur and the amount of fine. The economic intuition behind this inverse relationship is fairly clear. When the level of net worth of an entrepreneur is very low its gain from misrepresentation is very high. Hence, to prevent him misrepresentation he should be kept under a higher threat.

The Availability of Credit:

After selecting the optimal fine, the only problem the financial intermediary faces is the problem of adverse selection. To avoid this problem, the intermediary tries to find out a screening device to sort out the creditworthy borrowers from the total set. The net worth of the borrower can act as an effective instrument for this particular purpose.
Consider the net worth level $W^*$. For firms having net worth greater than or equal to $W^*$, the total amount borrowed is so small that the entrepreneurs will always be able to repay the loan even if they invest in project $P_2$ and bad state occurs. Hence, the intermediary will not hesitate to provide credit to them.

For the entrepreneurs with net worth less than $W^*$, the intermediary needs to be selective. The availability of credit to these entrepreneurs depends both on the level of net worth and on the choice of projects.

Consider the entrepreneurs with access to project $P_0$. For them there is a critical level of net worth $W_0$, for which

$$\pi_0 = R_0 - (1+r)(K^* - W_0) = 0$$

Hence, the entrepreneurs will not get access to their required funds if their net worth is less than $W_0$. The group of entrepreneurs with net worth less than $W_0$ will prefer to keep their money in the financial intermediary. This would act as a source of fund to the borrowers. The rest of the entrepreneurs will invest in the project.

For the group of entrepreneurs with access to projects $P_1$ and $P_2$, the inability to distinguish between the two will force the financial intermediary to consider their pooled expected returns. This expected return depends on the state of the economy prevailing in period 1. For example, if the economy were in good state in period 1, expected output of this group would be $\alpha R_1 + (1 - \alpha) R^s$. Hence there is an optimal level of net worth $W^s$ for which

$$\pi_s = \alpha R_1 + (1 - \alpha) R^s - (1+r)(K^* - W^s) = 0$$

The pooled group of firms with net worth greater than or equal to $W^s$ will get access to their required funds and hence will be a part of the group of
entrepreneurs of the economy. The rest of them will be savers. Since \( \alpha R_t^R + (1 - \alpha) R_s^R > R_0 \), \( W_0 \) is greater than \( W^* \). This implies, the risky group faces a lower threshold level of net worth than the certain one.

On the other hand, if period 1 experiences bad state, then the expected output level of the borrowers becomes \( \alpha R_t^R + (1 - \alpha) R_f^R \) net worth \( W_f^R \) can be defined as one which makes the net return-

\[
\pi_f = (\alpha R_t^R + (1 - \alpha) R_f^R) - (1+r)(K^* - W^*) = 0 \quad (17)
\]

Since \( \alpha R_t^R + (1 - \alpha) R_f^R < R_0 \), the financial intermediary becomes more restrictive in providing credit to the pooled group of borrowers.

Thus we find that both the level of net worth and the state of the economy play an important role in the allocation of credit to the entrepreneurs. The relationship between the level of net worth, the state of the economy and the availability of credit can be summarized as follows:

a) For entrepreneurs with net worth greater than \( W^* \), there is no agency cost of borrowing. The entrepreneurs will get the additional funds with no wedge between the cost of internal and external funds.

b) For entrepreneurs with net worth less than \( W^* \), information asymmetry about borrower type and borrower action engenders a positive agency cost. The existence of this agency cost makes external finance costlier than internal finance.

i) When \( W^* > W_i \geq W_f^R \), the financial intermediary provides funds to all the entrepreneurs irrespective of the nature of the project and the state of the economy.

ii) When \( W_f^R > W_i \geq W_0 \), a good state in period 1 would motivate the entrepreneurs to provide funds to all the entrepreneurs. However, if the
state of the economy in period 1 is bad, only certain borrowers (i.e. P₀ entrepreneurs) will get their required credit.

iii) When \( W_0 > W_i \geq W_s \), the financial intermediary will stop lending to the entrepreneurs with project \( P_0 \). However, if the current state of economy is good, then the pooled set of \( P_1 \) and \( P_2 \) entrepreneurs will get access to the external source of finance.

iv) When \( W_i < W^* \), no entrepreneur will get the required credit.

Though this model presents the entire system of lending and borrowing in a simplified manner, yet it is able to highlight some of the major implications of capital market imperfections on investment decisions:

First, when an entrepreneur gets the scope to expand his project through internal funds, the only cost he faces is the opportunity cost. But when the expansion is made through external funds, the entrepreneur not only incurs a liability of paying a rate of interest equivalent to the opportunity cost but also faces an agency cost. The agency cost is manifested in two ways. First, for entrepreneur with low net worth the supply of funds becomes restricted. Second, the entrepreneurs with uncertain return face a threat of auditing in the bad state. The presence of these agency costs makes external borrowing costlier.

