finance and numerous aspects of the tax code, including personal and corporate tax rates, investment tax credits, and depreciation deductions. Stockmarket fluctuations influence the cost of capital by affecting the expected cost of equity finance. A decline in the stock
market implies an increase in the market implies an increase in the expected cost of equity finan
thus, in the cost of capital. Focusing on the cost of capital as the link between the stock market and investment, however, ignores the advantages of the $q$ approach. In theory, stock-market fluctuations occur in response to new information about both fu
ture demand and future capital costs. If true, this implies that $q$ should be more informative than the cost of capital.
As a practical matter, however, the advantages of the $q$ approach have yet to be realized. While financial markets seem to respond to a wide variety of reached agreement on how to isolate the information contained in market values relevant to investment decisions. If market values are not equal to

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tember 1987).
the present discounted value of future returns to capital, the link between $q$ substantially Investment is weakened the replacement value of the capital stock is complicated by continual tech nological change and lack of price physical assets. Measurement of market values of financial liabilit difficult because many financial liabili ties are not widely traded.

## Conclusion

In this Economic Commentary, we have focused on the relations between $q$, stock market fluctuations, and investment. The links between the three are greatest rate information about future returns from the capital stock. Even then, how ver, the response of investment to a costs incurred in adjusting the capital stock and the delay inherent in the ppropriations-orders-investment process. Another problem that persists even

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if financial-market values are correct is he difficulty of calculating marginal $q$. more easily measured than marginal $q$. is limited in analyzing short-run changes in investment. If stock-market values are not "correct," as may have rise and plunge, the link between $a$ and investment is weaker still. In that case movements in the stock market may be expected to influence investment through their effect on the cost of financing investment
However, recent research emphasizes that some firms may fail to respond to
changes in the cost of equity finance changes in the cost of equity inance
because of financial constraints. Of course, a focus on the cost of capital as the mechanism through which stockmarket fluctuations influence invest ment ignores the advantage of $q$ : $q$ should incorporate information about ital. Unfortunately, as a practical mat ter, the advantages of the $q$ approach have yet to be realized.

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## ECONOMIC COMMENTARY

## Stock-Market

Gyrations and Investment

The worldwide stock-market decline on October 19 has increased uncertainty about future changes in employment and output both in the United States and abroad.
Part of the reason for this uncertainty is that changes in the level of equity prices have been one of the best (Moore, 1980). In particular, the stock market decline may affect consumer spending and business purchases of plant and equipment
Consumer spending may be influenced through changes in the level of consumer confidence and changes in ment (BFI) may be affected by changes in the cost of financing investment and by changes in businesses expectations of future demand.
In addition, there is a presumption that stock prices, to some extent, refuture interest rates, and a wide variety of other factors that are related to future economic activity. Whether stock prices correctly reflect the best available information is a widely debated ques tion in the economics profession. To new information, stock prices may be valuable aids in forecasting future eco nomic activity, particularly investment. While some preliminary information useful in predicting future consumer spending and BFI becomes availabl before actual spending data are quent compared to the almost instan taneous revaluations of equities reflected in the stock market.

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Bank of Cleveland or of the Board of Governors of

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the Federal Reserve System.

In this Economic Commentary, we analyze the relationship between stock market gyrations and business fixed than on consumption for two reason than on consumption for two reasons.
First, although BFI comprises only 10 percent of gross national product (GNP) fluctuations in BFI are tied closely to changes in GNP. Second, if stock prices correctly reflect the best available information, then stock-market fluc
tuations should be closely tied to BFI. One widely used investment theory di rects us to focus on the ratio of the the replacement value of physical assets, a ratio called $q$. In this article we use the $q$ theory to examine the rela tionship between the stock market and BFI. We find that, even if stock-market values are "correct," stock-market fluc tuations only indirectly influence BFI.

## Investment and $q$

A relationship between stock-market fluctuations and investment was pre dicted by Keynes (1936, p. 151):
...daily revaluations of the Stock Exchange... inevitably exert a dec sive influence on the rate of cur
sense in building up a new enter-
prise at a cost greater than that a which a similar existing enter-
prise can be purchased..
This passage, and subsequent devel opments in investment theory, implie ship between $q$ (the ratio of the mark
value of financial liabilities to the eplacement value of physical assets) and the rate of physical investment. ${ }^{2}$ The theory relating $q$ to investment is the "preferred theoretical description of investment" because it links investment to expectations about the futur
The link between $q$ and The link between $q$ and investment valuations of debt plus equity correctly reflect relevant economic information and if investment decisions are made so as to maximize the market value of a In theory, the correct value of debt plus equity reflects all information about the returns to be received by the owners of a firm's physical capital. In fact, the market value of debt plus equity should equal the present discounted value of the future after-tax returns to be received by the bondfinancial markets' valuations are correct, they reflect two types of informa tion: 1) information about the future returns to be received after firm revenues are used to pay wages and taxes, and 2) information about rates of ments (these are used to "discount" the future returns, that is, to translate hem into present values)
If the value of debt plus equity reflects the value of the returns to be generated by the capital stock, and if our second assumption is met, changes
in the value of debt plus equity should be related to decisions to add to the cap. ital stock. Because investment is an

