Chapter 2

Tobin’s q Theory of Investment
CHAPTER 2: TOBIN's q THEORY OF INVESTMENT

In our study so far we have tried to see whether there exists any link between financial liberalization and economic growth. In the last chapter we have undertaken a review of the literature in this area. Though there are various theories propagating the role of financial liberalization in economic growth, we would confine our study to specifically look at the Tobin's q theory of investment. In the course of this chapter, we would deal mainly with the discussion of the measure of Tobin's q in detail. Over the years, economists, investors and market watchers have used Tobin's q for a variety of purposes. Here we would discuss how this measure has evolved over time and also its usefulness in various fields of economics. Finally we will also present a survey of the empirical work associated with the Tobin's q theory of investment for the developing countries.

2.1: THE MEASURE OF TOBIN's q

Put simply, Tobin's q is a measure of performance comparing two valuations of the same assets. It is the ratio of the market value of a firm's assets as measured by the market value of its outstanding stock and debt (enterprise value) to the replacement cost of the firm's assets. If a company is worth more than its value based on what it would cost to rebuild it, then excess profits are being earned. "It is common sense," wrote Tobin, "that the incentive to make new capital investments is high when the securities giving title to their future earnings can be sold for more than the investment costs."
Chapter 2

The value can be observed directly if the ownership of the investment can be traded in the secondary market; otherwise it is an imputed value computed as the expected present value of the stream of profits it would yield. Assets are of value to the shareholders only to the extent that they generate profits. It really does not matter much what the worth of the company is, if it does not earn sufficient profits. For a company to be worth what it costs shareholders, it must earn the shareholder the required rate of return. Investment would be undertaken or expanded if \( q \) exceeds 1; it would not be undertaken and existing capital should be reduced, if \( q \) is less than 1. The equilibrium 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.

Markets for used durable producer and consumer goods are a central feature for an economy. These may be markets for the goods themselves or for claims to them. Tobin and Brainard (1977) suggests that direct used-goods markets provide ever changing market valuation of both non-reproducible real assets, like land and mineral deposits, and reproducible assets, like buildings and equipment. In the case of reproducible assets, the current cost of producing identical or competitive goods is obviously an important factor in the valuation of an existing good. They present an analogy between construction activities and the growth of a firm. In this respect they argue that a rise in the costs of residential construction can be expected to raise the value of existing homes; high valuations of existing stocks will lead both to increased production and to higher prices of newly produced substitutes. So if there is an increase in the market valuation of houses relative to the current cost of building, then this
will encourage residential construction. The inducement is the gain to be made by the excess of market price over the replacement cost.8

However, Tobin (1981) insists that there is a limit to the acceleration of capital formation generated by arbitrage of such margins. Abnormally rapid accumulations of capital, exceptionally high rates of investment, impose extra costs on investing firms individually and on the economy collectively. These adjustment costs are a principal reason that positive differences of market valuations from normal replacement costs of capital can and do arise and persist, without triggering virtually instantaneous jumps in capital stock accomplished at virtually infinite rates of investment. Likewise low market valuations of existing capital slow down capital formation, but rarely shut gross investment off completely while stocks are consumed at maximum speed. Tobin (1981) refers to replacement costs as current costs of production and installation at a normal rate9 of investment, a rate at which investment keeps the capital stock growing at the trend of the economy.

The profit that is gained is not wiped out immediately because construction takes time. However, in the long run, the increase in the stock brings market value in line with replacement cost, lowering the former and possibly raising the latter (Tobin and Brainard, 1977). They further argue that

8 This inducement is essentially what the great Swedish economist Knut Wicksell ascribed to a natural rate of interest (defined as the full employment rate) higher than the market interest rate, which is the rate fixed by the central bank (Tobin, 1981). In such a scenario, banks would lend to the entrepreneurs, who would utilize the funds to increase production. The growth in output would entail that the stock prices increase as a claim against the increase in profits.

9 In Harrod's terminology the "natural" growth rate of its exogenous resources as augmented by technological progress. However, it should be borne in mind that Harrod's natural rate is not necessarily the trend rate of growth.
in equilibrium the volume of construction will meet demands for replacement and normal growth, and the size of the stock will be such that its market value is the same as its marginal production cost for the equilibrium volume of construction.

Tobin and Brainard (1977) assert that the same mechanism applies to non residential structures and producers' equipment, though with a difference. The various physical assets of a business enterprise are often designed, installed, and used in complex combinations specific to the technology under operation. It is very expensive, and in most cases, impossible to detach and move individual assets or to apply them to alternative purposes. Therefore, the valuation of the business as a whole as a going concern is generally much more relevant than the separate valuations of the assets on used-goods market.

Markets for businesses take several forms. Small unincorporated business firms are bought and sold directly or through their brokers. Corporations acquire other companies by buying their assets or their stock. Mergers and leveraged buyouts are heavily influenced by the market valuation of a company in relation to the expected profitability of the company's assets as they are and as they would be in the proposed combination.

According to Tobin and Brainard (1977) the most important markets are those for corporate securities, where ownership of corporate businesses and other claims upon their assets, change hands daily. The securities markets provide a continuing market valuation of each enterprise and thus indirectly of the productive assets of the company. Like in used-goods markets, here too discrepancies arise and persist between the market valuations and the
replacement costs of the assets the market is implicitly valuing. On the same lines the formation of new businesses and the expansion of existing ones can be expected to respond to those discrepancies.

2.2: PRECURSORS TO TOBIN’s q

Keynes’s stress on the macroeconomic role of financial markets through their influence on the volume of capital investment has been affirmed and extended through the concept of q. The Tobin’s q ratio indicates the incentive of a firm to invest in capital, which is an extension of Keynes’ notion that capital investment becomes more attractive as the value of capital increases relative to the cost of acquiring the capital. Keynes’ expressed this view in his the General Theory. He states:

"... daily revaluations of the stock exchange though they are primarily made to facilitate transfers of old investments between one individual to another, inevitably exert a decisive influence on the rate of current investment. For there is no sense in building a new asset at a cost greater than that at which a similar existing asset can be purchased; whilst there is an inducement to spend on a new project what may seem an extravagant sum, if it can be floated on the stock exchange at an immediate profit" (Keynes, 1936, p.151)

Essentially Tobin’s q is the ratio of the valuations of the same asset (or a group of assets): the going price in the market for exchanging existing assets or the market valuation divided by the price in the market for newly produced commodities or replacement cost. It should be noted that this ratio was previously called the valuation ratio, ‘v’, by Kaldor (1966) and defined as the ratio of the market value of shares to the capital employed by the corporations.
q and v while basically the same measures, have had different emphasis placed on their meaning and usefulness. Tobin and Brainard first baptized q when they were discussing monetary policy/control and its effect in the market. They considered it as a nexus between financial markets and markets for goods and services. Kaldor on the other hand, looked at 'v' while discussing macroeconomic theories of distribution. According to Reinhart (1979) ‘v’ represents a pricing mechanism in the allocation and equilibrium flow of funds from the surplus sector of the economy to the deficit sector for investment purposes. The significance of q as a valuation ratio in the investment decision occurs through changes in the discount rate implicit in the market prices.

Tobin (1998) suggests that the q theory of investment is in the tradition of Wicksell and Keynes's earlier work (1930), where investment is related to discrepancies between marginal efficiency of capital and the interest rate. In fact Tobin emphasizes that under special conditions, q could be equivalently defined as the ratio of the marginal efficiency of capital, \( R \) to the interest rate, \( r \) used to discount future earning streams.

This can be seen as follows. Tobin's q is defined as

\[
q = \frac{V}{C},
\]

where \( V \) is the market value and \( C \) is the replacement cost.

If the gross marginal product of capital is denoted by \( MP_K \) and the depreciation rate by \( \delta \), the return on capital, \( r \) for the interval is

\[
r = \frac{MP_K}{V} + \frac{dV}{V} - \delta
\]
Equilibrium in the capital market is obtained when the expected return on capital $E(r)$ is equal to the rate of return required by the investors, $r_K$. This can be written, from the definition of return in equation (2),

$$ r_K = \frac{E(MP_k)}{V} + \frac{dV}{V} - \delta \quad (3) $$

The present value relationship can be now obtained by integrating equation (3)

$$ V = \int_{0}^{T} E[MP_k(t)]e^{-(t+\delta)} \, dt \quad (4) $$

Equilibrium in the capital market can be viewed interchangeably as determining $r_K$ or $V$, which are inversely related. The marginal efficiency of capital $R$ is defined implicitly by the net rate of return on replacement cost, i.e.,

$$ C = \int_{0}^{T} E[MP_k(t)]e^{-(R+\delta)} \, dt \quad (5) $$

In the special case where $MP_k$ is constant over time $C = MP_k/(R + \delta)$ and $V = MP_k/(r_K + \delta)$, so $q$ can be expressed as a function of the marginal efficiency of capital and the discount rate:

$$ q = \frac{R + \delta}{r_K + \delta} \quad (6) $$

However, the inherent problem of the above analysis of Tobin is that he implicitly assumes that the profit stream is the same as the expected value of gross marginal product of capital, $E(MP_k)$. For instance, if we do not have a production function, but fixed coefficients, i.e. $MP_k=0$, then it is not necessary
that the profit stream would be zero. If we follow Tobin's proposition, the two would mean the same, which is not true.