Second, the agency costs of external funds depend on the level of net worth of the entrepreneur. The lower the level of net worth the higher is the agency cost. Hence there is an inverse relationship between the level of net worth and the cost of external finance.

Third, since the cost of external finance varies inversely with the level of net worth of the firm, a fall in net worth, by raising the cost of funds results in a
reduction of investment. Thus, there is a positive relationship between the level of net worth and the level of investment.

**Fourth**, an economic downturn lowers the return from uncertain projects. Under this situation the financial intermediary stops lending to these projects and put its fund to the relatively safer project, i.e., project P₀. This results into flight of resources towards relating certain (quality) projects (the Flight to Quality).

### 3.3 From a Theory of Capital Market Imperfections to a Theory of Investment.

So far I have investigated the consequences of capital market imperfection on the availability of credit and on the cost of external finance. In this section I shall try to find out how this imperfection affects the investment decision of a firm by directly incorporating the wedge between internal and external finance in the value-maximizing problem. This would lead to a more explicit treatment of the investment decision under imperfect capital market. Though a handful of papers on financial accelerator have implicitly talked about the relationship between internal net worth and investment under an imperfect capital market "...no paper has verified directly whether a higher investment-cash flow sensitivity is related to financial problems and, if it is, in what way. In particular, there is no test of the fundamental assumption implicit in all these tests - that investment-cash flow sensitivity increases monotonically with financial constraints." [Kaplan and Zingales (1997)]
Kaplan and Zingales used a single period model to point out the shortcomings of the empirical literature that tried to highlight investment-cash flow sensitivity as an evidence of capital market imperfections. According to them, inherent in the empirical analysis, was the assumption that investment-cash flow sensitivity increases monotonically with the degree of financial constraints. They pointed out that though imperfection in capital market leads to investment-cash flow sensitivity, this sensitivity need not necessarily increase with increase in the degree of financial imperfection. Certain restrictive conditions are needed.

In the following analysis I shall extend the analysis of Kaplan and Zingales to a multi period value maximization framework. The basic structure of the model is similar to that of Hayashi (1982) except the assumption that the imperfection in capital market creates a wedge between the cost of internal and external funds. My findings suggest that in a multi period framework there is no guarantee that the investment cash-flow sensitivity will increase monotonically with increase in the degree of financial constraints. Moreover, the model also effectively distinguishes between the ‘internal fund effect’ and ‘net worth effect’ of increase in cash flow. This finding bridges the gap between the theoretical and empirical explanations of investment cash-flow sensitivity.

The Model:

Suppose at any particular time a firm is trying to find out the optimal time path of Labour (N) and Investment (I) that maximize its value. The cost of labour is fixed at w, the prevailing wage rate. However, the cost of investible fund depends on whether it is obtained internally or externally. Suppose at any period t, I (t) is the total amount of investment undertaken by the firm. Of this total amount of investment, a proportion \( \alpha \) is financed by the firm internally. The cost per unit of internal fund is its opportunity cost equal to the price of the investment good in
that market. However, imperfection in the financial market imposes an additional cost on external finance - the agency cost. This cost varies directly with the amount of external finance required and the degree of financial market imperfections. Following Kaplan and Zingales we denote the additional cost per unit as $\xi (\alpha, \kappa)$. Here $\alpha$ denotes the proportion of internal fund invested and $\kappa$ a parameter representing the degree of financial market imperfection present in the economy. Clearly, $\xi _{\alpha} < 0$, $\xi _{\kappa} > 0$, $\xi _{\alpha \alpha} < 0$ and $\xi _{\alpha \kappa} > 0$.

When $I(t)$ is the total amount of investment, the cost of internal finance becomes $\alpha P_i(t).I(t)$; where $P_i$ is the price of investment good. On the other hand the price of external finance is $(1- \alpha) P_i(t).I(t) + (1- \alpha) \xi (\alpha, \kappa; t). I(t)$. Hence the total cost of fund becomes: $P_i(t) I(t) + (1- \alpha) \xi (\alpha, \kappa; t) I(t)$.

