POLICY RESEARCH WORKING PAPER 1612

Stock Market and Investment

The Signaling Role of the Market

Cherian Samuel

Complaints that resources are misallocated as a result of stock market activity may be exaggerated. The results of Samuel's investigation suggest that shareholder myopia about capital expenditures is unlikely to result in managerial myopia.

The World Bank
Operations Policy Department
Operations Policy Group
May 1996

POLICY RESEARCH WORKING PAPER 1612

Summary findings

Samuel examines the role of the stock market as a signal to managers in undertaking capital expenditures. He asks, what do managers base their investment decisions on? Do they go by their own perceptions (managerial perceptions) of fundamentals, or by market evaluations (market perception)?

Is the stock market a sideshow, and should managers ignore short-term changes in share prices if they do not reflect the firm's long-term prospects? Or must they respond to market valuations, believing that the stock market's role is to value the firm as well as provide finance?

Samuel concludes that both managerial and market perception are important, but that managerial perception is more important than market perception. The evidence suggests that as a statistic, the Q ratio is not sufficient to explain firms' capital expenditure decisions. So, despite its theoretical elegance, the standard Q model of investment should be modified. A more eclectic approach would provide a more meaningful description of a firm's capital spending decisions.

Overall, the results suggest that stock market activity has only limited implications for the economy's resource allocation process. Evidence for the Q theory of investment (firm-level data) confirms previous findings in the literature that the model's poor empirical performance was partly the result of using aggregate data for the whole economy.

These findings also have implication for the debate about the relationship between shareholder and managerial shortsightedness (myopia). In the literature, there is a notion that the stock market puts too much pressure on managers, who then underinvest for the long term, especially in research and development. But the results of Samuel's investigation suggest that because market perception plays only a limited role in determining capital expenditures, shareholder myopia is unlikely to result in managerial myopia.

The implications for developing countries: While the stock market may not be central to a firm's capital spending decisions, it is not a sideshow either. The stock market plays an important signaling role for managers. This is a powerful rationale for financial reform and capital development in developing countries.

The results also suggest that complaints that stock market activity leads to misallocation of resources may be exaggerated.

This paper is a product of the Operations Policy Group, Operations Policy Department. Copies of the paper are available free from the World Bank, 1818 H Street NW, Washington, DC 20433. Please contact Cherian Samuel, room MC10-362, telephone 202-473-0802, fax 202-522-3253, Internet address csamuel@worldbank.org. May 1996. (48 pages)

Stock Market and Investment: The Signalling Role of the Market*

CHERIAN SAMUEL

Operations Policy Group

Operations Policy Department

World Bank

*An earlier version of this paper was presented at the Eastern Economic Association Meetings in New York, March 18-20, 1995. I like to thank the session participants for their comments. I also like to thank Drew Lyon, Plutarchos Sakellaris, Luis Guasch, John Wallis, and Martin Loeb for their comments.

Stock Market and Investment: The Signalling Role of the Market

In a market economy, the stock market performs three basic functions: (i) a source for financing investment; (ii) a signalling mechanism to managers regarding investment decisions; and (iii) a catalyst for corporate governance.

This paper focusses on the role of the stock market as a signal to managers in undertaking capital expenditures.[1] What do managers base their investment decisions upon? Do managers go by own perceptions (managerial perception) of fundamentals or market valuation (market perception)? In other words, what are the relative roles of managerial and market perceptions in capital expenditure decisions at the firm-level? In this paper, an empirical assessment of these issues are undertaken by looking at a panel of U.S. manufacturing firms, taken from Standard and Poor's Compustat database.

The paper is divided into two main sections. The first section lays out the analytical framework for the study with a detailed discussion of the Q theory of investment and its modifications. The second section reports the results of the empirical analysis and discusses the implications for developing countries.

I

In the literature, there have been two contrasting views regarding the role of the stock market with respect to investment decisions in the economy. One view argues that the stock market is essentially a sideshow. For instance, Bosworth (1975) has shown that if managers are concerned about the market value of the firm in the long-run while undertaking investment

[1] Samuel (1995) deals with the financing role of the market and Samuel (1996a) deals with the governance role of the market.

decisions, they should ignore share price changes in the short-run if they do not reflect the firm's longer-term prospects.

The opposite of this view is that stock market valuation matters for investment. For instance, Fischer and Merton (1984) have shown that if the objective of managers is to maximize the wealth of existing shareholders, they should respond to market valuation even when this deviates from the true value of the firm. This is because the role of the stock market is to value the firm as well as provide finance. Fluctuations in share prices therefore would alter the cost of capital to the firm. For instance, if investors are willing to accept lower returns than justified by the true value of the firm--or stock prices are too high-- then firms should issue new shares and invest until the marginal product of capital equals that lower cost of capital. Such a strategy would maximize the wealth of existing shareholders.

One element of this argument is the assumption that firms invest the proceeds of the new share issue in physical assets. This need not be the optimal strategy since investing in physical capital reduces its marginal product. As shown by Blanchard et al. (1993), firms could in fact invest the funds in financial assets like treasury bills, which is equivalent to investing in a constant returns to scale technology. Therefore, fluctuations in share prices may change the composition of investment alone, without changing the level of investment.

In any case, as noted by Galeotti and Schiantarelli (1994), on a theoretical level, it is not clear whether firms should respond only to fundamentals, or whether all share price movements, including those caused by irrational changes in investor perception of future states, should matter. Therefore, what firms actually do is an empirical question.

Q theory

Within the class of alternative models of investment--accelerator, neoclassical, modified neoclassical, cash flow, Q--it is the Q theory that posits a direct link between the stock market and investment decisions in the economy.[2] At the level of the firm, Q theory provides a link between the market's valuation of the firm and investment decisions. In general, firms should undertake capital expenditures when the market value of an investment exceeds the replacement cost of the investment.

What is interesting about the Q theory of investment is that it attempts to explain investment on a financial basis in terms of portfolio balance; all other theories are sort of output-based. Even though the Q model was formulated by Brainard and Tobin (1968) and Tobin (1969), it can in fact be traced back to Keynes (1936, p.151): "The daily revaluations of the stock exchange, though they are primarily made to facilitate transfers of old investment between one individual and the other, inevitably exert a decisive influence on the rate of current investment. For there is no sense in building up a new enterprise at a cost greater than that at which a similar existing enterprise 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 off the stock exchange at an immediate profit".

One attractive feature of the Q theory is that it characterizes the complete evolution of the capital stock from the underlying optimization problem; this feature is also present in the irreversibility models.[3] In all the other models of investment, though the optimal level of capital

---

[2] Chirinko (1993) provides a comprehensive survey of the current state of research on investment theory, with particular emphasis on the Q-theoretic models.

[3] See Dixit and Pindyck (1994) for a more detailed discussion of irreversibility models.

stock is derived from the firm's maximization problem, the optimal adjustment path for the capital stock when it is away from that level is not explicitly considered. In these models, dynamics are introduced to the equation specification by appeal to delivery lags or other barriers to instantaneous capital adjustment that are not however considered while deriving the optimal capital stock itself.

The most common approach to modelling the Q theory rationalizes slow adjustment--when the capital stock is away from its optimal level--by introducing strictly convex costs of adjustment when the level of capital stock is changed. Convexity implies that adjustment costs are rising at the margin and therefore large changes in capital stock are heavily penalized and the firm is induced to respond instead with a sequence of smaller changes. Current level of investment is affected by both past developments, and expectations of future conditions. The adjustment costs themselves can be thought of either as explicit installation/dismantling costs, or as losses of output resulting from disruptions to the productive process when new capital is introduced/existing capital withdrawn.

There are three approaches to implementing this adjustment cost framework: (i) Q theory (Summers (1981)); (ii) Abel and Blanchard (1986) model, which avoids using stock market data and does not assume either perfect competition or constant return to scale: and (iii) Euler equation approach (Abel (1980)). In this paper, the focus is on the Q theory.

Following Summers (1981), an investment equation in terms of observables can be written as

$$(I/K)_t = c + (1/b)Q_t \qquad (1)$$

where I is investment, K is replacement cost of capital, Q is the ratio of the stock market's

valuation of the firm's capital to its replacement cost and b is the adjustment cost parameter. This valuation ratio is known as average Q or Tobin's Q.[4] In this formulation of the Q theory, all expectations relevant to the current investment decision are summarized in average Q through forward-looking market valuation.

Several features of the Q investment equation are worthy of note: (i) the parameters of the Q investment equation are the structural parameters of the assumed adjustment cost function. In other words, they are "deep" or "structural" parameters; and (ii) the theory predicts that the measured Q variable should be a sufficient statistic for the investment rate.

Discussion

(i) An attractive feature of the Q model is that since the market's expectations regarding future profitability are completely summarized by the Q ratio, the lag distribution excludes delays due to expectational lags. Rather, lagged values of Q represent only order, delivery, and gestation delays.