However, Tobin emphasizes several points in this regard. First, $q$ is observable as a ratio of market valuation to replacement cost, whereas $R$, $r_K$ and $\delta$ are not easily measured. Second, the discount rate is not any observed interest rate on long term bonds or other 'fixed-money value obligations'. Those interest rates are the discount factors for streams of payments with the risks and other characteristics of those instruments, while $r_K$ is the discount rate for streams of return with the characteristics of earnings on business capital. The rates are related but not identical. Third, the rates $R$ and $r_K$ are in the same interest-rate numeraire. As discount for a stream of current terms, they both would be nominal rates. As discount for a stream of earnings in constant terms, they would be real rates. The ratio $q$ is the same either way.

Using the $q$-theory of investment, Palley (1999) develops a model to show how an increase in the stock market valuation increases investment. Conventional macroeconomics links the financial and real sectors through the investment function, with the financial sector determining the general level of interest rates, and interest rates affecting real investment spending. The conventional investment function is given by

\[ I = I(r, ME_K) \quad I_r < 0, I_{ME_K} > 0 \]  \hspace{1cm} (i)

where $I$ is investment spending, $r$ is the real interest rate and $ME_K$ is the marginal efficiency of capital.
This conventional investment function contrasts with a q theoretic specification given by

\[ I = I(q) \quad I_q > 0, I(1) = \delta K \]  
\[ q = \frac{P_e}{P_K} \]  
\[ P_e = \frac{P_K E}{K} \]

where \( P_e \) is the equity market price of a unit of capital, \( P_K = \) current cost of a unit of capital, \( P_e \) is the unit price of equities, \( E \) is the number of equities in issue, \( K \) is the capital stock and \( \delta \) is the rate of depreciation. \( P_e \) is the implicit value of capital established through the stock market, and it is obtained by dividing the total value of equities by the existing capital stock. Substituting (iv) into (iii) yields

\[ q = \frac{P_e}{P_K K} \]

\( q \) is therefore the ratio of the stock market valuation of the corporate sector \((P_eE)\) to the current replacement cost of physical capital owned by the corporate sector \((P_K K)\). According to the q theory, an increase in stock market prices raises \( P_e \) and \( q \), which then increases investment spending.

Tobin and Brainard (1977) assert that equity markets affect the cost of equity capital and send coherent signals about the marginal efficiency of capital. Demand for equities thus represents a portfolio demand for physical capital by wealth holders. They therefore view equities as a "veil" through which shareholders see to the underlying capital assets owned by firms. Thus the increased demand for physical capital by portfolio holders raises equity prices,
which lowers the cost of equity capital, thereby giving managers an incentive to undertake more investment.

Minsky (1975, 1986) can be identified with the above version of q in which equity markets affect the cost of capital, but he disagrees with the other assertion, claiming that it send no coherent signals about the marginal efficiency of capital. Minsky argued that equity markets act as surrogate markets for existing capital, a view he shared with both Keynes and Tobin and Brainard. This can be seen in Minsky writings:

"There are really two systems of prices in a capitalist economy -- one for current output and the other for capital assets. When the price level of capital assets is high relative to the price level of current output, conditions are favorable for investment; when the price level of capital assets is low relative to the price level of current output, then conditions are not favorable for investment, and a recession or a depression is indicated." (1986, p.143)

"The theoretical argument of how investment is determined involves a comparison of the [demand] price of capital assets and [the supply price] of investment output. In a corporate capitalist economy with a stock exchange, the market's valuation of a firm's capital assets and market position substitutes for the [demand] price of capital assets" (1986, p.186).

However, Minsky disagrees over the issue of the determination of stock prices, believing that they are determined in accordance with Keynes' "beauty contest" theory rather than fundamental valuation theory. This opens the possibility of waves of speculation and pessimism that can drive equity prices up and down.
2.3: USEFULNESS OF THE MEASURE OF TOBIN's q

While the concept of Tobin's q has been around for some time now, it has often not been used in the finance literature. Despite that, over the years, economists, investors and market watchers have used Tobin's q for a variety of purposes. For investors its greatest value has been as a timing tool, but its usefulness in explaining industry structure or characterizing management should not be overlooked. Tobin's q plays an important role in many financial interactions. It has been employed to explain a number of diverse corporate phenomena, which are presented in the box below.

<table>
<thead>
<tr>
<th>Studies</th>
<th>Studies by</th>
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<tr>
<td>cross-sectional differences in investment and diversification decisions</td>
<td>Jose, Nichols &amp; Stevens (1986), Malkiel, von Furstenberg &amp; Watson (1979)</td>
</tr>
<tr>
<td>relationship between managerial equity ownership and firm value</td>
<td>McConnell and Servaes (1990), Morck, Shleifer, and Vishny (1988)</td>
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<tr>
<td>relationship between managerial performance and tender offer gains</td>
<td>Lang, Stulz, and Walkling (1989)</td>
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<td>investment opportunities and tender offer responses</td>
<td>Lang, Stulz, and Walkling (1989)</td>
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<tr>
<td>financing, dividend, and compensation policies</td>
<td>Smith and Watts (1992)</td>
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<td>relation between board size and company performance</td>
<td>Yermack (1996)</td>
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<tr>
<td>investment opportunities to examine the determinants of leveraged buyouts</td>
<td>Opler and Titman (1993)</td>
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<tr>
<td>investigate the effects of dividend changes</td>
<td>Denis, Denis, and Sarin (1994), Lang and Litzenberger (1989)</td>
</tr>
<tr>
<td>firm performance and monitoring by outside block holders</td>
<td>Park and Song (1995)</td>
</tr>
</tbody>
</table>
If 'q' is greater than one, the inference is that the market assesses current asset values more highly than it would the asset's value in its next best alternative use, its replacement cost, and so would encourage firms to undertake new investment projects.

Let us look at the usefulness of this measure in various fields of economics.

2.3. A: Market Timing Tool

In their recent book "Valuing Wall Street: Protecting Wealth in Turbulent Markets", Andrew Smithers and Stephen Wright (2000) have provided inputs to investors as how to avoid losing money in the stock market by understanding and using Tobin's q. The book explains that many times throughout history the stock market has gone through euphoric periods where stocks are extremely overvalued. By learning and applying the 'q' ratio, Smithers and Wright suggest that an investor can measure and track the market and determine when investments are at high risk. Using 'q', Smithers & Wright show why today's stocks are dangerously overvalued, and what an investor can do to protect their assets from the dramatic downturn. Viewed as a messenger of unwelcome news, Tobin's q had fallen out of favour in the early 1990s, when calculations began suggesting that U.S. stocks were overvalued.

This fact has been corroborated by Newman (2004) where he covers the historic 'q' measure and notes that the ratio attained a value of nearly 2 at the end of 2004. With this rising value of 'q' again, the stocks were now about 95 per cent over valued. A variation of the market timing tool also comes from Jeremy Grantham (2005), who uses Tobin's q as a guide for long-term asset
allocation. He discusses market cycles and admonishes investors that the anticipated market low following the 2000 bubble has not yet fully played out.

2.3. B: Merger and Acquisitions

Analyzing mergers and acquisitions is another one of the more valuable uses for Tobin’s q. The ‘q’ model relates investment to the firm’s stock market valuation, which is meant to reflect the present discounted value of expected future profits. Under certain assumptions about the firm’s technology and competitive environment, the ratio of the stock market value of the firm to its replacement cost (Tobin’s q) should be a sufficient incentive for investment by the company. Researchers, for instance, Lang & Stulz (1993) have also been able to characterize historic acquisition activity using the ‘q’ measure.

Aharony & Barniv (1995) illustrated another facet of Tobin’s q in analysing mergers and acquisitions. It was determined that investors in firms targeted by foreign acquirers gained the highest abnormal returns, whereas those who invested in leveraged buy-outs gained the lowest abnormal returns over long time intervals. Leveraged buy-outs occurred among larger and more profitable firms which also had lower research and development intensity, lower financial leverage and lower Tobin’s q ratios. Firms acquired by private firms had lower profitability, lower research and development and were relatively smaller. These firms had higher financial leverage, and higher liquidity and growth. Finally, firms acquired by public firms had larger research and development and advertising intensities, but tended to have somewhat lower Tobin’s q ratios.
2.3. C: Industry Research

Tobin’s q has also proven valuable in analyzing certain industries. Indeed, researchers have found a distinct relationship between ‘q’ measures and industry market structure. Market structure consists of those factors that are supposed to determine the competitiveness of an industry, affecting market performance through the conduct or behaviour of firms (pricing, advertising, entry deterrence). Firms with high ‘q’ ratios tend to have unique products and factors of production while firms with low ‘q’ ratios are typically relatively competitive or tightly regulated industries. Michael Salinger (1984) found Tobin’s q a better measure of monopoly profits than indices of single-period profitability because it measures long-run monopoly power. For example, empirical tests of the relationship between Tobin’s q and measures of market structure and unionization provide evidence that unions do capture monopoly rents in the U.S. economy.