With the introduction of agency cost, the return to the firm at period $t$ can be presented as:

$$R(t) = [1-u(t)] \{ p(t)F(K(t), N(t)) - w(t)N(t) \} - [P_i(t)I(t) + (1- \alpha) \xi (\alpha, \kappa; t) I(t) ]$$

(18)

The task of the firm is to maximize its value

$$\max V(0) = \int_0^\infty R(t) \exp[- \int_0^t r(s) \; ds] \; dt$$

(19)

$$\text{Sub to } K(t) = \Psi(I, K; t) - \delta K(t)$$

(20)

Ignoring the time subscript, the current value Hamiltonian can be presented as

$$H = (1-u) \{ p F(K, N) - w N \} - \{ P_i I + (1- \alpha) \xi (\alpha, \kappa) I \} + \lambda [ \Psi(I, K) - \delta K ]$$

(21)

The first order conditions for this problem are

$$H_N = 0 \Rightarrow p F_N = w$$

(22)

$$H_i = 0 \Rightarrow -P_i - (1- \alpha) \xi (\alpha, \kappa) + \lambda \Psi_i = 0$$

(23)
\[ \dot{\lambda} - r \lambda = -H_k \quad \Rightarrow \quad \dot{\lambda} = (r + \delta - \Psi_k) \lambda - (1-u)pF_k \quad \text{(24)} \]

The transversality condition is:

\[ \lim_{t \to \infty} \lambda(t) K(t) \exp \left( \int_0^t r \, ds \right) = 0 \quad \text{(25)} \]

From (24) we get:

\[ \lambda(t) = \int_t^\infty \left[ 1 - u(s) \right] p(s) F_k(s) \exp \left\{ -(r + \delta - \Psi_k) (s-t) \right\} ds \]

Hence \( \lambda(t) \) represents the present discounted value of additional future profit due to one additional unit of current investment.

Hence using Hayashi's definition of marginal and average \( q \), we can rewrite (23) and (24) as:

\[ q / \left[ 1 + (1-\alpha) \xi(\alpha, \kappa) / P_1 \right] = 1/ \Psi_1 \quad \text{(26)} \]

\[ q = (r + \delta - \hat{P}_1 - \Psi_K) q - (1-u)p F_k / P_1 \quad \text{(27)} \]

where \( \hat{P} = \hat{P}_1 / P_1 \)

Assuming the installation function to be linear homogeneous in \( I \) and \( K \), we get the optimum investment function:

\[ I/K = g \left\{ q / \left[ 1 + (1-\alpha) \xi(\alpha, \kappa) / P_1 \right] \right\} \quad \text{(28)} \]

where \( g'() > 0 \) and \( g''() > 0 \)

Equation (27) depicts the optimum time path of \( q \).

The interesting aspect of the equation (28) is that, with the introduction of capital market imperfections, the optimal rate of investment now becomes a function of Tobin's \( q \), the amount of external finance \( (1-\alpha) \) and the agency cost function \( \xi(\alpha, \kappa) \).
Capital Market Imperfection and Underinvestment:

Equation (28) helps us to depict one of the major consequences of capital market imperfection, viz., imperfection in the capital market leads to an under investment equilibrium. In a perfect capital market with no agency cost \( \xi(\alpha, \kappa) = 0 \). Hence investment becomes a monotonically increasing function of \( q \) only. On the other hand, in an imperfect capital market \( \xi(\alpha, \kappa) > 0 \). Hence, the amount of external finance and the extent of agency cost also influences the investment decision. Moreover, as \( q > \frac{1}{1 + \frac{(1- \alpha)\xi(\alpha, \kappa)}{P}} \) existence of capital market imperfection leads to a decrease in the optimum level of investment.

Internal Fund Effect and Net Worth Effect:

A major significance of equation (28) is that it integrates two parallel approaches developed to explain the consequences of capital market imperfections. The standard approach to find out the role of capital market imperfection in investment adds cash flow in a model of Tobin’s \( q \) and interprets the residual sensitivity investment to cash flow as an evidence of financial constraints. The sensitivity of investment to cash flow has been interpreted from two angles. The empirical researches argue that, as external fund is costlier than internal fund, increase in current cash flow directly increases the stock of low cost funds available for current investment. This motivates the firms to take new investment. We define this effect as Internal Fund Effect. The theory of financial accelerator, on the other hand, implies that the premium on external funds depends on the collateral represented by the net worth of the firm. Increases in cash flow raises the amount of net worth of the firm. As net worth rises, the premium on external funds falls. This makes investment sensitive to the underlying cash flow. We define this effect as the Net Worth Effect. Hence
increase in cash flow creates simultaneous operation of two forces. So far no paper has distinguished between them. To differentiate between the two, we differentiate (28) w.r.t \( \alpha \) and get:

\[
\frac{\delta(I/K)}{\delta \alpha} = g' \left( \frac{q}{1 + \{(1-\alpha)\xi(\alpha, \kappa)/P_1\}} \right) \frac{q}{\left[1+(1-\alpha)\xi(\alpha, \kappa)/P_1\right]^2} - \frac{(1-\alpha)^{\alpha(\alpha, \kappa)}}{P_1}\]

\[
= \frac{\xi(\alpha, \kappa)}{P_1} - (1-\alpha) \frac{\xi(\alpha, \kappa)}{P_1} - (1-\alpha)^{\alpha(\alpha, \kappa)}\]

\[
\text{----------------- (29)}
\]

