# Profit expectations and investment

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*This article examines the relationship between expectations of future profits and companies' physical investment. Theory suggests that increased profit expectations should raise share prices as well as investment. But this correlation between investment and share prices may be rather weak if investors' opinions of companies' prospects differ from those of the companies' managers. Using a simple aggregate investment equation, the article illustrates that measures of profit expectations based on current profits and analysts' earnings forecasts appear to be more informative for investment than stock prices themselves. This result is consistent with recent research at the Bank using company data.*

## Introduction

Investment is driven by companies' expectations about their future profits. Although such expectations are unobservable, share prices are influenced by a similar factor—the stock market's expectations of companies' future profits. Changes in share prices might therefore be correlated with future changes in investment.

Business investment growth in the United Kingdom picked up sharply in the latter half of the 1990s, before weakening markedly. This experience has broadly tracked that of the UK stock market—Chart 1 compares the annual growth in the FTSE All-Share index with annual growth in business investment at current prices. A similar picture emerges from a cross-country comparison. Chart 2 shows that countries that experienced a pick-up in current-price business investment (as a share of GDP) in the second half of the 1990s also experienced sharp rises in stock market capitalisation (as a share of GDP). But both charts show that these relationships are far from perfect.(1)

**Chart 1**
**FTSE All-Share index and business investment**

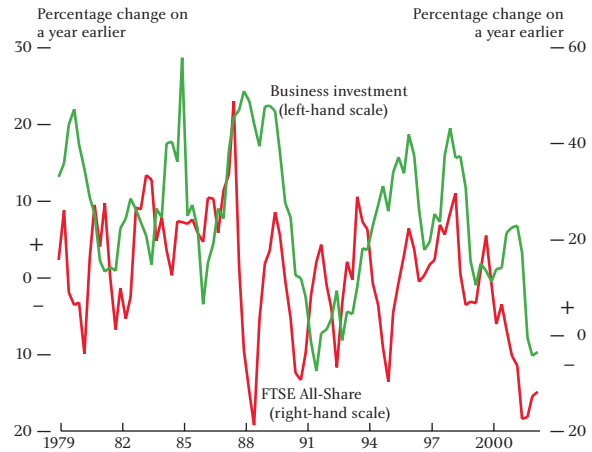
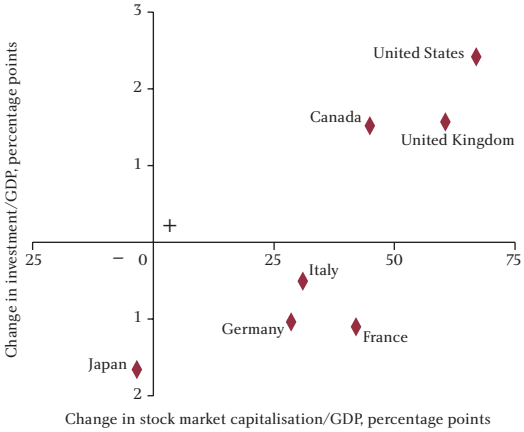



**Chart 2**(a)
**Change in business investment and stock market capitalisation (as shares of GDP) in G7 economies between 1991–95 and 1996–2000**




(a) Chart 2 shows the change between 1991–95 and 1996–2000 in the average level of the investment-to-GDP ratio and the stock market capitalisation-to-GDP ratio. The data on stock market capitalisation are from the International Federation of Stock Exchanges (FIBV), while data on investment and GDP are from the IMF and the OECD. Note that data for Italy are 'private investment' rather than 'business investment'.

## Q theory and investment

One approach to looking at the link between expected future profitability and investment is Q theory. This

(1) This might in part reflect the fact that companies listed on the stock market represent a smaller sample than contained in the 'business sector' investment category. And many of these companies have large overseas investment activities. There may also be structural reasons for the increase in stock market capitalisation, such as privatisations.

states that a company should invest if the discounted value of future profits from an extra unit of capital exceeds the cost of acquiring it. When companies invest, they are typically thought to incur adjustment costs, such as training workers to operate new machinery, and these are usually thought to be increasing in the rate of investment. This means that companies tend to adjust their capital stocks only gradually.