Li, Oum & Zhang (2002) recently studied the performance of the global airline industry by applying Tobin’s q. Looking at data for 27 airlines from the Asia Pacific, Europe, and North American markets over the period of 1989 to 1999, they found that the industry on average was a low ‘q’ ratio industry. However, European carriers generally had even lower ‘q’ values relative to their counterparts in the other two regions. There was a general pattern of low correlation between ‘q’ and other financial measures except the variable of price to book-value ratio, indicating that Tobin’s q captures additional dimensions of the airline performances.
2.3 D: Evaluation of Government Policies

Salinger and Summers (1981) has pointed out that the q-theory approach of investment has several virtues relative to other standard approaches to explaining investment. A important virtue of the q theory approach, according to them is that it can be used to evaluate a wider menu of policy proposals than standard methods. They insist that almost all of the empirical literature on tax policy and investment neglects entirely taxes levied at the personal level which are difficult to introduce into investment equations of the flexible accelerator type. Since they do impact on stock market values, they are easily handled by the q theory approach. In addition, because the q theory is derivable directly from the assumption of intertemporal optimization, it can be used to evaluate the effects of policy announcements and temporary policies. The approach is forward looking and so can be used to study the effects of future policies on current investment. As Robert Lucas has emphasized standard econometric investment equations cannot be used to predict the effects of any fundamental changes in policy.

Perhaps most importantly, the q theory approach is supply oriented. In the formulation of Salinger and Summers (1981) firms make output and capital intensity decisions simultaneously which captures the essence of an important channel through which stimulus to investment are supposed to work. They argue that by reducing the cost of one factor of production, firms are encouraged to supply more output. This channel, they assert is obscured in most of the standard econometric approaches to investment decision making in which the level of output is taken as predetermined.
2.3 E: Role of Stock Market in the Process of Capital Accumulation

According to Palley (1999) the q theory approach to the transmission mechanism increases the macroeconomic significance of stock markets which now take on an important role in managing the process of capital accumulation. This argument has taken on heightened policy significance, especially in the context, where there are over privatization of state public sector units.\(^\text{10}\) He argues that privatization would likely to increase saving in the form of equities, thereby increasing equity prices and q. If q theory holds, this would raise investment spending and capital accumulation.

A second reason why q theory could be of increased policy significance is the shift within the government budget. It has been argued that a reduced national debt will increase investment because reduced supplies of debt will lower interest rates and have a portfolio reorganization that raises equity prices and q.

Finally, a third policy development concerns the encouragement of equity markets in developing countries. If q matters for investment, then developing countries should be encouraged to promote local stock markets, and this provides a justification for privatization in order to create widespread equity ownership.

\(^{10}\) A similar situation can be observed in the context of the Indian economy.
2.4: DRAWBACKS OF THE MEASURE OF TOBIN's q

Despite its appeal to researchers, educators and portfolio managers, Tobin's q theory of investment also has its detractors. Tobin's insight was based on the view that the market value of installed capital summarizes the incentive to invest. However, recent research has shown that the measure of Tobin's q fails to achieve the desired results. Some of these studies are enumerated below.

2.4 A: Theory fails in the presence of bubbles in the stock market

Research on measurement error, as done by Gilchrist, Himmelberg & Huberman (2004), suggests that the 'q' measure may not be correctly calculated if there are "bubbles" in stock market valuations that are persistent over time.

2.4 B: Presence of growth options causes fluctuation in firm valuation

The volatility of firms' market value greatly exceeds the volatility of the fundamentals that they supposedly summarize. Abel & Eberly (2003) demonstrated that models based on growth options can address this situation as well as that of cash effects. They argue that the presence of growth options, such as an upgrade in technology, causes fluctuation in firm valuation that are not matched by current variation in cash flows.

2.4 C: Difficulty in measurement

For 'q' to be meaningful, it is necessary to accurately measure both the market value and replacement cost of a firm's assets. It is usually possible to get an accurate estimate for market value of a firm's asset by summing the
values of the outstanding securities of that company. It is an entirely different task to estimate the replacement costs of those assets since the balance sheet reflects historical value not replacement value and ignores some intangibles altogether. For example, a trio of researchers, Bharadwaj, Bharadwaj & Konsynski (1999) demonstrated that information technology assets contribute to a firm's performance potential and, if included in the calculation, have a significantly positive association with Tobin's q value.

2.4 D: Absence of other relevant information to firms' investment decisions

According to Bo (1998) it appears that q does not carry all the information relevant to investment decisions. Other variables such as cash flow and changes in output are often found to be significant in explaining investment. The implicit assumption in the standard q-theory of investment that a firm's capital structure is irrelevant to investment decisions is found to be another reason why empirically q does not satisfactorily explain the investment by firms.

Even though Tobin's q is widely used among researchers, it is perhaps not the case with the financial community, who make little use of this important statistic as an analytical tool. Chung and Pruitt (1994) argue that part of the reason is that the traditionally accepted methods of measuring 'q', such as the Hall (1990) and Lindenberg and Ross (1981) methodologies, are complex in their calculations and require access to multiple, limited databases. Chung and Pruitt (1994) argues that if there were a simpler approximation of
the 'q' ratio that statistically resembled the complex but rigorous measures, then Tobin's q would become a useful financial tool for analysts. The motivation for examining the Chung and Pruitt (1994) measure of 'q' is that it does not require an estimate of the market values of debt and preferred stock, and approximates the replacement value of assets as its book value. This makes the computer programming easier and alleviates the need to gather bond and preferred yield data.

Tobin's q effectively illustrates the valuation of the firm in terms of its replacement value. Thus higher values of 'q' illustrate that the firm is considered to be more valuable as a going concern than as a collection of individual assets. However, we should also bear in mind that as Tobin's q depends upon the market valuation of the firm and hence the expectations of the financial markets, its reliability is dependent upon financial markets being fairly well developed. Furthermore, inflation has a variable impact on the market to book ratio as it will artificially reduce the book value but not the market value of capital. Hence in order to establish reliable measures of 'q' it is necessary that the economy under study is relatively stable at the macroeconomic level.

Researchers have developed numerous methods for computing 'q', and several studies have found that choice of method can affect statistical and economic inference substantially. Although sophisticated algorithms to compute the components of Tobin's q from accounting data can add to measurement quality, all such efforts still leave a substantial part of the variation in any proxy for 'q' unexplained. The measurement error problem with Tobin's q must stem from issues such as aggregation and unobservable assets.
2.5: EMPIRICAL ANALYSIS OF TOBIN's q THEORY ACROSS THE GLOBE

It is often reiterated that once an economy embarks on the path of liberalization, stock markets, in particular, the cost of capital falls\textsuperscript{11}, and it is reflected in a higher value of Tobin's q. Stock market liberalization is a decision by a country's government to allow foreigners to purchase shares in that country's stock market. Standard models of international asset pricing predict that stock market liberalization may reduce the liberalizing country's cost of equity capital (Stulz, 1999). Henry (2000) asserts that this prediction has two important empirical implications for those emerging markets that liberalized their stock markets in the late 1980s and early 1990s. First, if stock market liberalization reduces the aggregate cost of equity capital, then holding expected future cash flows constant, one should observe an increase in a country's equity price index when the market learns that stock market liberalization is going to occur. The second implication is that one should observe an increase in physical investment following stock market liberalization, because a fall in a country's cost of equity capital will transform some investment projects that had a negative net present value (NPV) before liberalization into positive NPV endeavors after liberalization.

Henry (2000) shows that in the study for 12 developing countries that had liberalized their stock markets, the data confirm the first implication. A country's cost of equity capital has two components: the equity premium and the risk-free rate. Thus, there are three reasons why stock market liberalization might cause a fall in the liberalizing country's cost of equity capital. First, stock

\textsuperscript{11} Levine and Zervos (1998) and Henry (2000b) discusses at length on why stock market liberalization can lead to decline in the cost of capital
market liberalization might increase net capital inflows, and an increase in net capital inflows could reduce the risk-free rate. Second, allowing foreigners to purchase domestic shares facilitates risk sharing between domestic and foreign residents. Increased risk sharing, it is argued should reduce the equity premium. Finally, Levine and Zervos (1998b) demonstrate that increased capital inflows may also increase stock market liquidity. Increased liquidity may also reduce the equity premium (Ahimud and Mendelson, 1986; Ahimud et al., 1997). Henry (2003) further argues that as the cost of capital is the equilibrium required rate of return on the stock market, so if liberalization reduces the cost of capital it would lead to one-time revaluation of stock prices, when liberalization occur.