Since \( g(.) > 0 \) and \( \xi(.) < 0 \), hence \( \frac{\delta(I/K)}{\delta \alpha} > 0 \). To find out why increase in the value of internal cash flow increases the value of investment we reconsider equation (28). From equation (28) we find that increase in the value of \( \alpha \) has two effects. **First**, as \( \alpha \) increases, the value of \( \xi(\alpha, \kappa) \) decreases. This is because increase in cash flow increases the level of net worth of the firm. The increase in net worth raises the creditworthiness of the firm. This eases the flow of credit which raises the level of investment. **Second**, suppose \( \xi(\alpha, \kappa) \) is discontinuous in \( \alpha \). In this case every increase in \( \alpha \) does not necessarily decrease the level of \( \xi(\alpha, \kappa) \). But there is the cash flow effect which, by reducing the value of \( (1-\alpha) \), raises the investment level of the firm.

Thus our analysis highlights the fact that increase in cash flow engenders dual effects – the ‘Net Worth Effect’ and the ‘Cash Flow Effect’ both of which influence the level of investment separately.

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**Degree of Financial Constraint and Investment:**

The investment cash flow sensitivity is not the only outcome of financial market imperfections. It also suggests that degree of imperfection in the financial market

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2. In real world creditworthiness of the firm are judged by finding out whether the net worth of the firms exceeds certain hurdle level or not. This suggest \( \xi (\alpha, \kappa) \) is, in general, discontinuous in \( \alpha \).
puts its stamp on the investment behavior of firms. According to Kaplan and Zingales (2000), "there are two ways for a firm to be more constrained than another one ....... First, a firm may have fewer internal funds than other. ....... Alternatively, one firm may be more constrained than another because the firm's intrinsic characteristics make it more costly to raise a given amount of external funds." This suggests, the higher the degree of financial constraint, the lower is the level of investment. To find out the validity of the data, we differentiate (28) w.r.t \( \kappa \) and get:

\[
\frac{\delta (I/K)}{\delta \kappa} = -g' \left[ \frac{q}{1 + \{(1-\alpha) \xi(\alpha, \kappa)/P_i\}} \right] \\
\left[ \frac{q}{1 + \{(1-\alpha)\xi(\alpha, \kappa)/P_i \}} \right] \left\{(1-\alpha) \xi(\alpha, \kappa)/P_i \right\}
\]

Equation (30) suggests \( \frac{S (I/K)}{S \kappa} < 0 \). This result has two interpretations. First, within an economy, the firms that are considered to be more financially constrained due to their intrinsic characteristics have lower rate of investment compared to their less constrained counterparts. Second, if we compare between countries, the result suggests that, the more the degree of financial market imperfection in a country, the less is the level of investment. Hence, if one of the primary objectives of a country is to raise its level of investment, it should usher in liberal forces in the economy.
Monotonicity of Investment-Cash flow sensitivity to Financial Market Imperfections:

The empirical approaches to explain the existence of capital market imperfection consider the sensitivity of investment to cash flow as an indicator of imperfection in the financial market. The empirical researches classify the firms based on some a priori idea about the value of \( \kappa \), the degree of imperfections.

According to them, the higher the value of \( \kappa \), the higher is the sensitivity of investment to changes in cash-flow. This suggests:

\[
\left( \frac{\partial}{\partial \kappa} \right) \left[ \frac{\delta(I/K)}{\delta \alpha} \right] > 0
\]

Differentiating (30) w.r.t \( \kappa \) we get.