(ii) The major problem with the Q theory relates to the measurement of the unobservable marginal Q. What is measured in practice is the average Q. There are situations where the marginal and average Q could be quite different.

For example, suppose that an unexpected energy price increase made a considerable portion of the firm's existing plant and equipment obsolete, yet simultaneously created substantial opportunities for profitable new investment in more energy-efficient equipment. In such a case, average Q might be less than unity, while marginal Q could exceed unity.

---

[4] See Hayashi (1982) for conditions under which average Q is equal to marginal Q, which is the measure indicated by theory.

(iii) One common finding of empirical research (based on eq.1) on Q theory is that variations in Q are unable to explain a large part of the variations in investment[5]; the residuals also turn out to be highly serially correlated, suggesting that important explanatory variables may have been omitted.[6]

For instance, output and profit variables still enter significantly when added to the Q investment equations. Abel and Blanchard (1986) examined specifications where the two components of marginal Q--marginal profit and the cost of capital--are specified as separate regressors. They found that the marginal profit component had a larger and more significant effect on investment than the cost of capital component, lending further empirical support to the earlier finding of Bischoff (1971) and Eisner (1978) that investment responds more to changes in output than to variations in the user cost of capital. Likewise, Fazzari et al. (1988) and others, have found the cash flow term to be significant in specifications of the Q model.[7] This approach is considered in greater detail below.

(iv) The empirical validity of the Q theory remains an unresolved issue. A strict interpretation of the Q model would predict a decline in investment following a dramatic decline in stock prices. This however did not happen after the stock market crash of October 1987. For instance, in Dun and Bradstreet's (1988) survey of 5000 firms, about 75% of the companies said that their

---

[5] See for instance von Furstenberg (1977), Summers (1981), and Poterba and Summers (1983).

[6] Given that the levels specification leads to serially correlated errors, the Q model is usually estimated in first differences. See Blanchard et al. (1993) for instance.

[7] Cash flows are defined as the sum of retained earnings and depreciation. In this paper, the terms cash flows and internal finance are used interchangeably.

capital spending plans for 1988 would not be negatively affected by the stock market slump.[8] This indicates that the fundamentals did not change with the crash of the stock market, even though investor sentiments did. Likewise, Seyhun (1990) has shown that insiders who bought stocks aggressively following the 1987 crash benefitted significantly suggesting that insiders did not perceive a shift in fundamentals and viewed the market break as being driven by investor sentiments.

(v) As noted by Abel and Blanchard (1986), one reason for the poor empirical performance of Q investment equations could be aggregation, since most of the early studies used aggregate time-series data. One solution to this problem of aggregation is to use firm-level data, as done in this paper and a host of others previously. The other advantage of using firm-level data is that several variables used in the construction of Q can be measured more accurately; in particular, using share prices of individual firms provides a direct measure of market value. The use of panel data also helps in improving the precision of parameter estimates.

Another explanation for the empirical shortcomings of the standard Q model is to note that if managers react only to changes in fundamentals and if the stock market is not efficient, then the value of shares is a very imperfect proxy for fundamentals.

Additionally, the fact that firms make so little use of new equity issues and that there appears to be so much noise in stock prices seems to suggest that investment may not be driven solely by the Q ratio.

---

[8] It should however be noted that for the year, the S & P 500 changed from its closing value of 246 on January 1, 1987 to 247 on December 31, 1987. Since managers are likely to pay more attention to this long-term change in share prices than daily movements in the context of capital expenditure decisions, the absence of any significant spillover of the market crash of October 1987 into capital expenditures may not be surprising.

(vi) Blundell et al. (1992) have shown that while measured Q contains significant information for investment behavior, the implied adjustment process is unacceptably slow and therefore measured Q is not a sufficient statistic for investment as predicted by the underlying theory. Somewhat disappointingly, this conclusion was found to be applicable to panel data studies as well as aggregate time series studies.

(vii) Finally, it should be emphasized that neither stock prices nor the Q-ratio could be said to cause investment in any useful sense; it is more like stock prices and the Q ratio reacting to information relevant to the firm. Anticipated sales, profits or investments affect both investment and stock prices. Therefore, changes in stock prices could predict changes in capital expenditures without there being a causal link from stock prices to investment. In other words, managers may not look at the Q ratio in deciding their level of capital expenditures. However, the information set on the basis of which managers make their investment decisions is correlated with the information that investors use in evaluating securities, and both of these are correlated with the cash flows of the firm.

Modifications to the standard Q model

These considerations suggest that the Q ratio is not a sufficient statistic to describe the behavior of capital expenditures at the firm-level.[9] One solution is to take an eclectic approach and formulate an investment equation that incorporates elements from the alternative theories of investment. This is the approach taken in Fazzari et al. (1988) and other studies. It should be noted though that the primary focus of these studies is to highlight the role of internal finance

[9] When the alternative models of investment were compared for the sample firms, it was found that the adjusted r^2 for the different models were remarkably close, suggesting that output, cost of capital and cash flows were also important determinants of capital expenditures in addition to the Q ratio. These results are not shown here though.

in capital expenditures in the presence of information asymmetries between insiders and outside suppliers of capital. Therefore, the Q ratio is primarily used as a proxy for investment opportunities in these studies.[10]

Another solution is to argue that investment is driven by market valuation as well as fundamentals and use proxies for both. While the Q ratio and share prices can be used as proxies for market valuation, sales(level as well as growth rate), cash flows, and dividends can be used as proxies for fundamentals. Blanchard et al. (1990, 1993) and Rhee and Rhee (1991) have taken this approach. However, cash flows could also indicate the presence of managerial discretion and information asymmetries. While there is no explicit attempt to distinguish between these various roles of cash flows in this part of the paper, these considerations are sufficient to regard cash flows as a fundamental variable from the manager's perspective with regard to capital expenditures.

Finally, it is also possible to split the Q ratio into two parts reflecting market and managerial perception elements and use proxies for managerial perception (fundamentals). This approach is based on Blanchard et al. (1990). These modifications to the standard Q model are discussed in detail below.

What is important to note about the last two approaches is that they highlight the role of the stock market as a signal to managers while undertaking investment decisions. Blanchard et al. (1993), and Rhee and Rhee (1991) have argued that the issue here is whether managers follow the signals given by the stock market even if market valuation does not match their own perceptions of fundamentals.

---

[10] See Samuel (1995) for a more detailed treatment of this approach.

Blanchard et al. (1993) argue that there could be at least three reasons for the manager's valuation of an investment project to differ from that of the market: (i) the market may have less information than managers; (ii) even if information sets are the same, the market may not value assets at their fundamental value, and market valuation could include a rational speculative bubble; and (iii) the market may be subject to fads which cause market valuation to deviate from fundamentals for long periods of time.

In order to assess the relative roles of market perception and managerial perception empirically, two estimation strategies could be followed. The first approach is due to Blanchard et al. (1990) wherein the Q-ratio is split into two components: one showing market perception, and the other managerial perception.

$$Q = V/K = (V/F).(F/K) \qquad (2)$$

where Q is the ratio of market value (V) to the replacement cost of capital (K), and F is fundamentals; (V/F) shows market perception and (F/K) shows managerial perception. In the literature, fundamentals are proxied by sales, cash flows, and dividends.

As noted by Morck et al. (1990), sales could be viewed as a proxy for the future demand for the firm's products and could signal the profitability of investment. The use of sales as a fundamental is also motivated by the accelerator theory of investment that emphasizes the role of demand factors and regards past levels of output as the most important determinant of future output.[11] Cash flows are a proxy since they measure current (and presumably future) profitability and because it facilitates investment if the firm is constrained in capital markets.

---

[11] Eisner (1978) argues that the rate of expected output should be the primary determinant of investment. In practice, this translates to formulating investment as a distributed lag function of current and past changes in sales.

Profits also affect investment by way of the fact that they are an important variable in the bond-rating of the firm and hence the amount of debt that can be contracted. Dividends are related to the permanent earnings of the firm, based on Lintner's (1956) theory of dividends.

As emphasized by Mairesse and Dormont (1985) and others, investment decisions depend upon expectations since they are forward looking. Only the sales and cash flow increases which the firm perceives as long-term or permanent will lead to net investment, while short-term or transitory changes must be met by utilization of existing capital. One way to build in this consideration is to substitute current or past variables for anticipated or future ones wherein it is assumed that firms view their current and past changes in sales and cash flows as permanent.

Therefore, the investment equation can be specified as

$$\ln(I/K) = a0 + a1(L)\ln(F/K) + a2(L)\ln(V/F) + \epsilon \qquad (3)$$

The logarithmic specification is also helpful in that the coefficients can be interpreted as elasticities; it helps to reduce the skewness of the size-distribution as well.