As far as the second implication of stock market liberalization, as argued by Henry (2000), is concerned, we will look into it further in Part II, where we discuss the empirical survey of the q theory of investment; whether an increase in the stock market valuation leads to an increase in the investment in the context of India. For the present, we focus on the premise whether the financial liberalization in the developing countries had in fact led to a fall in the cost of capital, reflected by a rise in the Tobin's 'q' (which measures the rise in the value of the stocks after liberalization). Before moving any further we try to establish whether the proposition that the cost of capital falls with liberalization, holds true or not.

Suppose a firm wants to buy some capital goods. Let the price of a unit of the capital good is $P_k$. The firm can either buy the capital good by borrowing money or with cash in hand. If it borrows money, then the interest cost is $iP_k$,
where $i$ is the nominal interest rate. In case the firm bought the capital good with cash, the interest cost in this case would be the same, i.e., $iP_K$, because on spending the cash on buying the capital good, the firm loses out on the interest it could have earned by depositing the cash in the bank.

Once the firm acquires the capital asset, its price can change over the period of time. If the price falls (rises), the firm loses (gains), because the firm’s asset has fallen (risen) in value. The cost of this loss or gain is $(-\Delta P_K)_{12}$.

The capital good also suffers wear and tear over the period of time, called depreciation. If $\delta$ is the rate of depreciation, the fraction of the value of capital lost per period due to wear and tear, the money cost of depreciation is $\delta P_K$.

Thus the total cost of a unit of capital for one period ($C$) is given by

$$C = iP_K + (-\Delta P_K) + \delta P_K$$

$$= P_K (i - \frac{\Delta P_K}{P_K} + \delta)$$

$$= P_K (i - \pi + \delta)$$

To make the expression simpler we have assumed that the price of capital goods rises with the prices of other goods. In that case, $\frac{\Delta P_K}{P_K}$ will be equal to the overall rate of inflation, $\pi$. Then the real rate of interest ($r$) will be

$$r = i - \pi$$

The cost of capital ($C$) can now be written as

$$C = P_K (r + \delta)$$

---

12 The negative sign is because we are measuring the cost of capital.
If we want to express the cost of capital relative to the other goods in the economy, then the real cost of a unit of capital good \( (C_R) \) will be given by

\[
C_R = \frac{p_k}{p} (r + \delta)
\]

So, with liberalization as the real rate of interest \( (r) \) falls, we will have a lower cost of capital which will make the projects which were not viable earlier, now viable.\(^{13}\)

Before dwelling on the empirical work of our study, in the present chapter we present a survey of the empirical work associated with the Tobin’s q theory of investment for the developing countries (except India)\(^{14}\). Of all the models of investment, we have used the q theory of investment for our analysis. Tobin’s q theory of investment has a number of theoretical advantages over competing models of investment, some of which would be enumerated below.

**Output is endogenously determined**

Bosworth (1975) suggests that unlike most other models, the Tobin’s q theory allows output to be endogenously determined so that it offers the advantage of not requiring the explicit measurement of expected output and expected prices needed in the neoclassical models. According to Bosworth this simplification results from the assumption that the market correctly values the

\(^{13}\) However, this would not be true in a situation where ‘r’ had been kept low to start with.

\(^{14}\) The survey of the empirical work on Tobin’s q in the case of India would be presented in Part II of the thesis.
future earning capacity of the firm. In other words, an estimate of the discrepancy between the actual and the desired capital stock of the neoclassical model is available by comparing the market value of the firm with the replacement cost of its current capital stock. Not only that, Schaller (1990) argues that unlike the Jorgenson’s neoclassical model, it is forward looking rather than being based on lags of past variables.

**Positive link between corporate investment and stock market valuation**

Baker, Stein and Wurgler (2002) suggests that corporate investment and the stock market are positively correlated, both in the time series and in the cross-section. The traditional explanation for this relationship is that stock prices rationally reflect the marginal product of capital. This is the usual interpretation given to the relationship between investment and Tobin’s q, for example, as in Tobin (1969) and von Furstenberg (1977). Keynes (1936) on the other hand suggests a very different explanation. He argues that stock prices contain an important element of irrationality. As a result, the effective cost of external equity sometimes diverges from the cost of other forms of capital. This affects the pattern of equity issues and in turn corporate investment. This “equity financing channel” has been developed in the works of Bosworth (1975), Fischer and Merton (1984), Morck, Shleifer and Vishny (1990) and Blanchard, Rhee and Summers (1993).

According to Baker et al (2002) it has been proved that it is difficult to determine the relative merits of these explanations. This is partly because the equity financing channel has not been articulated in a form that can be
Tobin's q Theory of Investment

empirically distinguished from the traditional view. Empirical tests have had to focus on indirect implications of the two views, or else have had to impose structural assumptions on the data. Researchers taking the former approach have examined whether the stock market valuations is a better parameter to forecast investment over and above other measures of the marginal product of capital, such as profitability or cash flow. If it does not, they argue, the stock market then is probably connected to investment only insofar as it reflects fundamentals.

This empirical strategy has yielded mixed results. Barro (1990, p. 130) attributes an important independent role to the stock market: "Even in the presence of cash flow variables, such as contemporaneous and lagged values of after-tax corporate profits, the stock market variable retains significant predictive power for investment." In contrast, Morck, Shleifer and Vishny (1990, p. 199) conclude from their analysis of firm-level data that "the market may not be a complete sideshow, but nor is it very central." Blanchard, Rhee and Summers (1993, p. 132) summarize their study of the aggregate data by stating that "market valuation appears to play a limited role, given fundamentals, in the determination of investment decisions."

Availability of internal funds

This is another important determinant of firms' investment and the importance diminishes as firms enjoy better access to capital markets. Oliner and Rudebusch (1992) claims that the heterogeneity arises in part because of the information asymmetries, which make it costly, if not impossible, for some
firms to obtain the desired investment funds. Limited access to capital markets, in turn, enhances the customary preference for using internal funds to finance investment.

If internal funds are important in countries where capital markets are well developed and highly competitive, then it is even more likely that firms in developing countries rely on internal sources to finance investment. In developing countries, however, there often exist government sponsored promotional programs that provide funds to firms otherwise denied access to capital markets (Kitchen, 1992). The pattern of reliance on internal funds observed in developing countries, therefore, may be jointly determined by asymmetric information and government sponsored promotional programs. Athey and Reeser (2000) investigate both these assertions. They argued that if such governmental programs are effective, investment by targeted firms may be insensitive to the fluctuations in the availability of internal funds. For non-targeted firms, however, internal funds may be less important for those firms that can mitigate informational problems.

In the earlier studies the availability of internal funds was found to be an important determinant of investment (Bilsborrow, 1977) with the importance varying among groups of firms that are determined by access to formal capital markets (Nabi, 1989), number of employees (Harris, Schiantarelli and Siregar, 1994) and access to government sponsored promotional programs (Athey and Laumus, 1994).
Effect of systematic risk on stock market valuations

A central tenet of asset pricing theory is that capital will be allocated in such a way that risk-adjusted returns are equalized across assets. The level of expected stock returns should vary across all sections according to the level of firms' exposure to systematic risks. Whenever there is a change in the level of systematic risk, stock prices should change in such a way that risk-adjusted returns are equalized once again.

This prediction is tested empirically by Chari and Henry (2001). In recent years a number of countries have undertaken stock market liberalizations. Stock market liberalization is a decision by a country's government to allow foreigners to purchase shares in that country's stock market. Opening the stock market to foreign investors enables domestic agents in a small open economy to share risk with the rest of the world. Thus, they claim that stock prices should move in line with the change in systematic risk.

It is important to understand whether stock prices respond to changes in systematic risk, because stock prices provide public signals of real investment opportunities (Fischer and Merton, 1984; Stulz, 1999a; Tobin and Brainard, 1977; Summers, 1985). If liberalization decreases the riskiness of a firm, then, all else equal, its stock price should increase. This price increase signals to managers that they can increase shareholder benefits by investing in physical capital. On the other hand, if liberalizations are associated with stock price

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15 Systematic risks are risks that are common to an entire class of assets, whereby the value of the investment may decline over a period of time simply due to economic changes (change in interest rates, recession in the economy) or other events, like wars that impact large portions of the market. It is different from non-systematic risks, which are specific to a company.
increases that are unrelated to changes in risk, then the optimal investment response is less clear (Blanchard, Rhee and Summers, 1993; Morck, Shleifer, and Vishny, 1990). Therefore, an empirical analysis of whether stock prices move in line with changes in systematic risk also provides a first step toward understanding whether physical investment is allocated when barriers to capital movements are removed.