The ratio of discounted future profits to the acquisition cost of new investment—marginal Q—is unobservable. But Hayashi (1982) demonstrated that under certain assumptions it equals average Q, the ratio of the discounted value of a company's future profits to the replacement cost of its total capital stock. First, companies must operate in a competitive environment where they are unable to influence the market-clearing price of their goods. Second, there must be constant returns to scale—if a company uses twice as much capital and labour as another company, it will produce twice as much output.(1)

Average Q is observable and suggests a simple rule of thumb. If the ratio of the stock market value of a company to the replacement cost of its assets—Tobin's Q—exceeds one, then the company can increase profits by investing. And the rate at which it invests will depend on the costs of adjustment. Tobin's Q should be a 'sufficient statistic' for investment, summarising all information relevant to the company's investment decision.

However, Tobin's Q has generally fared poorly in empirical studies of its predictive power for aggregate investment. Even though Q should theoretically incorporate all information relevant to the company's investment decision, studies have found that other variables, such as cash flow (that is, current revenue less expenses and taxes) and sales, are also significant in explaining movements in investment. Given that Q theory assumes that companies can borrow freely at the market rate for similarly risky projects, this has been widely interpreted as supporting the existence of borrowing constraints for companies in the credit market.(2)

The poor performance of Q may equally reflect violations of the assumptions under which marginal Q is equal to average Q; or mismeasurement of average Q itself, perhaps due to unreliable estimates of the replacement cost of companies' capital stock.(3) Mismeasurement could also arise if the stock market's expectations of future profitability differ from managers' expectations. In this case, a Q measure based on stock market valuation would no longer be a sufficient statistic for investment.

## Managers' Q

At times, the stock market's expectations of a company's future earnings (as implied by its share price) may differ from managers' own opinions about their company's future profitability. This might occur if, for example, managers have superior information about their investment projects.

Fischer and Merton (1985) argue that, as a large part of companies' finance comes from the stock market, the terms at which they obtain that finance—that is, the value the market places on their shares—will affect investment decisions. They argue that companies should take advantage of cheaper financing costs to raise equity and invest if *Tobin's Q* rises—even if their *own* estimate of Q does not.

Blanchard *et al* (1993) extend this analysis. They point out that if managers issue equity when the stock market valuation of their company exceeds their own, then the buyers of that equity will lose out if and when the stock market value returns to equal managers' expectations. So issuing equity benefits a company's current shareholders at the expense of future shareholders. Further, they observe that as shareholders will only realise gains if and when they sell their shares, then investors' horizons will matter, so 'managers who are concerned with their long-term shareholders should follow their own valuation…but managers of firms whose shareholders have short horizons should…go with the market valuation'.

Several empirical studies have examined the effect of divergences of opinion over companies' valuation. Blanchard *et al* construct an estimate of *managers' Q* based on past profits and dividends, and find that the market valuation has only a marginal impact on investment when they control for companies' expectations of future profits in this way.

(1) Note that the constant returns to scale assumption applies not only to a company's output, but also to its adjustment costs.
(2) See Hubbard (1998) for a review of the literature on credit market imperfections and investment.
(3) See Erickson and Whited (2000) for a detailed discussion of mismeasurement and Q theory. The authors suggest that Q has good explanatory power once purged of measurement error.

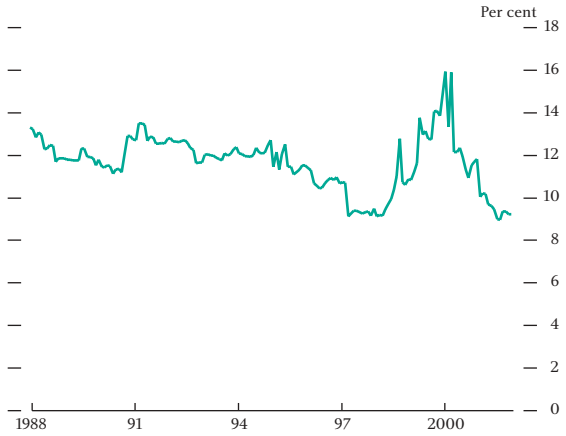
## Analysts' Q

An alternative approach is to use the information contained in equity analysts' earnings forecasts rather than the conventional stock market valuation as a guide to companies' future profitability.(1) Measures based on analysts' forecasts might arguably give a better indication of managers' opinions than stock market valuations, given that analysts have a close understanding of the companies they cover.

Given that share prices tend to react to changes in analysts' earnings forecasts, one could interpret earnings forecasts differently, as a proxy for the market's earnings projections. But on their own, changes in earnings forecasts explain only a small part of equity price movements. This might in part reflect investors reacting to other aspects of analysts' reports, such as price targets,(2) or not fully reacting to changes in earnings forecasts themselves. Either way, to the extent that analysts' earnings forecasts differ from the market's, the analysts' projections might arguably give a better indication of managers' opinions than stock market valuations.

