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ECONOMIC COMMENTARY

Stock-Market Gyrations and Investment

by William P. Osterberg

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 leading indicators of economic activity (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 consumer wealth. Business fixed investment (BFI) may be affected by changes in the cost of financing investment and by changes in businesses' expectations of future demand.[1]

In addition, there is a presumption that stock prices, to some extent, reflect information about future demand, future 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 question in the economics profession. To the extent that they correctly reflect new information, stock prices may be valuable aids in forecasting future economic activity, particularly investment.

While some preliminary information useful in predicting future consumer spending and BFI becomes available before actual spending data are released, the data releases are infrequent compared to the almost instantaneous revaluations of equities reflected in the stock market.

In this *Economic Commentary,* we analyze the relationship between stock-market gyrations and business fixed investment. We focus on BFI rather 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 fluctuations should be closely tied to BFI.

One widely used investment theory directs us to focus on the ratio of the market value of financial liabilities to the replacement value of physical assets, a ratio called q. In this article, we use the q theory to examine the relationship between the stock market and BFI. We find that, even if stock-market values are "correct," stock-market fluctuations only indirectly influence BFI.

Investment and q

A relationship between stock-market fluctuations and investment was predicted by Keynes (1936, p. 151):

> ...daily revaluations of the Stock Exchange... 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....

This passage, and subsequent developments in investment theory, implies that there should be a close relationship between q (the ratio of the market value of financial liabilities to the replacement 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 future (Fischer and Merton, 1984).

The link between q and investment is strongest if the financial markets' 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 firm's liabilities (debt plus equity).[3]

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 bondholders and stockholders. Thus, if the financial markets' valuations are correct, they reflect two types of information: 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 return available on alternative investments (these are used to "discount" the future returns, that is, to translate them 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 capital stock. Because investment is an

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1. Business fixed investment (BFI) refers to the nonresidential business fixed investment component of the GNP accounts. Expenditures on plant and equipment constitute about 90 percent of BFI.

2. While this article focuses on BFI, it is difficult to separate the market value of physical assets such as plant and equipment from the value of other assets such as land, inventories, and intangibles such as future investment opportunities or patents.

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 cost of adding to the capital stock. If the ratio between the market value and the cost for additions (marginal *q)* exceeds one, net investment (BFI minus depreciation) will be positive. If marginal *q* falls below one, net investment will be negative.

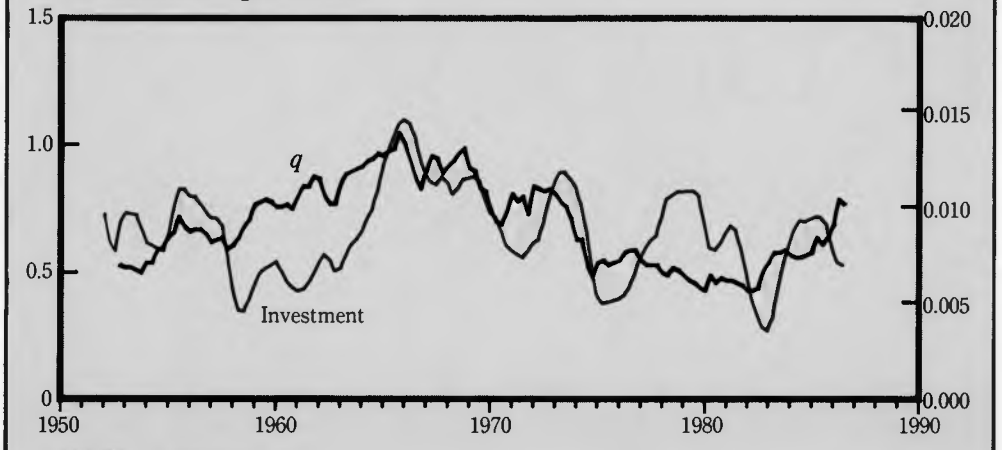
The act of building up or reducing the capital stock alters average *q* (the market value of all existing liabilities divided by the replacement value of the existing capital stock) by increasing the total replacement value of the capital stock. Average *q* will eventually equal one, as indicated in the quotation from Keynes.[4]

Under the assumptions of the *q* theory, the value of current *q* contains most, if not all, of the information needed to predict investment. An alternative approach would focus on individual variables affecting the market value of the firm's liabilities, because maximization of that total is the objective for investment decisions.