There are several hypotheses that can be tested from this specification: (i) the managerial perception hypothesis that firms respond only to fundamentals as managers perceive them implies that $a1(L)>0$ and $a2(L)=0$; (ii) if $a1(L)>a2(L)$, managerial perception matters more than market perception even though both are important; (iii) if $a1(L)=0$ and $a2(L)>0$, only market perception matters; (iv) if $a1(L)<a2(L)$, market perception matters more than managerial perception even though both are important; and (v) if $a1(L)=a2(L)$, firms respond to movements in Q, no matter what their sources is.

The second estimation strategy followed in this paper is similar to the approach in Blanchard et al. (1993) wherein investment is a function of both managerial and market

perceptions. This is essentially similar to the specification in eq. 3 except that explicit proxies for managerial and market perceptions are used; in contrast, eq. 3 uses proxies only for fundamentals. One specification could be

$$(I/K) = b0 + b1(L)\, F + b2(L)\, V + \epsilon \qquad (4)$$

where F is managerial perception, and V is market perception. The proxies for managerial perception are cash flows, sales(level as well as growth rate), and dividends; the proxies for market perception are the Q-ratio, and real stock prices. The predictions for b1(L) and b2(L) are similar to the predictions for a1(L) and a2(L) discussed before.

The use of real stock prices also addresses the issue raised by Barro (1990) regarding the role of stock prices in investment decisions. Barro (1990) found changes in stock prices to be significant in investment regressions for the U.S. and Canada at the aggregate economy level, even in the presence of cash flow variables. Barro (1990) has argued that the stock market outperforms the standard Q-ratio because of possible measurement problems with market value of debt and replacement value of capital stock using aggregate data.

Morck et al. (1990) also used proxies for managerial and market perceptions to investigate the role of the stock market with regard to the firm's investment decision using firm-level data. They concluded that since the stock market has small explanatory power for investment beyond its ability to predict fundamentals, complaints about misallocation of resources due to the stock market may be exaggerated. In other words, while the stock market may not be a sideshow, it is not very central either.

Financing and investment

It is also possible to infer the relative roles of managerial and market perceptions in

capital expenditure decisions at the firm-level by looking at financing patterns. Specifically, if the market perception hypothesis is correct and managers respond to market valuation even when it exceeds their own assessment of fundamentals or when equity is overpriced relative to fundamentals, firms should issue new equity and finance investment out of this new equity. However, as noted by Blanchard et al. (1993), it is not necessary that the firm always use the proceeds of the stock issue for capital expenditures. The firm could also invest these proceeds in financial assets like Treasury bills. What the firm does in practice therefore is an empirical issue.

Therefore, firms can be expected to issue equity when equity is overpriced relative to fundamentals or when market valuation is expected to be more important than fundamentals. On the other hand, firms would finance internally, issue debt or buy back shares when equity is underpriced relative to fundamentals or when fundamentals are expected to dominate market valuation. In the literature, this is also termed as the "market timing" hypothesis. The undervaluation and overvaluation of equity can be assessed by looking at trends in a broad market index like the S&P 500 or changes in the price earnings ratio.

There is broad support for the market timing hypothesis in the literature. For instance, using U.S. data, Taggart (1977) showed that firms preferred to issue equity when the stock prices were relatively high. For the UK, Marsh (1982) found that the timing of security issuance was towards periods when the equity market in general and the firm's stock in particular were experiencing large price gains and when interest rates were at relatively low levels. This may reflect the effect of lower market discount rates increasing firm values at the same time that more investment projects became profitable.

One way to test the market timing hypothesis is by looking at the composition of investment finance at the firm level for different years. In particular, analysis of 1987 should be of interest. As noted earlier, 1987 was the year of the stock market crash, when share prices were believed to have deviated significantly from fundamentals. The findings of Seyhun (1990) noted earlier, reflect this. Insiders gained substantially by buying shares aggressively, since they knew correctly that the market break was due to a shift in investor sentiment and not because of changed fundamentals. However, it should be noted that in a world of perfect capital markets, this sort of market timing for financing investment is not an issue at all. This is because, with perfect capital markets, valuation is always based on fundamentals.

Also, regression equations 3 and 4 can be estimated on a year-by-year basis and the relative roles of market valuation and fundamentals with regard to capital expenditures assessed. This relative assessment of market valuation and fundamentals can then be juxtaposed against the observed patterns in equity issues on an yearly basis to make inferences regarding the validity of the market timing hypothesis.

The market timing hypothesis can also be tested by analyzing firm-specific factors and larger macroeconomic factors, by way of a multivariate regression that models the firm's decision to issue equity as a function of firm-specific factors like the Q ratio, financial slack[12], issue of long-term debt on a net basis, return on investment, and economy-wide parameters like changes in the S&P 500 index and GDP growth.

The coefficient on the Q ratio and the S&P 500 index is expected to be positive, for the

---

[12] Financial slack is defined as the difference between internal finance and capital expenditures and shows how far the firm can avoid external finance while undertaking capital expenditures. Building financial slack essentially allows managers to effectively insulate themselves from the constant scrutiny of capital markets. See Samuel (1995) for a more detailed discussion.

"market timing" hypothesis to be true. In other words, firms would like to issue equity when it is overpriced relative to fundamentals and the general market conditions are bullish. The GDP growth coefficient is expected to be positive also, given that the stock market and the economy tend to move together and that the stock market is one of the leading indicators for the aggregate economy. The coefficient on the financial slack variable is expected to be negative, since higher levels of financial slack imply that firms are likely to be more dependent on internal finance and less dependent on external equity; higher levels of financial slack also indicate that internal finance is sufficient to meet the firm's capital expenditure needs. The coefficient on long-term debt is expected to be negative, based on considerations of the "financing hierarchy" hypothesis[13], wherein firms issue equity only after issuing debt and exhausting its debt capacity. In a world of perfect markets again, this is not an issue. Finally, the coefficient on return on investment is expected to be positive, since firms that attain higher returns on their investments are more likely to use external capital markets and issue equity.

[13] According to the financing hierarchy/pecking order hypothesis, the firm's preferred ordering of the source of finance is: (i) internal finance; (ii) external debt; and (iii) new equity. See Samuel (1995) for a detailed discussion.

II

(I) Q model of investment (table 1)

The empirical results are based on a panel of 603 manufacturing firms from the Standard and Poor's Compustat database for the 1972-1990 period. The Q ratio has been computed following the methodology outlined in Salinger and Summers (1983).

It is probably useful to begin the discussion of the results with a baseline model of the Q theory. Table 1 presents the estimates in levels, first difference, and estimates using one-period lag of Q as an instrument.[14] These estimates appear to be consistent with the previous findings in the literature. For instance, most of the existing studies estimate the coefficient on Q to be between 0.003 and 0.010 and the estimate here is well within the range.[15] These estimates also imply highly convex adjustment costs and very slow adjustment.[16]

The specification is also run in first differences, following the practice in the literature regarding concerns about serial correlation. There has also been a suggestion in the literature that the Q ratio may in fact be endogenous and correlated with the error term. The instrumental variable approach, using a one-period lag of Q as the instrument is meant to address this issue.[17]

---

[14] In general, the relationship is specified as

$Y_{it} = \beta_0 + \beta_{it}X_{it} + \alpha_i + v_t + e_{it}$ where α_i is the individual firm effect and v_t is the year effect. The standard approach for sweeping out fixed effects, by transforming variables to deviations from their firm-specific means, has been used in this paper. These estimates are also referred to as the "within-group" estimate in the literature. See Hsiao (1986) for a more detailed discussion of this approach.

[15] Salinger and Summers (1983) report estimates of 0.004 to 0.006; Fazzari et al. (1988) of 0.004; Hayashi and Inoue (1991) of 0.004; Hoshi and Kashyap (1987) of 0.009; and Blundell et al. (1992) of 0.005.

[16] It may be recalled that the adjustment cost parameter is the reciprocal of the estimated Q coefficient.

[17] See Schaller (1990) for instance.

Market perception versus managerial perception with Q split into two components (table 2)

The results of the regression based on eq. 3 are shown in table 2. Three proxies were tried for fundamentals: cash flows, sales, and dividends. Of these, the cash flow proxy produces the best fit. In all instances, both the market and managerial perception terms were important, even though the managerial perception term turned out to be more important than the market perception term. Also, in all but one instance, the market perception term is significantly different from the managerial perception term. In other words, while both market and managerial perceptions are important, the latter is somewhat more important in capital expenditure decisions at the firm level. It is also interesting to note that the one-period lagged terms are significant in all cases. In fact, all the regressions in this paper have been estimated with one-period lags. Lags of higher order were tried, but turned out to be insignificant. In the case of the formulation that involves net sales, the negative coefficient suggests the presence of monopolistic elements, consistent with findings of Schiantaralli and Georgoutso (1990).