## Business fixed investment (BFI) refers to the nonresidential business fixed investment comp

 nent of the GNP accounts. Expenditures on plant and equipment constitute about 90 percent of BFI. intangibles such as future investment opportuni ies or patents.

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addition to the capital stock, however, firms need to compare the market value of the returns to be generated by
additions to the capital stock and the additions to the capital stock and the he ratio between the market value and he cost for additions (marginal exceeds one, net investment (BFI minus depreciation) will be positive. If marginal $q$ falls below one, net investment will be negative.
The act of building up or reducing the apital stock alters average $q$ (the marby the replacement value of the existing capital stock) by increasing the total replacement value of the capital stock.
verage $q$ will eventually equal one, as ndicated in the quotation from Keynes. Under the assumptions of the $q$ themost, if not all, of the information needed to predict investment. An alter native approach would focus on individual variables affecting the marke alue of the firm's liabilities, because maximization of that total is the objecive for investment decision bles is difficult, and the of such vari required is not readily available. The dvantage of the $q$ approach is greatest ff financial markets and, thus, $q$ corectly reflect information about expecations. In this case, no individual vari hould help $q$ predict investment, since hould help $q$ predict investment, since value of the firm's liabilities (the numerator of $q$ ).
In figure 1 we have plotted average $q$ and the rate of investment for nonfi ancial corporations. ${ }^{5}$ The likely mpact of the stock-market decline on verage $q$ can be approximated by notent of the total market value of liabili ies. The average price of stocks, as measured by the Standard and Poor's 500 index, declined 22 percent from une 30, 1987, to the end of November 1987, so we would expect the numera$q$ theory, the rate of investment folowing this decline will be lower than it therwise would have been.


Lags in the Response of
nvestment to a Change in Even if a change in $q$ reflects a change in the correct valuation of the future returns generated by the capital stock he response of investment to a change in marginal $q$ will be delayed and ncreasing $q$ firms first have to decid that a larger capital stock is desired before appropriating funds and placing orders for future delivery. If $q$ falls, firms could reduce investment by can eling orders, or could decide to reduce ppropriations or orders
Since few orders are actually canon previously placed orders. To furthe complicate matters, expenditures do not necessarily coincide with the deliv ery and installation of new capital goods. In fact, there is some evidence hat payment is spread out between the ime that orders are placed and the time of delivery
Because it is costly to change the size of the capital stock rapidly, the respons of investment will be spread out over irms have to pull could be costly if firms have to pull resources away from production to adapt to new plant and output, of increasing the capital stock may vary with the rate at which the capital stock is increased. This implies that the net return from investing decreases with the rate of investment.

At first, if $q$ has increased, a rela tively high and costly rate of investment can be justified. After the initial tional investment falls (since the mar ginal product of capital declines with a larger capital stock), and subsequen rates of investment will be lower. ined the lag lengths involved in the investment process. Von Furstenber (1977) found that, given an average ratio of unfilled orders to shipments, 20 percent of new orders for plant and equipment received one quarter ago were shipped in the current quarter. In
the second, third, and fourth quarters, 44 percent, 28 percent, and 7 percent new orders were shipped, respectively The response of investment to a decline in $q$, however, should be some what different from the response to an increase in $q$. At the extreme, investment can be reduced to the point at
which the capital stock is allowed to wear down or be slowly scrapped. Cancellation of some orders or appropriations is a more likely response to a decline in $q$. In fact, the ratio of orders canceled to new orders increases in downturns (see Zarnowitz, 1973). On average, the rate of cancellation of percent of appropriations by manufac turing firms were canceled in 1986 (se The Conference Board, 1987).