Measuring expectations of such variables is difficult, and the information required is not readily available. The advantage of the *q* approach is greatest if financial markets and, thus, *q* correctly reflect information about expectations. In this case, no individual variable relevant to investment decisions should help *q* predict investment, since such variables influence the market value of the firm's liabilities (the numerator of *q).*

In figure 1 we have plotted average *q* and the rate of investment for nonfinancial corporations.[5] The likely impact of the stock-market decline on average *q* can be approximated by noting that equity has comprised 60 percent of the total market value of liabilities. The average price of stocks, as measured by the Standard and Poor's 500 index, declined 22 percent from June 30, 1987, to the end of November 1987, so we would expect the numerator of *q* to fall by 13 percent. According to *q* theory, the rate of investment following this decline will be lower than it otherwise would have been.[6]

Figure 1 Average *q* and the Rate of Investment for Nonfinancial Corporations



SOURCE: See footnote 5, below.

Lags in the Response of Investment to a Change in *q*

Even if a change in *q* reflects a change in the correct valuation of the future returns generated by the capital stock, the response of investment to a change in marginal *q* will be delayed and drawn out. If the stock market rises, increasing *q,* firms first have to decide that a larger capital stock is desired before appropriating funds and placing orders for future delivery. If *q* falls, firms could reduce investment by canceling orders, or could decide to reduce appropriations or orders.

Since few orders are actually canceled, investment expenditures depend on previously placed orders. To further complicate matters, expenditures do not necessarily coincide with the delivery and installation of new capital goods. In fact, there is some evidence that payment is spread out between the time that orders are placed and the time of delivery.

Because it is costly to change the size of the capital stock rapidly, the response of investment will be spread out over time. Investment could be costly if firms have to pull resources away from production to adapt to new plant and equipment. The cost, in terms of lost 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 relatively high and costly rate of investment can be justified. After the initial response, the net benefit from additional investment falls (since the marginal product of capital declines with a larger capital stock), and subsequent rates of investment will be lower.

Several empirical studies have examined the lag lengths involved in the investment process. Von Furstenberg (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 of new orders were shipped, respectively.

The response of investment to a decline in *q,* however, should be somewhat 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 orders or appropriations is low. Only 5 percent of appropriations by manufacturing firms were canceled in 1986 (see The Conference Board, 1987).

3. The studies cited in the text differ as to the assumed objective.

4. A slightly more complicated version of the *q* story implies that average *q* may not equal one in the long run. An investment-tax credit, for example, alters the replacement value of the capital stock and, thus, *q.*

5. The calculation of *q* follows that of Von Furstenberg (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 structures and equipment, then added together. For each series I utilize the perpetual inventory formula with the starting values set at the end-of-1950 net-constant-dollar stocks for nonfinancial corporations published in the Survey of Current Business. The expenditure series are the real expenditures on plant and equipment from the National Income Accounts. I utilized .014 and .032 as the quarterly depreciation rates in the perpetual inventory formula. The investment rate was then calculated as $[K(t+1)-K(t)]/K(t)$,

Marginal and Average *q*

Because investment concerns additions to the capital stock, the relevant measure of *q* is marginal *q*. The stock market, however, reflects not just the value of the returns from the new capital stock, but the value of the returns from the existing capital stock. Because of the difficulty of separating the change in the value of new capital stock from the changed value of old capital, economists focus on average *q*, calculated as the ratio of the market value of a firm's existing debt plus equity to the replacement cost of its existing capital. The link 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 energy prices. The market's value of the existing, less-energy-efficient capital would decrease relative to the value of returns anticipated from new capital designed to economize on expensive energy. In such a case, average *q* may fall in spite of increased incentives to invest. More generally, changes in expectations of relative factor prices may 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. The investment tax credit affected the replacement cost of new capital and, thus, marginal *q*. Tax-code provisions 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 1960s 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 investment 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 about future returns from the capital stock. If actual market values do not accurately reflect such information, how useful is *q*? Many analysts have suggested that the stock-market decline in October did not reflect a revaluation of future returns. Does this imply that BFI will be unaffected?