The results of the equation involving cash flows as proxies for fundamentals suggest that an increase of 1 per cent in market valuation not matched by an increase in fundamentals leads to an increase in investment of 0.184 per cent, whereas an increase in market valuation matched by an increase in fundamentals leads to an increase in investment of 0.604 per cent. Again, these results are broadly consistent with the results in Blanchard et al. (1993).

Market perception versus managerial perception with proxies for both (table 3)

The results of the regression based on eq. 4 are shown in table 3. These regressions were run with proxies for both market and managerial perception. The proxies for managerial

perception (fundamentals) are cash flows, sales(level as well as growth rate), and dividends. The proxies for market valuation are Q, and share price.

The parameter estimates for both the managerial and market perception terms are significant in all instances except where dividends and sales growth have been used as proxies for fundamentals. In most of these cases, the market perception term is significantly different from the managerial perception term as well. This suggests that dividends and sales growth are not good proxies for managerial perception elements and have other roles. Of all the models, the Q-sales model performs the best with Q as the proxy for market perception and sales as the proxy for managerial perception. As noted before, the negative sales coefficient is consistent with the presence of imperfect competition, which introduces an additional wedge between marginal and average Q that depends on the present value of current and future output. Further, the managerial perception term is higher than the market perception term in almost all of these regressions. This implies that managers pay much more attention to their own perception of fundamentals than those conveyed by the market. Overall, the evidence suggests that both market valuation and fundamentals have strong effects on investment, even though the elasticity of investment with regard to fundamentals is larger. Based on the best-fitting stock price-sales model, the results suggest that an increase of 1 per cent in market valuation not matched by an increase in fundamentals leads to an increase in investment of 0.0011 per cent, whereas an increase in market valuation matched by an increase in fundamentals leads to an increase in investment of 0.018 per cent. These results are broadly consistent with the evidence in Blanchard et al. (1993) based on aggregate U.S. data for the 1922-1990 period, though the elasticity estimates are somewhat lower.

(II) Analysis of variance

It is interesting to complement the regression analysis with an analysis of variance in order to isolate the effects of fundamentals and valuation in capital expenditures at the firm level. In what follows, this analysis of variance has been done for the sample split in three ways: pooled, cross-section, and time-series.

Proxies for fundamentals after splitting the Q ratio (table 4)

Table 4 presents the results of the analysis of sources of variation after splitting the Q ratio into two components and using proxies for fundamentals. In all instance, cash flow proved to be the best proxy for fundamentals. The estimates from pooled regressions with fixed firm and year effects suggest that fundamentals accounted for 11-14 percent of the total variation in investment (I/K). In contrast, market valuation explained only 1-4 percent of the investment variation. The estimates from cross-section regressions suggest that fundamentals accounted for 30 percent of the variation in investment. In contrast, market valuation explained only 0-1 percent of the investment variation. The estimates from time-series regressions suggest that fundamentals explained between 55-68 percent of the total variation in investment. On the other hand, market valuation explained only 6-20 percent of the investment variation.

These results suggest that while both fundamentals and market valuation are important for explaining variations in capital expenditures at the firm level, fundamentals are much more important than market valuation.

Proxies for managerial and market perceptions (table 5)

Table 5 presents the results of the analysis of sources of variation after using separate proxies for fundamentals and market valuation. While the cash flow-share price model turned

out to be the best in cross section and time series regressions, the cash flow-Q model was the best in pooled regressions.

The estimates from pooled regressions with fixed firm and year effects suggest that fundamentals accounted for 7-8 percent of the total variation in investment (I/K). In contrast, market valuation explained only 0-2 percent of the investment variation. The estimates from cross-section regressions suggest that fundamentals accounted for 29-31 percent of the variation in investment. In contrast, market valuation explained only 3-5 percent of the investment variation. The estimates from time-series regressions suggest that fundamentals explained 56-65 percent of the total variation in investment. On the other hand, market valuation explained only 3-11 percent of the investment variation.

These results again suggest that while both fundamentals and market valuation are important for explaining variations in investment, fundamentals are much more important than market valuation. In other words, these results from the analysis of variance reinforce the earlier regression results in that though both market valuation and fundamentals are important in capital expenditures at the firm level, fundamentals play a much greater role than market valuation.

(III) Aggregate time-series estimates

As noted by Schaller (1990), one way to test the extent to which aggregation is responsible for the poor empirical performance of the standard Q model is to construct a synthetic aggregate time series from the firm-level data. This provides an intermediate case between a true aggregate time-series and firm-level panel data. Such a synthetic aggregate allows better exploitation of the firm-level data such as the value of the equity. On the other

hand, it involves the same sort of aggregation problems as a true aggregate time-series since the individual components are calculated at the firm level and summed and the aggregate values are calculated as ratios of these sums. The results presented in Schaller (1990) do suggest that aggregation bias is statistically significant.

The aggregate analysis is also useful in testing the consistency of these relationships noted at the firm level. In addition, this is useful in checking the consistency of these results against the results of Blanchard et al. (1993) for the aggregate U.S. economy.

Proxies for fundamentals after splitting the Q ratio (table 6)

Three proxies were tried for fundamentals: cash flows, sales, and dividends. At all levels of lags--from two to zero--the sales proxy proved to be the best. What is interesting to note about these results is that lagged terms turn out to be insignificant in these regressions. Again, capital expenditure decisions seem to be much more dependent on managers' own perceptions of fundamentals than market perception.

Proxies for managerial and market perceptions (table 7)

Based on adjusted r^2, the stock prices-sales model does best at the aggregate level in a formulation with no lag terms; it may be recalled that in firm-level regressions, the Q-sales model was number one and the share price-sales model number two. However, stock prices have the wrong, negative sign. As seen elsewhere, managerial perception of fundamentals matters more than market perception factors, even though both sets of factors are important. At one level, these results are similar to the results in Barro (1990) in that stock prices do better than the Q ratio as a proxy for market valuation in aggregate investment equations.

Next, regressions were run with lags in them; the first consideration was in working with

lags of different lengths. What is interesting to note here is that even though two lags were tried, none of the lagged terms turn out to be important in the time-series regressions. This is unlike the finding from the firm-level regressions where lagged values of managerial and market perception factors were often found to be significant. As noted before, the managerial perception factors seem to be more important than market perception factors in the firm's capital expenditure decisions.

These results in tables 6 and 7 suggest the presence of autocorrelation and the correction appears to be adequate. This is consistent with the finding in the literature where the level specifications are often plagued with serial correlation errors and therefore, the regressions come to be estimated in first differences of logarithms.[18]

These results from aggregate regressions suggest that there is no one-to-one correspondence between findings from the firm-level regressions and aggregate regressions. In other words, the results from firm-level and aggregate regressions are inconsistent. However, to the extent that the estimates from firm-level regressions are more likely to be precise since the relevant variables can be measured more accurately, one could place greater trust in the firm-level results shown in tables 2, 3 rather than the aggregate results shown in tables 6, 7. Also, the fact that the market perception term has the wrong, negative sign in tables 6, 7 suggest that the aggregation procedure might have led to significant measurement problems. Finally, aggregation bias could also result from incorrectly assuming that all firms face the same adjustment cost functions.[19]

---

[18] See Blanchard et al. (1993) for instance.

[19] This is also a problem in firm-level regressions to the extent that all firms are estimated with a single coefficient on the Q ratio.

(IV) Financing and investment

Market perception Vs Managerial perception: Q split (table 8)

Of the eighteen years in the study, cash flow turned out to be the best proxy for fundamentals in all the years except 1974. For 1974, net sales turns out to be the best proxy for fundamentals. Interestingly, in all instances where cash flows were used as proxies for fundamentals, managerial perception turned out to be more important than market perception; this pattern is reversed in the one case where sales was used as the proxy with market perception proving to be more important than managerial perception. Also, in all of these 18 years, the market perception term was significantly different from the managerial perception term; in some instances, it was true for both current and the lagged terms.

What about 1987, the year of the stock market crash? Cash flow turns out to be the best proxy for fundamentals for 1987, and the managerial perception term higher than market perception term. This result accords well with the notion that the stock market correction of 1987 had only limited impact on capital expenditure decisions at the firm-level and the overall resource allocation process in the economy. Managers did not seem to have perceived a shift in the fundamentals facing firms in the wake of the market crash, even though there was a significant shift in the investor sentiment governing the market.

Market perception Vs Managerial perception: Proxies for both (table 9)

The conclusions from using separate proxies for market and managerial perceptions are very similar to the conclusions from splitting the Q ratio and using different proxies for fundamentals that were described in the previous section. Of the eighteen years under study, the Q-cash flow model performed best in nine years, while the share price-cash flow model was

best in the other nine years. This is consistent with the previous results in this chapter of Q and stock prices being the best proxies for market perception and cash flows and sales as proxies for managerial perception. In all instances, capital expenditure decisions at the firm-level seem to be more guided by the managers' own perceptions of fundamentals than market perceptions.