In this context, Chari and Henry (2001) focuses on an experiment in which the level of systematic risk changes unexpectedly and examines whether expected returns move in a direction that is consistent with the theory. They suggest that emerging market stock prices do convey information about firm-specific changes in risk when the economy is opened to foreign portfolio investment.

Specifically, in order to determine whether stock market liberalizations are associated with increased investment, Henry (2000) analyzes the behavior of real private investment following stock market liberalization in eleven emerging markets. He asserts that the relationship between private investment growth and stock market liberalization persists after controlling for world business cycle effects, contemporaneous economic reforms, and domestic fundamentals. However, one cannot assertively conclude that stock market liberalizations cause investment booms, because the possibility of reverse causality cannot be ruled out.

Therefore, it is important to realize that liberalizing the stock market need not always cause a fall in the cost of equity capital. While stock market liberalization unambiguously reduces the equity premium, it could, in principle,
lead to an increase in the risk-free rate. If the liberalizing country's risk-free rate rises following stock market liberalization, then its cost of capital could increase. Whether a country's risk-free rate rises or falls following stock market liberalization depends crucially on whether: 1) the liberalization of restrictions on capital inflows through the stock market is accompanied by a liberalization of restrictions on capital outflows by domestic residents; 2) the autarky risk-free rate is above or below the world rate at the time the liberalization occurs.

**Effect of CAL on stock market valuation**

Stock market liberalization is a specific type of a more general policy reform called CAL, which is a decision by a country's government to remove restrictions on capital inflows and outflows more generally. The empirical literature on capital account liberalization can be separated usefully into two strands: finance and macroeconomics. Tesar (1995), Tesar and Werner (1998), and Stulz (1995, 1999a, 1999b) provide comprehensive surveys of the finance literature on CAL and international risk sharing. The central message from their survey suggests that the portfolios of developed-country investors are still biased toward domestic securities, but CAL has led to greater diversification. The effects of increased financial integration are most readily seen in emerging market stock prices. Kim and Singal (2000), Henry (2000), and Bekaert and Harvey (2000) find evidence consistent with the hypothesis that stock market liberalization causes a one-time revaluation of emerging market stock prices and a fall in the cost of capital. Levine and Zervos (1998b) provide evidence that suggests that stock market liberalization also increases liquidity. Though these
studies confirm that stock market liberalization has financial effects, but they do not address the investment question.

Effect of CAL on investment

The empirical macroeconomics literature, on the other hand looks at the impact of CAL on investment. Levine and Zervos (1998a) examine whether countries experience a permanent increase in the growth rate of their capital stocks when their stock markets become more integrated with the rest of the world. They find no evidence that increased stock market integration leads to permanently higher capital stock growth rates. This result is somewhat surprising given the evidence regarding the impact of stock market liberalization on the cost of equity capital. One possible explanation is that stock market liberalization leads to a temporary increase in the growth rate of the capital stock, not a permanent increase.

To examine this possibility, Henry considers a closed economy Solow (1956) model in steady state, so that the capital stock and the labor force are growing at the same rate. In such a scenario, the stock market is liberalized to foreign capital inflows. If stock market liberalization reduces the cost of capital, agents will respond by driving down the marginal product of capital to the new cost of capital. This result can only occur if the capital stock temporarily grows faster than the labor force. Once the marginal product of capital equals the post-liberalization cost of capital, the growth rate of the capital stock will return to its pre-liberalization rate (i.e., the same rate as the labor force). In other
words, theory suggests that stock market liberalization will induce a temporary increase in the growth rate of a country's capital stock.

Henry (2000a) presents a theoretical discussion of the channels through which stock market liberalization may influence aggregate valuation and physical investment. He has documented three salient facts about the stock market and private investment in developing countries. First, private investment booms follow stock market liberalizations. Second, there is a strong positive correlation between the growth rate of private investment and changes in stock market valuation. Third, this correlation is stronger for liberalization-specific valuation changes than for generic valuation changes. He argues that if we take into consideration the previous work that demonstrates that stock market liberalizations cause large increases in stock market valuation, then these three facts constitute strong evidence that stock market liberalizations cause investment booms. The key issues framed by Henry are an open economy extension of the analysis of Tobin and Brainard (1977).

Here we give a brief account of Henry's analysis. Initially he assumes that both the domestic stock market and money market are closed to foreign investors. Assuming all profits are paid out as dividends, \( \pi \), denote expected aggregate profit per unit of capital, and \( V \), denote the expected present value of aggregate profit per unit of capital. Depreciation of the capital stock is ignored here. Further, \( r \), is the autarky domestic real interest rate, \( \theta \), the autarky equity premium, and he assumes that the world risk-free interest rate, \( r^* \), is less than the domestic risk-free rate \( r \). For simplicity of exposition, he also assumes that
firms expect future interest rates, the equity premium, and profit per unit of capital to remain same as the current level. Since increased risk sharing has theoretically and empirically ambiguous implications for the domestic savings rate, Henry assume that stock market liberalization has no effect on the domestic savings rate.\textsuperscript{16} Finally, he assumes that stock market liberalization has no effect on $\pi$. Given these assumptions, in the absence of bubbles, the autarky value of the stock market is given by

$$V_i = \frac{\pi}{(r + \theta)} \quad (1)$$

If $P_k$ is the price of a unit of physical capital, and assuming that

$$V_i = \frac{\pi}{(r + \theta)} = P_k \quad (2)$$

so that the market for capital is in equilibrium and firms are indifferent to investing. Eq.(2) highlights the fact that the discount rate used in evaluating existing projects within a country consists of two components: the real risk-free rate of return and the equity premium. Starting from this equilibrium, the stock market is liberalized to foreign investors, with the domestic money market remaining closed. He first considers the impact of stock market liberalization on the equity premium. In autarky, the equity premium, $\theta$, will be proportional to the variance of the country's aggregate cash flows.\textsuperscript{17} Once liberalization takes place and the country's stock market becomes fully integrated, its equity premium will be proportional to the covariance of the country's aggregate cash

\textsuperscript{16} Levine and Zervos (1998a) find no impact of that increased capital market integration on savings rates.

\textsuperscript{17} Henry based his analysis on the assumption that the investors are risk averse and the coefficient of rate of risk aversion is constant.
flows with those of a world portfolio. Therefore, the necessary condition for the equity premium to fall following liberalization is that the variance, which can be interpreted as the local measure of risk, exceeds the covariance, the global measure of risk. Stulz (1999b) demonstrates empirically that every emerging market satisfies this necessary condition. Tesar and Werner (1998), and Bekaert and Harvey (2000) also argue that this condition holds in practice.

Next Henry (2001) considers the impact of stock market liberalization on the risk-free rate. Although the assumption is that the domestic money market remains closed following the stock market liberalization, the stock market liberalization may have an indirect effect on the domestic risk-free rate. As he has assumed that the domestic savings rate is constant, the capital inflow generated by stock market liberalization increases the total stock of loanable funds at the given level of income. This increase could cause the domestic risk-free rate to fall. He also assumes \( r' < r \) to be the post-liberalization risk-free rate. Finally, by assumption, liberalization has no impact on the expected rate of profit of per unit of capital, \( \pi \). Therefore, after the stock market is liberalized, aggregate valuation is given by:

\[
V'_t = \frac{\pi}{(r' + \theta)} > P_K \tag{4}
\]

Stock market liberalization drives a wedge between market valuation and the price of a new machine, thereby generating an incentive for firms to invest in physical capital.

There are two key objections to this description of the impact of stock market liberalization on a country’s aggregate valuation and investment. First,
it is possible that the autarky risk-free rate might be lower than the world risk-free rate. Second, it may not be reasonable to assume that expected future profits and stock market liberalization are uncorrelated. Henry in his study has considered each of these objections.

Assuming $r < r^*$ and assuming (more realistically) that the domestic money market is also liberalized when the stock market is opened, he finds that in this case, in addition to the foreign capital inflow into the stock market, capital will flow out of the domestic money market until the domestic risk-free rate rises to the world risk-free rate. Although the equity premium still falls due to increased risk sharing, under this scenario the countervailing effect of an increase in $r$ might lead to a net increase in the discount rate. Therefore, if $r < r^*$, in autarky, the post-liberalization cost of capital might actually rise following stock market liberalization. If the internal, market-determined interest rates in these countries are observed, it would be instructive to compare pre-liberalization and post-liberalization interest rates. However, according to Williamson and Mahar (1998) all of the countries in the sample considered by Henry had some form of “financial repression” in place during the period.