Economists refer to the excess of the actual stock-market value over the value calculated as a present discounted value of future returns as a "bubble." It can be argued that firms will respond to a change in *q* even if firms' managers view the market as 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 funds via stock issues falls. The total cost to a firm of financing via equity equals the rate at which it pays out dividends, plus the rate at which it must reinvest retained earnings to generate capital gains for the shareholders. Since dividend policy is relatively stable, when the price of a share rises, the cost of equity falls. Further investment then becomes profitable, since investment decisions involve comparing the rate of return on the investment with the cost of financing investment.

In other words, even if the firm's management has not revised its view of the future, it may respond to the stock-market rise. If the price of equity falls, by the same reasoning, the cost of financing investment rises, and previously profitable investment opportunities may be cut off. Rather than issue shares, firms may now use funds previously designated for investment to repurchase their shares at lower prices.

It is not clear, however, that investment will immediately respond to the issue or repurchase of equity. Firms' decisions to change their capital stock will be based on their own internal assessment of future demand for their output. In addition, many investment decisions involve large and irreversible commitments. However, market fluctuations give firms the opportunity to 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

Recent work (for example, Fazzari, Hubbard, and Petersen [1987]) has explicitly shown how constraints on firms' ability to raise funds for investment can weaken the link between *q* and investment. Not all firms will issue shares if their share price rises or buy back equity if their share price falls. So, fluctuations in *q* will not affect the rate of investment for all firms.

Small and growing firms are likely to face constraints on their ability to finance investment. Small firms may not be as well-known, so investors may require a higher rate of return, or lower price, in order to hold their shares. A growing firm needs to utilize external sources of funding, since funds required to finance investment will tend to exceed 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 to compensate for the additional return demanded by investors and to make the cost of equity issue lower than the cost of using internal funds. Fluctuations in stock prices that do not succeed in reducing the cost of share issue below the cost of retained earnings will not result in equity issue. Because such firms tend 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*, and Investment

An alternative to focusing on *q* as the link between stock-market fluctuations 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

where $K(t)$ is the stock of structures and equipment centered on quarter t, to correspond to the centering performed in the calculation of *q*.

6. There are other ways that a firm can adjust output and affect the return to its physical capital. Firms can adjust hours and employment, for example, and thus avoid potentially high costs associated with changing the capital stock (see Shapiro [1986]).

finance and numerous aspects of the tax code, including personal and corporate tax rates, investment tax credits, and depreciation deductions. Stock-market 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 expected cost of equity finance and, 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 future 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 economic data, economists have not reached agreement on how to isolate the information contained in market values relevant to investment decisions. If market values are not equal to the present discounted value of future returns to capital, the link between *q* and the rate of investment is weakened substantially. In addition, measuring the replacement value of the capital stock is complicated by continual technological change and lack of price information for many types of unique physical assets. Measurement of market values of financial liabilities is difficult because many financial liabilities 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 if financial markets correctly incorporate information about future returns from the capital stock. Even then, however, the response of investment to a change in *q* is not immediate because of costs incurred in adjusting the capital stock and the delay inherent in the appropriations-orders-investment process. Another problem that persists even if financial-market values are correct is the difficulty of calculating marginal *q*.

The usefulness of average *q,* which is 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 been the case during the recent market rise and plunge, the link between *q* 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 because of financial constraints. Of course, a focus on the cost of capital as the mechanism through which stock-market fluctuations influence investment ignores the advantage of *q:* *q* should incorporate information about more than just the expected cost of capital. Unfortunately, as a practical matter, the advantages of the *q* approach have yet to be realized.

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