With regard to 1987, the findings reported before continue to hold wherein managerial perception factors played a much greater role than market perception factors. In other words, managers did not seem to have perceived a shift in fundamentals facing firms in the wake of the market crash, even though there was a significant shift in the investor sentiment governing the market. These results also suggest that while cash flow is the best proxy for managerial perception, Q and stock prices are equally good proxies for market perception. This is consistent with the evidence from the previous sections.

Trends in sources of funds

Also, evidence elsewhere suggest that 1987 was the year with the second highest contribution from net issue of equity to total sources of funds; the highest contribution was in 1978.[20] It is remarkable that the stock market contribution to total sources of funds for the sample firms was positive in 1987, the year of the stock market crash. Though this result looks sort of implausible at first, it should be remembered that the market collapsed only in the month of October, and that there was a tremendous run-up in share prices until that time. As noted by Blanchard et al. (1993), the price-earnings ratio on the S&P 500 index increased from 11.0 at the end of 1984 to 20.3 in the third quarter of 1987, before falling to 14.0 at the end of 1987.

[20] For the 1972-1987 period, the contribution of net issue of equity to total sources of funds was positive in eight years and negative in the remaining eight years. See Samuel (1995) for more details.

This evidence together with the results in tables 8, 9 suggest that the equity issue decisions of firms were independent of the relative roles of market valuation and fundamentals. Therefore, there is no evidence here to support the hypothesis advanced by Blanchard et al. (1993) that if managers respond to market valuation even when it exceeds their perception of fundamentals, they would do so by issuing new shares, as a way of effecting the transfer from new to existing shareholders. In fact, in 1974, the only year in which market perception exceeded managerial perception (table 8), the net issue of shares for the sample firms was negative.[21] This evidence also reinforces the earlier finding that by and large, managers pay more attention to managerial perceptions than market perceptions with regard to capital expenditures at the firm level.

Regression analysis (table 10)

The results of the regression that explored the market timing hypothesis in terms of firm-specific as well as macroeconomic factors are shown in table 10. In general, all the variables are significant with the correct signs, except GDP growth and changes in the S&P 500 index which turn out to be insignificant. The insignificant coefficient on the S&P 500 index possibly reflects the fact that the sample omits major mergers. It is well known that mergers follow a wave-like pattern and closely follow movements in the stock market.[22] To the extent that mergers are financed through equity issues and to the extent that mergers are procyclical, movements in an aggregate stock index like S&P 500 are likely to have a positive effect on equity issues by the firm. The lack of such a positive relationship between changes in the S&P

---

[21] See Samuel (1995) for more details.

[22] See Mueller (1987) for instance.

500 index and equity issues, as found here, possibly reflects this. The positive, significant coefficient for the Q ratio provides broad support for the "market timing" hypothesis and implies that managers do pay attention to the movements in the Q ratio while undertaking equity issues. It is also consistent with the Myers and Majluff (1984) prediction that firms tend to issue equity when the level of asymmetric information is low. During bull markets, public information may dominate private information of managers, and make an equity issue attractive. The positive coefficient for the return on assets term suggests that firms that attain higher returns on investment are more likely to be dependent on external finance and issue equity.[23]

Conclusions and Discussion

The evidence in this paper suggests that while Q and real stock prices are the best proxies for market perception, cash flow and sales are the best proxies for managerial perception. Both managerial and market perception elements are important for capital expenditure decisions at the firm-level; however, managerial perception matters more than market perception. Therefore, these results at the firm-level reinforce the findings of Blanchard et al. (1993) regarding the importance of managerial perception elements at the aggregate economy level for the U.S.. From the perspective of managers undertaking capital expenditure decisions at the firm-level, these results imply that while stock market signals and activity are important, they are only of secondary importance. What is of primary importance is the manager's own perception of fundamentals facing firm. Therefore, these results are also consistent with the finding of Morck et al. (1990) regarding the limited implications of stock market activity for the resource

[23] Though return on sales and return on equity were tried as alternative measures of return on investment, return on assets provided the best fit.

allocation process in the economy. Also, the overall evidence for the Q theory of investment based on firm-level data confirms the previous finding in the literature that the poor empirical performance of the Q model in the past has been due in part to the use of aggregate data at the economy level.

These results also suggest that the Q ratio is not a sufficient statistic to explain capital expenditure decisions at the firm-level and that managerial as well as market perception are important. Further, managerial perception matters more than market perception. Therefore, the evidence in this paper underscores the need to modify the standard Q model of investment, despite its theoretical elegance, and adopt a more eclectic approach in order for it to serve as a more meaningful description of capital expenditure decisions at the firm-level.

In addition, these findings have important implications for the debate in the literature regarding the relationship between shareholder myopia and managerial myopia.[24] There is a notion in the literature that the stock market puts too much pressure on managers, who in turn indulge in myopic behavior by underinvesting for the long-term, especially by way of R and D expenditures. The results presented here suggest that, given the limited role that market perception elements play in the determination of capital expenditures at the firm-level, shareholder myopia is unlikely to lead to managerial myopia.

From the perspective of developing countries, these results imply that while the stock market may not be central to the firm's capital expenditure decisions, it is not a sideshow either.

---

[24] Shareholder myopia means the tendency of shareholders to focus on the behavior of stock prices in the short term as opposed to the long term. Likewise, managerial myopia implies managerial behavior focussed on improving earnings in the short term at the expense of long term growth; for instance, by way of skimping on R and D and maintenance expenditures that would eventually prove to be perilous to the firm's long term prospects. See Samuel (1996b) for a more detailed discussion.

The stock market plays a useful and important role as a signalling device for managers. This finding in turn provides a powerful rationale for financial sector reforms and capital market development in developing countries.

However, in practice, the application of the Q model to developing countries has been limited, given the rather exacting data requirements for the computation of the Q ratio, following the methodology outlined in Salinger and Summers (1983). In particular, it is difficult to estimate the replacement cost of the firm's capital stock precisely and one has to use the book value instead. Given these data limitations, testing of investment theories in developing countries have been confined to accelerator, neoclassical, and cash flow theories of investment.[25] Once firm-level data becomes available for developing countries, it would be interesting to replicate the analysis done in this paper to test the robustness of these results.

The findings in the paper with regard to the market timing hypothesis are also interesting. The results suggest that managers do pay attention to the movements in the Q ratio while issuing equity. In particular, firms tend to issue equity when the level of asymmetric information is low, as for instance during bull markets. There is some evidence from India that supports this market timing hypothesis. Reserve Bank of India's (RBI (1995)) survey of public response to capital issues for the 1986-87 to 1990-91 period suggest that there was an increasing tempo in the activities of the capital market during this period, when there was an overall boom in the Indian stock market.[26]

---

[25] Athey and Laumas (1994) found support for the cash flow theory of investment for India. Likewise, Nabi (1989) and Tybout (1983) found support for the cash flow theory for Pakistan and Colombia respectively. Also, Bilsborrow (1977) found support for accelerator and cash flow theories using panel data for manufacturing firms in Colombia.

[26] See RBI (1995) for more details.

The evidence presented in this paper also offers an interesting perspective on the more general issue of stock market activity and its implications for the resource allocation process in the economy. To paraphrase, the results here suggest that the stock market is neither a sideshow nor is it central. In other words, complaints about misallocation of resources in the economy due to stock market activity may be exaggerated.

This finding is especially relevant for developing countries. There is a view in the literature that stock market activity encourages speculation, excessive volatility of share prices, short-termism etc. and channels resources into socially unproductive activities.[27] Therefore, stock market development may not be a beneficial endeavor for developing countries. The results in this paper offer a powerful counter argument. Given that managerial perceptions are more important than market perceptions for capital expenditure decisions at the firm-level and given that the stock market plays a rather limited role as a source of finance[28], it is unlikely that stock market activity has deleterious implications for the resource a'ocation process in the economy.

This conclusion of course raises another question: what are the other implications of stock market activity for firms, over and above its financing and signalling functions. The answer is that there are many other roles that the stock market plays in a market economy: (i) it acts as the market for corporate control; (ii) it functions as a catalyst for corporate governance;[29] (iii)

---

[27] See Singh (1993) for instance.

[28] Samuel (1996c) undertakes a comparison of Indian and U.S. firms and shows that the stock market plays a limited role as a source of finance in both countries.