\[
\left( \frac{\partial}{\partial \kappa} \right) \left[ \frac{\delta(I/K)}{\delta \alpha} \right] = -g'' \left[ \frac{q}{1+(1-\alpha)\xi(\alpha, \kappa)/P_1} \right] \left[ \frac{q}{\{1+(1-\alpha)\xi(\alpha, \kappa)/P_1\}^2} \right]
\]

\[
\left[ (1-\alpha)\xi(\alpha, \kappa)/P_1 \right] \left[ \frac{\xi(\alpha, \kappa)}{P_1} \right] \left[ \frac{(1-\alpha)}{\xi(\alpha, \kappa)/P_1} \right] - 2 g' \left[ \frac{q}{\{1+(1-\alpha)\xi(\alpha, \kappa)/P_1\}^3} \right]
\]

\[
\left[ (1-\alpha)\xi(\alpha, \kappa)/P_1 \right] \left[ \frac{\xi(\alpha, \kappa)}{P_1} \right] \left[ \frac{(1-\alpha)}{\xi(\alpha, \kappa)/P_1} \right] + g' \left[ \frac{q}{\{1+(1-\alpha)\xi(\alpha, \kappa)/P_1\}^2} \right]
\]

\[
\left[ \xi(\alpha, \kappa)/P_1 \right] \left[ (1-\alpha)\xi(\alpha, \kappa)/P_1 \right]
\]

\[
-\frac{2 g' \left[ \frac{q}{\{1+(1-\alpha)\xi(\alpha, \kappa)/P_1\}^3} \right]}{\left[ (1-\alpha)\xi(\alpha, \kappa)/P_1 \right] \left[ \frac{\xi(\alpha, \kappa)}{P_1} \right] \left[ \frac{(1-\alpha)}{\xi(\alpha, \kappa)/P_1} \right]}
\]

\[
(31)
\]

Given \( g'(\cdot) > 0 \) and \( g''(\cdot) > 0 \) the first two terms in the R.H.S. of (31) are negative. Hence, for \( \left( \frac{\partial}{\partial \kappa} \right) \left[ \frac{\delta(I/K)}{\delta \alpha} \right] \) to be positive we require \( \frac{\xi(\alpha, \kappa)}{\xi(\alpha, \kappa)} \).
(α, κ) to be not only greater than (1 - α), but also sufficiently large so that the third term in the R.H.S exceeds the absolute value of the sum of the first two terms.

Thus we find that the relationship between investment-cash flow sensitivity and degree of financial constraint is not certain. It depends specifically on the nature of the cost function ξ(α, K). This finding clearly casts doubt on the method undertaken by empirical researches that implicitly assume investment-cash flow sensitivity to be a monotonically increasing function of the degree of financial constraints. In other words, it is not necessarily true that between two firms, the one with higher sensitivity of investment to internal cash flow should be considered as the one facing more severe financial frictions. Kaplan and Zingales (1997) pointed out that managers often prefer to rely on internal cash-flow for investment despite the availability of low cost funds. In their next paper (2000), they pointed to the case of Microsoft, which showed high sensitivity of investment to cash-flow over the period 1986-97. Given the strong financial position of Microsoft, it seems very unjustified to define the investment cash-flow sensitivity as an indicator of financial constraint. Fazzari, Hubbard and Petersen (2000) found financially distressed firms (i.e., firms that face the highest wedge between the cost of internal and external funds) often show less investment cash-flow sensitivity than the financially constrained firms. Indian pharmaceutical industry can also provide strong evidence in this regard. Big multinational corporations like Burroughs Welcome Limited and Smithkline Beecham Pharmaceuticals expand most of their investments by internal cash-flow. Though their standing in the financial market is quite high (both have assets with value exceeding Rs. 200 crores), they have completely avoided long-term borrowing in financing their investment project.
3.4 Summary Of Results Obtained:

a) Information asymmetry in the financial market creates the problems of adverse selection and moral hazard. This engenders an agency cost that makes external finance costlier than internal finance.

b) To avoid these problems the lenders of funds searches for an indicator that shows the credibility of the borrowers. Net worth of a firm acts as an effective screening device in this regard. The higher the level of net worth, the higher is the creditworthiness of the firm. Hence there is an inverse relationship between the level of net worth and the cost of external finance.

c) A fall in the level of net worth raises the cost of external finance. This reduces the incentive of the firms to take new investment projects. Hence there is a positive relationship between the level of net worth and the level of investment. Moreover, a fall in the level of net worth restricts the flow of credit towards relatively riskier projects.

d) An increase in the level of internal cash flow has two effects. First, since internal funds cost less than external funds, this increases the stock of low cost funds that the firms can use for current investment. This motivates the firms to take new investment projects. Second, an increase in the level of internal cash flow raises the level of net worth of the firm. This lowers the cost of external finance that motivates further investment.

e) However there is no guarantee that the investment cash flow sensitivity increases monotonically with increase in the degree of financial market imperfections. This directly questions the validity of the assumption inherent in almost all the empirical papers.