In such a situation he then consider the plausibility of this alternative assumption that $r < r^*$. The autarky interest rate is an equilibrium outcome of domestic savings and investment. Historically, a number of emerging Asian countries have had very high savings rates relative to developed countries (Collins and Bosworth, 1996; Kim and Lau, 1994). If it has a high autarky savings rate, it is plausible that a developing country might have a lower

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18 In all the above models it is assumed that there is full employment
autarky risk-free rate than the world risk-free rate. On the other hand, economies with high-savings rates may also have more attractive investment opportunities. Thus, it is not clear that high savings-rate countries will necessarily have autarky interest rates that are lower than the world rate.

Henry suggests that the central message from the discussion, then, is not that stock market liberalization will in all cases lead to a fall in a country's cost of capital. Rather, the point is that there are sound theoretical reasons to believe that stock market liberalization may change the liberalizing country's cost of capital, with attendant implications for physical investment. Ultimately, whether a country's cost of capital rises or falls following stock market liberalization is an empirical question that is to be considered case by case.

A second objection to the theoretical framework is that it assumes that expected profits do not change when the stock market is liberalized. To the extent that stock market liberalizations are correlated with events that improve a country's physical investment opportunity set, this assumption is clearly unrealistic. At least one possible alternative explanation for the temporary surge in the growth rate of private investment is that policymakers in the developing countries timed the liberalizations to coincide with high points in the world business cycle.

Henry suggests that overstating the impact of stock market liberalization on private investment could also occur because of the contemporaneous implementation of other economic reforms which are the occurrences of: 1) macroeconomic stabilization programs, 2) trade liberalization, 3) privatization programs, and 4) easing of exchange controls. With only two exceptions, the
sample countries that he considered in his study implemented all four types of reforms during the period 1985-1994. The two exceptions are Malaysia, where no stabilizations were attempted, and Mexico, where exchange controls were not eased during this period.

**CAL leads to more liquid markets**

In addition to allowing for increased risk sharing, stock market liberalization may also lead to more liquid markets, in which trading equities becomes less costly (Levine and Zervos 1998a, 1998b). Ahimud and Mendelson (1986) and Ahimud et al. (1997) find that increased liquidity reduces the equity premium, which decreases the cost of capital and raises firm value. The fact that shareholders demand a liquidity premium means that, in addition to the premium they require for bearing systematic risk, they also require compensation for the frictional costs of trading equity. Thus the equity premium, \( \theta \), is supposed to consist of two components: (1) the premium required for bearing systematic risk, and (2) a liquidity premium. Therefore, increased liquidity also reduces the equity premium.

From a valuation standpoint, then, the empirical implications of increased liquidity are observationally equivalent to the implications of increased risk sharing. An increase in either, or both, reduces the equity premium. It is therefore important to bear in mind that, in addition to increased

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19 The sample countries considered by Henry in his study are: Argentina, Brazil, Chile, Colombia, India, Korea, Malaysia, Mexico, Philippines, Thailand, and Venezuela.
risk sharing, increased liquidity may play a central role in any liberalization-induced valuation and investment boom.

In addition to the world business cycle and contemporaneous reforms, it is important to account for domestic fundamentals, such as the growth rate of GDP, the terms of trade, and the external debt-to-GDP ratio. For any country, more rapid GDP growth could lead to stronger sales and higher profits. One possible outcome of such a scenario is a private investment boom driven by an aggregate demand shock that is independent of stock market liberalization policies. Similarly, the literature on debt overhang and investment (Krugman, 1989; Sachs, 1989) argues that a large external debt-to-GDP ratio acts as a drag on investment. Therefore, a large fall in the external debt-to-GDP ratio could also lead to a substantial increase in future investment that is unrelated to stock market liberalization.

**Stock market as an indicator of business cycles**

Biswas (2006) suggests that economies without a well-functioning stock market may suffer from three types of imperfections. First, if there is no stock market, or the stock market is not adequately liquid, opportunities for risk diversification are limited for investors and entrepreneurs. The high costs of diversification may induce firms to avoid the use of financial markets and may influence the firms' investment decisions. Thus, firms may choose less capital intensive production technologies that are subject to lower long-term risk, or they may invest less and remain smaller than if their shares were widely held.²⁰

²⁰ However, this does not necessarily affect aggregate demand of the economy; it may be the case they would simply consume more.
Second, in the absence of a well-functioning stock market, firms are unable to optimally structure their financing packages. Third, stock markets play an important informational role. Well-functioning stock markets collect information about the prospects of firms whose shares are traded, and make it available to creditors and investors. By improving the flow of information about firms and simplifying takeovers, well-functioning stock markets may contribute to corporate governance and thus lead to greater managerial competence.

Economic theory tells us that in a “well-functioning stock market”, changes in stock prices reflect both revised expectations about future corporate earnings and changes in the discount rate at which these expected earnings are capitalized. According to Fischer & Merton (1984) corporate profits are an important part of GNP and are also likely to be positively correlated with other components of GNP. The forward looking property of stock prices would, therefore, appear to qualify the stock market as a predictor of the business cycle. If, moreover, the information reflected in stock prices is of high quality, then stock prices should provide accurate predictions.

Moore (1983, Chap. 9) reviews and interprets the evidence from 1873-1975 on the stock market as a business cycle indicator. He noted that since 1873, stock prices had led the business cycle at eighteen of the twenty three peaks and at seventeen of the twenty three troughs. For the post World War II period, the “only instances since 1948 of an economic slowdown where there was no substantial decline in stock prices were in 1951-52 (and 1980).” (p. 147)

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21 Strictly, it is not "corporate earnings" but "net cash flow available for distribution to the current stockholders" which is capitalized in stock prices. The two are, of course, closely related, especially at the aggregate level.
Regression analysis, which provides more formal measures of predictive power, also shows that the stock market helps predict GNP of an economy. As part of the explanation of the negative relationship between stock returns and inflation, Fama (1981) showed that stock returns are positively related to the subsequent rate of growth of real GNP. Fama also showed that the stock market predicts a measure of the average rate of return on physical capital. He described his evidence as suggesting "a ‘rational expectations’ or ‘efficient markets’ view in which the stock market is concerned with the capital investment process and uses the earliest information from the process to forecast its evolution." (p. 555) Fama did not make any more specific claims about the role of the stock market in the business cycle. In particular, he chose not to distinguish between the stock market as predictor of the cycle and the stock market as possibly a causal factor in the cycle.

The regression studies (Fama, 1981) show that the stock market's forecasting ability of GNP can be traced to the fact that stock prices lead both investment and consumption expenditures. Stock prices and the inflation rate provide strong predictive power for investment although the long term real interest rate also has a significant coefficient. He further examines the relationship between stock price returns and other financial variables and the growth rates of the three major components of investment, business fixed investment, inventory investment and residential fixed investment. In each of the univariate regressions, the stock market helps predict each of the components of investment, especially the first two types.
2.6 IMPLICATIONS OF THE EMPIRICAL STUDIES ON THE TOBIN’S q THEORY OF INVESTMENT

The q theory of investment centres on the relationship between investment and stock prices. In fact the basic idea can be observed in Keynes (1936)22 which is the essence of the approach in Tobin and Brainard (1977). The q theory, associated particularly with James Tobin, and which has been developed more by macroeconomists than finance theorists, is one of the preferred theoretical description of investment behaviour. The rate of investment is determined by the condition that the marginal cost for the firm of adding to its capital stock is equal to the price at which it can sell a weighted average package of equity and debt claims on that capital.

Although q typically enters regression equations for the rate of investment significantly,23 the empirical success of the q theory is generally regarded as mixed. There are two main difficulties. The first is that the residuals from the investment (relative to capital stock) on q equation have high

22 Keynes (1936), p. 151. See also p. 188 of the General Theory for further discussion of investment along the lines of the q theory.

23 Given that the estimated reproduction cost of capital varies slowly, movements in estimated q result predominantly from changes in stock prices. Accordingly, the premise that changes in stock prices predict changes in investment is consistent with the empirical results obtained by researchers using the q theory of investment. A general question arises with q theory of whether properly measured marginal q should not be equal to one for firms that are investing, and less than or equal to one for firms that are not investing. Provided it is understood that estimated q measures the reproduction cost of capital at some normal level of investment, it is not necessary that marginal q, as measured, need be unity. Alternatively, it is possible for there to be an aggregate relationship between q and investment even if the above relationship does hold at the individual firm level: in this case increases in aggregate investment correspond to more firms investing, and therefore more firms having marginal q at unity rather than below. In this latter case, properly measured (aggregate) marginal q would be less than or equal to unity.
serial correlation. Because the standard form of the adjustment cost function used in developing the theory implies that the rate of investment is determined solely by current $q$, the serial correlation is inconsistent with the simplest forms of the $q$ theory. But modification of the adjustment cost function to incorporate lags in the investment process implies that lagged $q$ also affects current investment (Fischer, 1984). Alternatively, the serial correlation may simply reflect errors in measurement caused by accounting measures of investment. Second, despite the fact that the existing forms of the $q$ theory has implied $q$ to be a sufficient statistic for the rate of investment, other variables, particularly GNP and/or profits, appear to affect investment over and above the effects of $q$. However, provided these additional variables are instrumented to remove simultaneity bias, Summers argues that $q$ still has explanatory power for investment. These difficulties in the empirical implementation of the $q$ theory of investment should not however obscure the main point that there are reasonable theoretical reasons and, a certain amount of empirical evidence to suggest that the stock market should be a predictor of the rate of corporate investment.