[29] See Samuel (1996a) for a detailed discussion of the role of the stock market as a catalyst for corporate governance.

it provides liquidity to individuals, helps them achieve their preferred time-path of consumption, and aids in their portfolio diversification; (iv) it serves as a means for transferring risks among various economic agents; (v) managers may worry about stock market activity because of the link between managerial compensation and stock prices, especially by way of stock options and warrants; (vi) managers would care about share prices if it is that their hiring and firing is linked to the performance of the stock price; (vii) stock market developments influence the debt capacity of the firm; (viii) managers care about stock market activity because of implications of shareholder trading horizons for managerial horizons, especially with regard to long-term investments like intangible investments.

These considerations are relevant for developing countries as well, especially those that are actively reforming their financial sectors and nurturing capital markets. They are also important in view of the current world-wide interest in emerging markets and the proliferation of global investors. Of course, much needs to be done by way of market microstructure reforms in developing countries, related to bolstering the institutional framework for capital markets, especially with regard to payment and settlement systems and national treatment of foreign investors in general and institutional investors in particular.

These considerations are also relevant to the debate in the literature on the costs and benefits of stock market-dominated economic systems versus bank-dominated economic systems and their implications for corporate governance and overall efficiency of the resource allocation process.[30] For instance, Allen (1993) has suggested that in some circumstances, banks will be the optimal way of allocating resources while stock markets are better in others. Banks will be

[30] See for instance, Porter (1992), Allen (1993), Stiglitz (1992).

a good way to provide financing in traditional industries such as agriculture where the technology is well known and there is a wide consensus on how things should be done. In industries where there is little consensus on how the firms should be managed, allocation of resources through the stock market is desirable. This is because the stock market provides a way of checking that firms are well run when there are divergences of opinion on how firms should be run. The theory is consistent with the observation that the stock market was important in the UK during the nineteenth century when it was the first country to go through the Industrial revolution. It is also consistent with the fact that the U.S. has relied heavily on stock markets in the twentieth century when it was the first country to go through the post-Industrial revolution.

From the perspective of developing countries, these considerations imply that for building basic industries where the technology is well known, banks are likely to be more appropriate. On the other hand, active stock markets are necessary to develop new industries where there is no consensus on technology. In other words, the choice of developing countries vis-a-vis banks and stock markets depends to a large extent on their stage of development. While developing countries need banks as well as stock markets, it may be more prudent for them to develop bank-based financial systems at the beginning of the industrialization process. This conclusion is especially relevant for transitional economies that are in the process of building basic industries.[31]

In conclusion, the evidence in this paper suggests that managerial perception is more

[31] See Long and Rutkowska (1995) for a detailed discussion of the role of banks in enterprise restructuring in Central and Eastern Europe.

important than market perception with regard to capital expenditure decisions at the firm-level. This combined with the fact that the stock market serves a limited role as a source of finance suggest that complaints about the misallocation of resources due to stock market activity may be exaggerated. While the U.S. experience may not be strictly valid in other country settings, the evidence presented in this paper does offer a rationale for financial sector reforms and capital market development initiatives undertaken in developing countries.

References

Abel, Andrew B. 1980. Empirical investment equations: An integrative framework. In Carnegie-Rochester conference series on public policy 12: 39-91.

Abel, Andrew B., and Olivier J. Blanchard. 1986. The present value of profits and cyclical movements in investment. Econometrica 54: 249-73.

Allen, Franklin. 1993. Stock markets and resource allocation. In Colin Mayer and Xavier Vives (eds.) Capital Markets and Financial Intermediation. Cambridge, U.K.: Cambridge University Press.

Athey, Michael J., and Prem S. Laumas. 1994. Internal funds and corporate investment in India. Journal of Development Economics 45: 287-303.

Barro, Robert J. 1990. The stock market and investment. Review of Financial Studies 3: 115-131.

Bilsborrow, R.E. 1977. The determinants of fixed investment by manufacturing firms in a developing country. International Economic Review 18: 697-717.

Bischoff, Charles W. 1971. Business investment in the 1970s:A comparison of models. Brookings Papers on Economic Activity, no.1: 13-58.

Blanchard, Olivier J., and Changyong Rhee, and Lawrence Summers 1990. Stock market, profit and investment. NBER Working Paper no. 3370

Blanchard, Olivier J., Changyong Rhee, and Lawrence H. Summers. 1993. The stock market, profit, and investment. Quarterly Journal of Economics 108: 115-36.

Blundell, Richard, Stephen Bond, Michael Devereaux and Fabio Schiantarelli. 1992. Investment and Tobin's Q: Evidence from company panel data. Journal of Econometrics 51: 233-257.

Bosworth, Barry P. 1975. The stock market and the economy. Brookings Papers on Economic Activity, no.2: 257-300.

Brainard, William C., and James Tobin. 1968. Pitfalls in financial model building, American Economic Review 58: 99-122.

Chirinko, Robert S. 1993. Business fixed investment spending:Modeling strategies, empirical results, and policy implications. Journal of Economic Literature 31: 1875-1911.

Dixit, Avinash K. and Robert S. Pindyck. 1994. Investment under uncertainty. Princeton, N.J.: Princeton University Press.

Eisner, Robert. 1978. Factors in Business Investment. Cambridge: Ballinger.

Fazzari, Steven M., R. Glenn Hubbard, and Bruce Peterson. 1988. Financing constraints and corporate investment. Brookings Papers on Economic Activity, no.1:141-195.

Fischer, Stanley and Robert C. Miller. 1984. Macroeconomics and finance:The role of the stock market. In Carnegie-Rochester conference series on public policy 21: 57-108.

Galeotti, Marzio and Fabio Schintarelli. 1994. Stock market volatility and investment: do only fundamentals matter? Economica 61: 147-65.

Hayashi, Fumio. 1982. Tobin's marginal q and average q: A neoclassical interpretation. Econometrica 50: 213-24

Hayashi, Fumio and Tohru Inoue. 1990. Relation between firm growth and Q with multiple capital goods: theory and evidence from panel data on Japanese firms. NBER Working Paper no. 3326.

Hoshi, Takeo and Anil K. Kashyap. 1990. Evidence on q and investment for Japanese firms. Journal of the Japanese and International Economies 4: 371-400.

Hsiao, Cheng. 1986. Analysis of Panel Data. Cambridge, U.K.: Cambridge University Press.

Keynes, John M. 1936. The general theory of employment, interest and money. New York: Harcourt, Brace.

Long, Millard and Izabela Rutkowska. 1995. The role of commercial banks in enterprise restructuring in Central and Eastern Europe. World Bank Policy Research Working Paper No. 1423.

Lintner, John. 1956. Distribution of incomes of corporations among dividends, retained earnings, and taxes. American Economic Review 46: 97-113.

Mairesse, Jacques and Brigitte Dormant. 1985. Labor and investment demand at the firm level: a comparison of French, German and U.S. manufacturing, 1970-79. 28: 201-31.

Marsh, Paul. 1982. The choice between equity and debt: An empirical study. Journal of Finance 37: 121-144.

Morck, Randall, Andrei Shleifer, and Robert Vishny. 1990. The stock market and investment:Is the market a sideshow. Brookings Papers on Economic Activity, no.2: 157-216.

Mueller, Dennis C. 1987. The corporation: growth, diversification and mergers. New York: Harwood Academic Publishers.

Myers, Stewart C., and Nicholas S. Majluff. 1984. Corporate financing and investment decisions when firms have information that investors do not have. Journal of Financial Economics 13: 187-221.

Nabi, I. 1989. Investment in segmented capital markets. Quarterly Journal of Economics 104: 453-462.

Poterba, James M. and Lawrence H. Summers. 1983. Dividend taxes, corporate investment, and Q. NBER Working Paper no. 829.

Porter, Michael E. 1992. Capital choices: Changing the way America invests in industry. Council on Competitiveness and Harvard Business School.

Reserve Bank of India. 1995. Capital issues and public response during 1986-87 to 1990-91. Reserve Bank of India Bulletin (February) 129-178.

Rhee, Changyong and W. Rhee. 1991. Fundamental value and investment: Micro data evidence. Mimeo.

Salinger, Michael and Lawrence H. Summers. 1983. Tax reform and corporate investment: A microeconomic simulation study. In Martin Feldstein (ed.) Behavioral simulation methods in tax policy analysis. Chicago: University of Chicago Press.

Samuel, Cherian. 1995. Stock market and the efficiency of investment: The financing role of the market. Paper presented at the Association of Indian Economic Studies's Conference. Chicago: May 19-20.

Samuel, Cherian. 1996a. The stock market and investment: the governance role of the market. Policy Research Working Paper No. 1578, World Bank.

Samuel, Cherian. 1996b. Does shareholder myopia lead to managerial myopia? A survey of issues and some evidence. Paper presented at the Eastern Economic Association Meetings. Boston: March 15-17.

Samuel, Cherian. 1996c. The stock market as a source of finance: A comparison of U.S. and Indian firms. Policy Research Working Paper No. 1592, World Bank.