Marginal and Average $\boldsymbol{q}$ Because investment concerns additions to the capital stock, the relevant mea ure of $q$ is marginal $q$. The stock mar of the returns from the new capital tock, but the value of the returns the existing capital stock. Because of difficulty of separating the change in the value of new capital stock from he changed value of old capital, econmists focus on average $q$, calculated as xisting debt plus equity to the a firm's ment cost of its existing capital. The ink between average $q$ and investment is weakened by divergences between average and marginal $q$.
An example of such a divergence is when new information leads to an upward revision of expected future he existing, less-energy-efficient capi tal would decrease relative to the value of returns anticipated from new capital designed to economize on expensive nergy. In such a case, average $q$ may in spite of increased incentives to ectations of relative factor prices in stimulate investment while decreasing average $q$.
Changes in expectations about the tax code can also cause marginal and average $q$ to move in opposite directions. he investment tax credit affected th replacement cost of new capital and, regarding deductions for depreciation affect the replacement value of the
entire capital stock.
There is some evidence that changes in expectations can explain some of the historical relation between average $q$
and investment. Elmer and Hendershott (1984) demonstrated that changes in expected prices of capital, energy, labor, and materials can explain the decline in average $q$ during the late 1960 s and
1970s.
Therefore, when expectations about future relative input prices are being revised, the link between average $q$ and
investment is weakened and the stock market is a poorer indicator of future investment. However, if expectations are not systematically high or low,
average $q$ would be a better guide to nvestment in the long run than in the immediate future

Stock Market "Bubbles" and $q$ So far, we have assumed that market values accurately reflect information bout future returns from the capital tock. If actual market values do not accurately reflect such information, how useful is $q$ ? Many analysts have in October did not reflect a revaluation f future returns Does this imply that BFI will be unaffected?
Economists refer to the excess of the actual stock-market value over the alue calculated as a present dis counted value of future returns as a "bubble." It can be argued that firms will respond to a change in $q$ even if being "irrational" (too high or too low) Firms may respond to stock-price changes simply because stock prices affect the cost of investment. When stock prices rise, the cost of raising cost to a firm of financing via equity quals the rate at which it pays out dividends, plus the rate at which it
must reinvest retained earnings to gen rate capital gains for the shareholders ince dividend policy is relatively stable, when the price of a share rises, the cost of equity falls. Further investment ment decisions involve comparing the rate of return on the investment with he cost of financing investment. In other words, even if the firm's man gement has not revised its view of the future, it may respond to the stockby the same reasoning the cost of fiancing investment rises, and previous profitable investment opportunities may be cut off. Rather than issue hares, firms may now use funds pre vously designated for investment to It is not their shares at lower prices. It is not clear, however, that investissue or repurchase of equity. Firms decisions to change their capital stock
where $K(t)$ is the stock of structures and equip.
ment centered on quarter $t$, to correspond to th
centering performed in the calculation of $q$.
centering performed in the calculation of $q$.
formula with the starting values set at the end-
of 1950 net-constant-dollar stocks for nonfinancial corporations published in the Survey of Cu
rent Business. The expenditure series are the rent Business. The expenditure series are the
real expenditures on plant and equipment from real expenditures on plant and equipment from
the National Income Accounts. I utilized .014 and .032 as the quarterly depreciation rates in the
will be based on their own internal essment of future demand for their deut. In addition, many investment decisions involve large and irreversible commitments. However, market flucuations give firms the opportunity to
ower the cost at which they obtain lower the cost at which they obtain
funding, either by issuing stock when the price is high or by buying back equity when the price is low.

Financial Constraints and the Link Between $q$ and Investment Hubbard, and Petersen [1987]) has xplicitly shown how constraints irms' ability to raise funds for investment can weaken the link between and investment. Not all firms will issue hares if their share price rises or buy ack equity if their share price falluat rate of investment for all firms. Small and growing firms are likely to face constraints on their ability to inance investment. Small firms may not be as well-known, so investors may equire a higher rate of return, or low rowing firm needs to utilize externa ources of funding, since funds require finance investment will tend to excee available internal funds, or cash flow. In order for such firms to respond to an increase in equity values by issuing stock, the stock price must rise enough demanded by investors and to make the cost of equity issue lower than the cost of using internal funds. Fluctuations in tock prices that do not succeed in reduc ing the cost of share issue below the cost of retained earnings will not result to be constrained by cash flow investment would tend to respond more to fluctuations in cash flow than to $q$.

## The Cost of Capital, $q$,

nd Investment
An alternative to focusing on $q$ as the and investment is to focus on the cost of capital. The cost of capital is the cost of financing investment, taking into account the costs of various methods of

## . There are other ways that a firm can adjust output and affect the return to its physical capi al. Firms can adjust hours and employment, for xample, and thus avoid potentially high costs ssociated with changing the capital stock (see

 Shapiro [1986]).ssumed objective
. A slightly more complicated version of the $q$ ory Implies that average $q$ may not equal one in ple, alters the replacement value of the capital stock and, thus, $q$.

> 5tenberg (1977). For years since 1976 , I assume that the ratio between preferred and common
dividends is still at its end-of-1976 value Real capital stock series are calculated separately for For each series I or each series I utilize the perpetual inventory