Theoretically, the traditional growth literature was not suited to explore the relationship between financial intermediation and economic growth because

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25 For example, Blanchard and Wyplosz (1981, p. 15). We should also note that the possible difference between average and marginal $q$ is sometimes cited as a potential cause of the empirical difficulties encountered by the theory. Hayashi (1982) discusses conditions under which average and marginal $q$ are equal. As noted above, Abel and Blanchard did not find significant differences between their marginal $q$ and stock market based measures on average $q$.

26 However the $q$ theory has a problem in the case of oligopolistic market structures with kinked demand curves. The MEC schedules in such cases are vertical.
it focused on steady-state level of capital stock per worker, or productivity, but not on the rate of growth (which was attributed to exogenous technical progress). The recent revival of interest in the link between financial development and growth stems from the insights of endogenous growth models, in which growth is self-sustaining and influenced by initial conditions. In this framework, the stock market is shown to not only have level effects, but also rate effects (Levine, 1991).

However, a debate now exists within this framework. On one side is the view that stock markets promote long-run growth, through a significant effect on investment. Although profitable investments require long run commitment to capital, savers prefer not to relinquish control of their savings for long periods. Liquid equity markets ease this tension by providing assets to savers that are easily liquidated at any time, while simultaneously allowing firms permanent access to capital that are raised through equity issues. Liquidity has also been argued to increase investor incentive to acquire information on firms and improve corporate governance (Kyle, 1984; Holmstrom and Tirole, 1993), thereby facilitating growth.27 Moreover, Greenwood and Smith (1997) show that stock markets lower the cost of mobilizing savings, facilitating investments into the most productive technologies. Obstfeld (1994) shows that international risk sharing through internationally integrated stock markets improves resource allocation and accelerates growth. Bencivenga, et al. (1996) and Levine (1991)

27 Kyle (1984) argues that, an investor can profit by researching a firm, before the information becomes widely available and prices change. Thus investors will be more likely to research and monitor firms. To the extent that larger, more liquid stock markets increase incentives to research firms, the improved information will improve resource allocation and accelerate economic growth.
have argued that stock market liquidity denoted by the ability to trade equity easily, plays a key role in economic growth.

The second view, on the other hand casts doubts on the contribution of stock markets to long-run growth through a significant effect on investment. For example, the role of stock markets in improving informational asymmetries has been questioned by Stiglitz (1985) who argues that stock markets reveal information through price changes rapidly, creating a free-rider problem that reduces investor incentives to conduct costly search. The contribution of liquidity itself to long-term growth has been questioned. Demirguc-Kunt and Levine (1996) pointed out that increased liquidity may deter growth. They argued that by reducing the uncertainty associated with investments, greater stock market liquidity may reduce saving rates because of the ambiguous effects of uncertainty on savings. Moreover, stock market liquidity encourages investor myopia, adversely affecting corporate governance and thereby reducing growth.

However, on the opposite side of the last issue, that of corporate governance, Jensen and Murphy (1990) argue that in well developed stock markets tying managers’ compensation to stocks is an incentive compatible design that aligns the interests of principles (owners) and agents (managers), thereby spurring efficient resource allocation and economic growth.

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28 More liquid markets make it easy for dissatisfied investors to sell quickly. Liquid markets may weaken investors' commitment and reduce investors' incentives to exert corporate control by overseeing managers and monitoring firm performance and potential.
2.7 IMPROVEMENTS IN THE EARLIER EMPIRICAL STUDIES

In the framework of the new growth theory, surprisingly few empirical studies of the relation between stock market and economic growth are available. The one important study mentioned earlier is the one by Levine and Zervos (1998) who are among the first to ask whether stock markets are merely burgeoning casinos or a key to economic growth. They examined this issue empirically and found a positive and significant correlation between stock market development and long run growth. However, their use of a cross-sectional approach limits the potential robustness of their findings with respects to country specific effects and time related effects.

Levine and Zervos (1998) however, make an attempt to close this gap by using panel data to reexamine the long-run impact of stock markets on economic growth. Moreover, it is the first such study to focus on emerging stock markets exclusively.29 A panel data approach is used that covers 21 emerging markets over 21 years (1977-97). This approach allows them to control for country specific effects as well as for one-way or two-way effects.30

29 Levine and Zervos did include LDCs in their sample but only as a part of their overall cross-section.

30 By contrast, Levine and Zervos, use long term average values for a cross section of forty-one countries over the period form 1976 to 1993, following Barro-type cross-sectional approach (1991), thus glossing over potentially important country specific variations in the observation. Moreover, over time changes occur within countries due to, policies, business cycles, or governments rising or falling, so averaging amounts to aggregation over time, blurring important events as well as differences across countries.

Levine and Zervos regress the growth rate of GDP per capita on a variety of control variables (to control for initial conditions) and a conglomerated index of stock market development, following the theoretical work of Atje and Jovanovic (1993). Though they find a positive and significant correlation between stock market development and long run economic growth, their approach entails possible measurement problems (they use two different sources: IFC and IFS), statistical problems (cross-sectional approach), and conceptual problems (combining several measures into a single measure) which may affect their results.
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model is a two-stage test of the hypothesis of whether the stock market affects economic growth. This is motivated by the well known theoretical study of Levine (1991) who proposes that investing in the stock market alleviates both the liquidity shock and the productivity shock that firms would otherwise face. Firms not facing liquidity shocks will have a higher level of investment leading to a higher growth rate (following Solow's model).

Levine further suggests that stock market development contributes to economic growth both directly and indirectly. Following the direct channel, he shows that market liquidity (turnover ratio) has a positive impact on growth. Indirectly, market size (market capitalization ratio) affects investments which, in turn, affect growth. The empirical results of Levine and Zervos do support the theoretical literature of Levine (1991), in suggesting that the stock market development leads to higher growth because it reduces both liquidity and productivity shocks.

Bosworth and Collins (1999) use regression analysis to evaluate the implications of capital inflows for the recipient countries, in terms of investment and savings. They use a panel data set consisting of balance of payments and investment and savings data in 58 developing countries for the period 1978-95. This panel data has certain advantages over the earlier studies. Firstly it allows to control for country specific effects when estimating investment and savings relationships, which the earlier studies did not consider as they assumed that country-specific effects were either absent or uncorrelated with the regressors. Their study has another added advantage; just as investment and savings may depend on capital inflows, so too the capital inflows that a country receives is
likely to depend on the domestic economic activity. So to uncover the effect of capital inflows on investment and saving, they use instrumental variables to isolate the flows that are related to exogenous factors. The regression results show that FDI has the strongest relationship with domestic investment, with an estimated coefficient almost close to unity, implying a one-to-one relationship.\(^\text{31}\) On the other hand, portfolio investment has the smallest and least significant relationship on the investment of the recipient country. The finding is much more evident for those developing countries, where the portfolio capital inflows account for the bulk of the total foreign investment inflows.

The Tobin's q theory views the stock market valuation of a firm as an all encompassing variable determining its investment decisions. This is evident in the study by Angelopoulou (2004) which looks into a sample of 779 UK manufacturing companies listed in the London Stock Exchange in the period 1971-1990. Keeping in mind general criticism of the q theory approach, e.g. the fact that q models can only be estimated for stock market listed firms or that marginal q is an unobservable variable and has to be approximated by a constructed variable which may entail significant measurement error, the empirical results imply a relative superiority of the q model over other models. This of course is so only in the sense that estimations deliver results consistent with theory, and the model specifications are not rejected. The fact remains that in the whole sample estimations q appears to have a quite low explanatory power for investment and the estimated coefficients on q are small, suggesting the presence of unreasonably high adjustment costs.

\(^{31}\) There is no doubt that FDI gives rise to investment, but what is important is that it should not substitute domestic investment as pointed out by Griffin.
Some additional interesting conclusions can be drawn from the robustness analysis. Although this type of a priori classification of firms to test for the validity of the neoclassical assumptions has been often criticized, however, in the case of the q model it has been possible to show that this specification provides a better description of reality for firms which have a long track record and also for large firms, while it has been a very (or relatively) poor description of investment behaviour for firms with short track records and for small firms. This could be attributed to financial constraints which are more likely to be binding for firms to display the latter characteristics. An attempt to classify firms on the basis of their dividend policies failed to deliver the expected results, indicating that dividend policy does not provide the necessary information content to reveal possible financial constraints.