Schaller, Huntley. 1990. A Re-examination of the Q theory of investment using US firm data. Journal of Applied Econometrics 5: 309-325.

Schiantarelli, Fabio and D. Georgoutsos. 1990. Monopolistic competition and the Q theory of investment. European Economic Review.

Seyhun, Nejat H. 1990. Overreaction or fundamentals: some lessons from insiders' response to the market crash of 1987. Journal of Finance. 45: 1363-88.

Singh, Ajit. 1993. The stock market and economic development: Should developing countries encourage stock markets?. UNCTAD Review (4): 1-28.

Summers, Lawrence H. 1981. Taxation and corporate investment: A q-theory approach. Brookings Papers on Economic Activity, no. 1: 67-127.

Stiglitz, Joseph E. 1992. Banks Versus Markets as mechanisms for allocating and coordinating investment. In The Economics of Co-operation: East Asian Development and the Case for Pro-Market Intervention. James A. Roumasset and Susan Barr (ed.) Boulder, Colorado: Westview Press.

Taggart, Robert A. Jr. 1977. A model of corporate financing decisions. Journal of Finance 32: 1467-84.

Tobin, James. 1969. A general equilibrium approach to monetary theory. Journal of Money, Credit and Banking 1: 15-29.

Tybout, J.R. 1983. Credit rationing and investment in a developing country. The Review of Economics and Statistics 65: 598-607.

Von Furstenberg, George M. 1977. Corporate investment: Does market valuation matter in the aggregate? Brookings Papers on Economic Activity 2: 347-408.

Table 1: Q model of investment

	ln (q)	**ln (q-1)**	**Adjusted r^2**
Estimates in levels	0.151(7.34)	0.300(14.95)	0.113
	Δln (q)	**Δln (q-1)**	**Adjusted r^2**
Estimates in difference	0.104(4.44)	0.301(13.03)	0.040
		q	**Adjusted r^2**
Estimates with instruments		0.406(43.49)	0.160

Notes: One-period lag of Q used as an instrument.
The regressions include fixed firm and year effects.
T-statistics are shown in parentheses.

Table 2: Market perception and managerial perception

	I	II	III
Market perception(t)	0.103 (4.77)	0.179* (8.43)	0.144* (6.83)
Market perception (t-1)	0.081* (3.98)	0.152* (7.73	0.224* (11.24)
Managerial perception(t)	0.127 (5.48)	-0.084 (-2.34)	0.121 (5.37)
Managerial perception(t-1)	0.477 (21.72)	0.716 (21.20)	0.274 (13.28)
NT	8422	8422	8422
Adjusted r^2	0.146	0.125	0.095

Note: (I) cash flow, (II) net sales, and (III) dividends were used as proxies for fundamentals.
* indicates that the market perception term is significantly different from the managerial perception term for the same time period.
The regressions include fixed firm and year effects.
T-statistics are shown in parentheses.
These regressions are based on eq. 3.

Table 3: Market perception and managerial perception

	I	II	III	IV	V	VI	VII
Market perception(t)	0.004* (9.77)	0.002* (4.90)	0.001 (3.42)	0.004 (2.87)	-0.002* (-1.29)	-0.004 (-3.17)	0.001* (3.49)
Market perception(t-1)	-0.002* (-9.07)	-0.0002 * (-0.95)	0.0003 (1.55)	-0.003* (-4.45)	0.001* (2.73)	0.003 (5.32)	0.0003 (1.54)
Managerial perception(t)	-0.018 (-2.85)	-0.027 (-17.18)	0.003 (0.29)	-0.005 (-0.7)	-0.027 (-16.81)	0.007 (0.67)	-0.00001 (-0.11)
Managerial perception(t-1)	0.154 (22.07)	0.046 (28.38)	0.010 (0.92)	0.138 (20.10)	0.045 (28.11)	0.013 (1.23)	0.000001 (0.12)
NT	10852	10852	10852	10852	10852	10852	10852
Adjusted r^2	0.078	0.091	0.021	0.072	0.088	0.020	0.021

Note: (I) Q-cash flow, (II) Q-sales, (III) Q-dividends, (IV) stock prices-cash flows, (V) stock prices-sales, (VI) stock prices-dividends,, and (VII) Q-sales growth.
* indicates that the market perception term is significantly different from the managerial perception term for the same time period.
The regressions include fixed firm and year effects.
T-statistics are shown in parentheses.
These regressions are based on eq. 4.

Table 4: Analysis of sources of variation in investment

Source of variation	Share of total sum of squares		
	(1)	(2)	(3)
Fundamentals and market valuation (RA)	0.148	0.307	0.742
Error (1-RA)	0.852	0.693	0.258
Fundamentals first			
Fundamentals (RB)	0.137	0.304	0.547
Market valuation (RA-RB)	0.011	0.003	0.195
Market valuation first			
Fundamentals (RA-RC)	0.113	0.295	0.681
Market valuation (RC)	0.035	0.012	0.061
Total sum of squares	1687.33	128.81	0.10
NT	8421	562	17

Note: These results are based on using cash flows as a proxy for fundamentals after splitting the Q ratio (eq. 3).
Entries in rows 3, 4, and 5 are ratios of sums of squares in individual regressions in relation to the total sum of squares for the full model (shown in row 6).
(1) is based on pooled regressions with fixed firm and year effects. (2) is based on cross-section regressions (Observation for each firm are averaged over the years). (3) is based on time-series regressions (Observations for each year are averaged across firms).

Table 5: Analysis of sources of variation in investment

Source of variation	Share of total sum of squares		
	(1)	(2)	(3)
Fundamentals and market valuation (RA)	0.092	0.336	0.680
Error (1-RA)	0.908	0.664	0.320
Fundamentals first			
Fundamentals (RB)	0.089	0.290	0.651
Market valuation (RA-RB)	0.003	0.046	0.029
Market valuation first			
Fundamentals (RA-RC)	0.069	0.310	0.561
Market valuation (RC)	0.023	0.026	0.119
Total sum of squares	27.97	1.24	0.001
NT	10852	602	17

Note: These results are based on using separate proxies for fundamentals and market valuation (eq. 4). (1) is based on the cash flow-Q model. (2) and (3) are based on the cash flow-share price model.
Entries in rows 3, 4, and 5 are ratios of sums of squares in individual regressions in relation to the total sum of squares for the full model (shown in row 6).
(1) is based on pooled regressions with fixed firm and year effects. (2) is based on cross-section regressions (Observation for each firm are averaged over the years). (3) is based on time-series regressions (Observations for each year are averaged across firms).

Table 6: Aggregate time-series: 1973-1990

	Lag 2	**Lag 1**	**Lag 0**
Market perception	0.001(0.07)	0.001(0.07)	-0.150(-22.02)
Managerial perception	0.001(0.03)	0.001(0.03)	0.859(36.56)
	D-W statistic	**AR parameter**	**Adjusted r^2**
	1.997	-0.998(-1570.4)	0.365
	Lag 2	**Lag 1**	**Lag 0**
Market perception	**	0.005(0.07)	-0.150(-22.02)
Managerial perception	**	0.01(0.03)	0.859(36.56)
	D-W statistic	**AR parameter**	**Adjusted r^2**
	1.997	-0.998(-1571.2)	0.365
	Lag 2	**Lag 1**	**Lag 0**
Market perception	**	**	-0.150(-22.04)
Managerial perception	**	**	0.858(36.53)
	D-W statistic	**AR parameter**	**Adjusted r^2**
	1.998	-0.998(-1800.2)	0.365

Note: Sales performed as the best the proxy for fundamentals (eq. 3). The parameters in the table are after correction for first-order auto correlation (AR). Intercept term not reported. T-statistics are shown in parentheses.

Table 7: Aggregate time-series: 1973-1990

	Lag 2	**Lag 1**	**Lag 0**
Market perception (a)	0.002 (0.10)	0.002 (0.10)	-0.626 (-27.34)
Managerial perception (b)	0.001 (0.06)	0.001 (0.06)	0.060 (37.78)
	D-W statistic	**AR parameter**	**Adjusted r^2**
	1.976	-0.999 (-1718.5)	0.274
	Lag 2	**Lag 1**	**Lag 0**
Market perception (a)	**	0.813 (1.62)	-1.245 (-2.48)
Managerial perception (b)	**	0.015 (6.01)	-0.033 (-0.92)
	D-W statistic	**AR parameter**	**Adjusted r^2**
	1.976	0.0998 (-1719.5)	0.274
	Lag 2	**Lag 1**	**Lag 0**
Market perception (a)	**	**	-0.627 (-27.35)
Managerial perception (b)	**	**	0.060 (37.70)
	D-W statistic	**AR parameter**	**Adjusted r^2**
	1.978	-0.999 (-2224.3)	0.274

Note: (a) stock prices, and (b) sales performed as the best proxies (eq. 4). The parameters in the table are after correction for first-order auto correlation (AR). Intercept term not reported. T-statistics are shown in parentheses.

Table 9: Market perception Vs Managerial perception: 1973-1990

	Market perception(t)	Market perception(t-1)	Managerial perception(t)	Managerial perception(t-1)	Adjusted r^2
1973(a)	0.005 (2.87)	-0.003* (-3.43)	0.103 (1.69)	0.244 (4.44)	0.175
1974(b)	-0.074* (-5.80)	0.031* (5.39)	0.124 (3.29)	0.245 (4.84)	0.243
1975(a)	0.006 (1.91)	0.002* (0.59)	-0.010 (-0.34)	0.217 (7.20)	0.217
1976(b)	-0.056 (-5.35)	0.093* (7.30)	-0.017 (-0.34)	00207 (3.92)	0.181
1977(a)	-0.007 (-2.03)	0.017* (3.88)	0.038 (0.85)	0.161 (3.37)	0.198
1978(b)	-0.036* (-2.76)	0.044* (3.15)	0.078 (1.59)	0.228 (5.25)	0.224
1979(b)	-0.049 (-3.64)	0.039* (3.37)	0.025 (0.52)	0.310 (5.83)	0.188
1980(a)	0.012 (2.99)	-0.002* (-1.45)	-0.012 (-0.20)	0.211 (4.21)	0.166
1981(a)	-0.019 (-3.30)	0.025* (5.15)	0.019 (0.43)	0.218 (3.78)	0.218
1982(a)	-0.0001* (-0.03)	0.010 (1.58)	0.134 (3.16)	0.054 (1.53)	0.165
1983(b)	-0.061* (-5.44)	0.068 (4.93)	0.147 (4.72)	0.123 (3.92)	0.225
1984(b)	-0.039 (-1.89)	0.007* (0.49)	0.011 (0.27)	0.338 (7.74)	0.244
1985(b)	-0.067* (-3.97)	0.052* (3.00)	0.088 (3.10)	0.235 (7.52)	0.255
1986(a)	-0.014 (-2.55)	0.024* (3.83)	0.025 (0.63)	0.151 (4.26)	0.192
1987(a)	-0.010 (-2.02)	0.016* (3.17)	0.010 (0.26)	0.175 (5.11)	0.160

1988(b)	-0.073* (-2.58)	0.063* (1.81)	0.054 (1.96)	0.212 (6.94)	0.205
1989(b)	-0.083* (-3.30)	0.052* (2.03)	0.116 (4.50)	0.156 (6.55)	0.244
1990(b)	-0.053 (-2.25)	-0.0001* (-0.01)	-0.049 (-1.82)	0.828 (9.83)	0.251

Notes: (a) Q-cash flow, and (b) share price-cash flow performed the best. Intercept term not reported (eq. 4).
* indicates that the market perception term is significantly different from the managerial perception terms for the same time period.
T-statistics are shown in parentheses.

Table 8: Market perception Vs Managerial perception: 1973-1990

	Market perception(t)	Market perception(t-1)	Managerial perception(t)	Managerial perception(t-1)	Adjusted r^2
1973(a)	-0.036* (-0.46)	0.325* (4.22)	-0.055 (-4.13)	0.637 (5.29)	0.192
1974(b)	0.017 (0.16)	0.311* (3.79)	0.138 (0.83)	-0.018 (-0.72)	0.166
1975(a)	0.288 (2.68)	-0.185* (-1.93)	0.144 (1.40)	0.405 (3.59)	0.179
1976(a)	0.148 (1.28)	-0.159* (-1.65)	0.133 (1.25)	0.310 (2.99)	0.128
1977(a)	0.213 (1.98)	-0.117* (-1.21)	0.290 (2.86)	0.197 (1.94)	0.168
1978(a)	0.266 (2.27)	-0.155* (-1.30)	0.347 (2.80)	0.217 (1.82)	0.215
1979(a)	-0.157 (-1.26)	0.155* (1.22)	-0.083 (0.67)	0.565 (4.52)	0.144
1980(a)	0.063 (0.59)	0.086* (0.70)	0.060 (0.50)	0.539 (4.15)	0.198
1981(a)	-0.200 (-1.70)	0.255* (2.37)	-0.243 (-2.07)	0.795 (6.51)	0.198
1982(a)	-0.314* (-2.67)	0.315 (2.59)	0.239 (1.94)	0.216 (1.62)	0.152
1983(a)	-0.077* (-0.63)	0.018* (0.15)	0.225 (194)	0.304 (2.56)	0.191
1984(a)	-0.162* (-1.16)	-0.035* (-0.28)	0.072 (0.53)	0.524 (3.92)	0.270
1985(a)	-0.140* (-0.84)	-0.109* (-0.69)	0.177 (1.21)	0.509 (3.34)	0.261
1986(a)	-0.037 (-0.21)	-0.023* (-0.13)	0.141 (0.74)	0.492 (2.63)	0.195
1987(a)	0.181 (1.45)	-0.204* (-1.60)	0.136 (1.08)	0.491 (4.01)	0.280

1988(a)	-0.061* (-0.51)	-0.102* (-0.85)	0.244 (1.83)	0.352 (2.74)	0.266
1989(a)	-0.059 (-0.47)	-0.076* (-0.57)	0.020 (0.15)	0.575 (4.29)	0.268
1990(a)	0.058 (0.49)	-0.026* (-0.20)	0.046 (0.37)	0.440 (3.46)	0.197

Notes: (a) cash flows, and (b) sales are used as proxies for fundamentals. Based on OLS regressions that split the Q ratio into components of market valuation and fundamentals (eq. 3). Intercept term not reported.

* indicates that the market perception term is statistically different from the market perception term for the same time period.

T-statistics are shown in parentheses.

Table 10: Share issues and firm characteristics

	(Net share issues/Total assets)
NT	3744
Q	0.001(7.11)
Financial slack	-0.129(-7.88)
Net issue of long-term debt	-0.164(-13.59)
Return on assets	0.045(3.46)
Changes in S&P 500	0.0002(0.31)
GDP growth	-0.002(-0.37)
Adjusted r^2	0.076

Note: The regressions include fixed firm and year effects.
T-statistics are shown in parentheses.

Policy Research Working Paper Series

	Title	Author	Date	Contact for paper
WPS1599	Economic Implications for Turkey of a Customs Union with the European Union	Glenn W. Harrison Thomas F. Rutherford David G. Tarr	May 1996	M. Patena 39515
WPS1600	Is Commodity-Dependence Pessimism Justified? Critical Factors and Government Policies that Characterize Dynamic Commodity Sectors	Nanae Yabuki Takamasa Akiyama	May 1996	G. Ilogon 33732
WPS1601	The Domestic Benefits of Tropical Forests: A Critical Review Emphasizing Hydrological Functions	Kenneth M. Chomitz Kanta Kumari	May 1996	PRDEI 80513
WPS1602	Program-Based Pollution Control Management: The Indonesian PROKASIH Program	Shakeb Afsah Benoit Laplante Nabiel Makarim	May 1996	A. Williams 37176
WPS1603	Infrastructure Bottlenecks, Private Provision, and Industrial Productivity: A Study of Indonesian and Thai Cities	Alex Anas Kyu Sik Lee Michael Murray	May 1996	S. Ward 31707
WPS1604	Costs of Infrastructure Deficiencies in Manufacturing in Indonesia, Nigeria, and Thailand	Kyu Sik Lee Alex Anas Gi-Taik Oh	May 1996	S. Ward 31707
WPS1605	Why Manufacturing Firms Produce Some Electricity Internally	Kyu Sik Lee Alex Anas Satyendra Verma Michael Murray	May 1996	S. Ward 31707
WPS1606	The Benefits of Alternative Power Tariffs for Nigeria and Indonesia	Alex Anas Kyu Sik Lee	May 1996	S. Ward 31707
WPS1607	Population Aging and Pension Systems: Reform Options for China	F. Desmond McCarthy Kangbin Zheng	May 1996	M. Divino 33739
WPS1608	Fiscal Decentralization, Public Spending, and Economic Growth in China	Tao Zhang Heng-fu Zou	May 1996	C. Bernardo 37699
WPS1609	The Public Sector in the Caribbean: Issues and Reform Options	Vinaya Swaroop	May 1996	C. Bernardo 31148
WPS1610	Foreign Aid's Impact on Public Spending	Tarhan Feyzioglu Vinaya Swaroop Min Zhu	May 1996	C. Bernardo 31148

Policy Research Working Paper Series

	Title	Author	Date	Contact for paper
WPS1611	Economic Analysis for Health Projects	Jeffrey S. Hammer	May 1996	C. Bernardo 37699
WPS1612	Stock Market and Investment: The Signaling Role of the Market	Cherian Samuel	May 1996	C. Samuel 30802