As an alternative approach to investigating the link between stock market and investment, the securities-valuation model places greater emphasis upon the stock market as a determinant of investment demand. In Tobin's model of the financial process, q provides the link between the real and financial sectors since it represents the ratio of the net return on real assets to the return on equity (Tobin, 1969). Monetary policy can influence real activity by affecting the rate of return on equity. An increase in the quantity of money reduces short term rates; and through portfolio-balance adjustments the public's demand for equities is increased, lowering the required rate of return and thereby raising q.

Malkiel, von Furstenberg and Watson (1979) made an important contribution to the 'q' theory of investment. Their model focused attention on
the formation of expectation and the presence of lags between investment decisions and the ultimate completion of the investment projects. Using industry data for the period 1956-76, they were able to estimate investment equations which approximated the relationship which they derived theoretically. Their results indicated that both changes in output relative to trend and changes in Tobin's q affected investment demand where the latter has shown a stronger affect. When the estimated changes in output relative to trend, are positive, they claimed that firms anticipate a need for larger future capital stocks. As Tobin's q reflects the market's valuation of the future profit prospects, they argue that it therefore guides investment demand. Moreover, they also indicate that there is a general tendency for q to come through more strongly, if the level of aggregation is lower.

Using the Malkiel, von Furstenberg and Watson (1979) model, Chappell and Cheng (1982) analyses individual firm level data. The results obtained by them are qualitatively similar to those reported previously using more aggregated data. The only difference that arises as suggested by the evidence of their analysis is because of behavioural differences between industries, combined with the particular distribution of firms across industries; differences in behaviour between large and small firms may also be partially responsible.

Ciccolo and Fromm (1980) analyze the relationship between investment and q by using observed average 'I/K' and average q for the period 1965-76 for 277 firms. They assert that it would be fallacious to infer that valuations placed in financial markets on debt and equity securities of firms relative to replacement costs of fixed assets are the only determinants of capital spending.
One would expect investment to be significantly related to $q$, but not to the exclusion of other variables. Moreover, since market valuations partially depend on expected returns from investment, $q$ should not be treated as if it was wholly exogenous.

The standard $q$ model describes the investment behaviour of a competitive firm subject to constant returns to scale and strictly convex costs of adjusting its capital stock. Bond et al (2004) presents a model where the firm's investment rate in each period is a function of marginal $q$ from the first-order conditions for optimal investment. The investment equation is of the following form:

$$\frac{I_t}{K_t} = a + \frac{1}{b} Q_t + \varepsilon_t$$

where $I_t$ is gross investment, $K_t$ is the net capital stock, $Q_t$ is $(q_t - 1)$ where $q_t$ is marginal $q$ and $\varepsilon_t$ is an additive shock to marginal adjustment costs. The parameters $a$ and $b$ are structural parameters of the adjustment cost function, which is assumed to be quadratic.

Tobin assumed that the market value of an additional unit of capital equals the average market value of the existing capital stock, i.e., the value of the marginal $q$ on an additional unit of investment is well proxied by average $q$, which is the ratio of the market value of the capital stock to its replacement cost. Following this it is assumed that the rate of investment is an increasing function of the marginal return to investment as proxied by $q$. 

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Hayashi (1982) showed that under certain restrictions on the profit function\textsuperscript{32}, marginal $q$, which is unobserved, equals average $q$, defined as follows:

$$q_t = \frac{V_t}{p_t \cdot (1 - \delta)K_{t-1}} \quad (2)$$

where $V_t$ is the net present value of the firm's expected future profits (adjusted for debt and taxes) and the denominator is the replacement cost at time $t$ of the capital stock inherited from the previous period. Here $p_t$ denotes the price of investment goods and $\delta$ is the rate of depreciation.

According to Bond et al (2004), the influence of expected future profits on current investment behaviour reflects the forward-looking nature of the investment decision in the presence of adjustment costs. If the fundamental value $V_t$ can be measured using the firm's stock market valuation, then under these particular assumptions there exists a single sufficient observable statistic for the firm's investment rates. More generally, this specification indicates that expectations of future profits should be an important explanatory variable for company investment.

Liu and Qi (2002) analyses how the dynamics in stock markets have a large impact on a firm's real decision. They consider an example of an entrepreneur who has an established business and is developing a new product that will require additional capital. Following Subrahmanyam and Titman (2001), they assume the payoff from the growth opportunity depends on the

\textsuperscript{32} The necessary condition is linear homogeneity of the profit function in $(K_t, h)$. Sufficient conditions for this to hold in the model presented here are perfect competition in output and input markets, and constant returns to scale in both production and adjustment cost technologies.
Tobin's q Theory of Investment

amount of capital invested and is correlated with the payoff on the assets in place.\textsuperscript{33} This is a two period problem. In period 1, production choices are made, and in period 2, the payoffs from the assets in place and the growth opportunity are realized. In period 1, when the manager makes the investment decision, she does not know the realization of future cash flow. She needs to extract information contained in the cash flow from stock prices.\textsuperscript{34} Thus, the stock trading behavior and the role of price information come into play in explaining a firm's investment.

By creating a link between stock market and corporate investment, Liu & Qi (2002) explicitly studies the role of the stock prices in transmitting information about the cash flow from informed traders to the manager. As the stock prices become more informative, the manager would be able to obtain more information about the cash flow. Therefore, they argue that the investment becomes more responsive to the cash flow. They show that the cross sectional difference in investment-cash flow sensitivity reflects the fact that the amount of information inferred from the stock market by the firm manager varies across firms. By adopting the Kyle (1985) model, they find a positive relationship between the number of informed traders and the investment-cash

\textsuperscript{33} The correlation is due to the fact that the new project is in the same industry as the existing assets, or an adjoining industry. It is particularly so for newer, smaller, faster-growing firms. These firms are still learning about their fundamental value. According to Liu & Qi, the realization of cash flow will presumably reveal relatively more information and provides a greater revision of expected profitability.

\textsuperscript{34} They assume that the capital market knows more about the payoffs of the firm's asset than the managers do for the following two reasons: (1) even though the manager may be better informed than any single investor, she is less likely to be better informed than all investors, whose separate information is aggregated into share prices; and (2) part of the information may be economy-wide (e.g., macroeconomic shocks), over which the investors may have advantages compared to the firm's manager.
flow sensitivity. Liu and Qi's model differs from the "financing constraint" view and offers a new explanation for the well-documented dependence between investment and cash flow. Their finding shows that the investment and cash flows are correlated simply because cash flows contain information about the firm's fundamentals.

In interpreting the correlation between corporate investment and the stock market traditional q theory argues that the stock prices rationally reflect the marginal product of capital, therefore there should be a positive relation between investment and Tobin's q (Tobin, 1969). Critics of the theory however, emphasize the irrational elements contained in stock prices. Since the stock prices deviate from the fundamentals all the time, their effect on the corporate investment is very limited. Therefore, the stock market is just something of a sideshow in terms of its influence on investment. Liu & Qi simply focuses on the information role of the stock market. By providing the firm manager with sufficient information about the firm’s cash flow and future investment opportunities, they argue that the stock market has a significant impact on corporate investment.

It is true that higher stock prices provide firms with a potentially cheap source of finance, so firms are expected to react by issuing equity. Economic theory, however leaves open the question of whether business fixed investment will respond to such a bubble. On the one hand, according to the active financing mechanism, firms may use the price-earnings ratio as a measure of

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35 See Keynes (1936); Fischer and Merton (1984); Morck, Shleifer and Vishny (1990), Blanchard, Rhee and Summers (1993) and Stein (1996).
the cost of capital so that a stock price bubble will lower the discount rate applied to future cash flows and stimulate investment. On the other hand, the \textit{inactive financing mechanism} suggests that firms might view stock prices as unreasonably high and though they issue shares, they put the proceeds into cash and securities, rather than fixed investment.

In the above discussion we have observed that some empirical studies do suggest that an increase in stock market valuation seems to have a significant impact on the investment levels, while other studies have vehemently opposed the view. This is true for the developing countries across the globe. The argument for liberalising the capital account is that there will be an inflow of foreign investment, which will increase the availability of capital with the domestic and commercial firms. Not only that, it is also expected that it will reduce the cost of capital, which will drive up the value of Tobin's q. In other words, the asset market value of installed capital goods is expected to rise relative to their replacement cost. In case q rises, the firms are expected to respond by investing more capital. In Part II of the thesis we are going to undertake empirical analysis of the above assertions to examine whether it truly happened in India in the post liberalisation period and specifically try to analyse whether the increase in stock market valuation brought about by the financial liberalisation policies adopted by the successive governments, has had any significant impact on the levels of fixed investment.