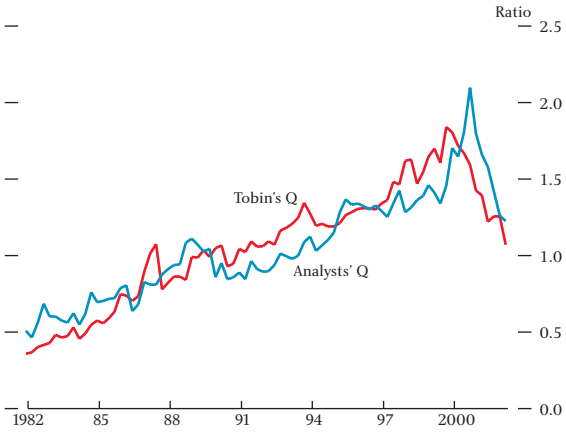
Chart 3 shows one measure of analysts' forecasts, provided by IBES. These forecasts are used to construct an *analysts' Q* measure, in which the numerator is the value of the FTSE All-Share index implied by a three-stage dividend discount model.(3) This model uses the forward-looking information provided by the analysts' forecasts as a guide to dividend growth in the medium term.(4) In the long run, dividend growth is assumed to converge to a rate at which the return on equity is equal to the cost of equity. This long-run growth rate depends on current earnings, as a higher level of earnings available for reinvestment raises the future growth rate of the company.

**Chart 3**
**IBES forecasts of medium-term earnings growth for FTSE 100 companies**




In calculating analysts' Q, the premium that investors demand for holding equities rather than risk-free assets is held constant at 4%. As such, analysts' Q and Tobin's Q may diverge, not only because analysts' earnings forecasts differ from those embodied in stock market valuations, but also because investors revise their opinion of the level of the risk premium over time. Chart 4 compares the standard Tobin's Q with the above measure of analysts' Q.

**Chart 4**
**Tobin's Q and analysts' Q**



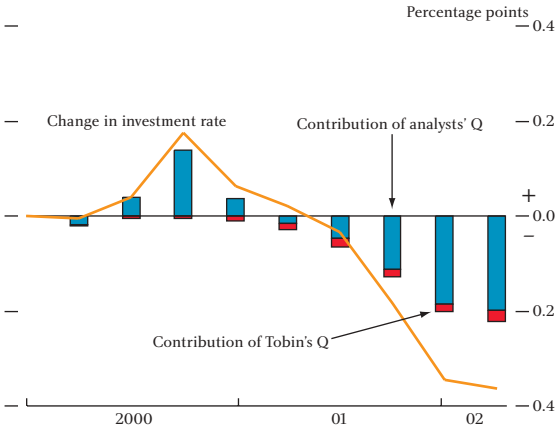

A simple aggregate econometric model illustrates the relative information content of analysts' Q and Tobin's Q for investment (see appendix for further details). Consistent with Q theory, this model relates the rate of investment to Tobin's Q. But the estimated equation also includes the above measure of analysts' Q.

To the extent that the equation can explain variations in the rate of investment, it does so almost entirely by the

(1) A wide literature has attempted to determine whether analysts' forecasts are biased. Keane and Runkle (1998) find that once they allow for aggregate shocks, which will only average out over many years, they cannot reject the hypothesis that Institutional Brokers Estimate System (IBES) one-quarter-ahead forecasts are unbiased. Chan, Karceski and Lakonishok (2001) compare realised long-term growth rates with forecasts provided by IBES and conclude that analysts' estimates tend to be too optimistic over long horizons.
(2) See Asquith *et al* (2002).
(3) The model is described in greater detail in Panigirtzoglou and Scammell (2002).
(4) This article uses IBES medium-term forecasts for the FTSE 100 index. These forecasts refer to the next business cycle, which IBES defines as three to five years. Note that long-term IBES forecasts for the United Kingdom begin in 1987. For earlier data in the sample, these profit expectations are approximated using the relationship between IBES forecasts and profits, GDP and inflation. This represents another potential source of mismeasurement.

Q measure that is based on analysts' earnings forecasts rather than that based on stock market valuations.(1) This is demonstrated in Chart 5, which shows the (cumulative) change in the investment rate since early-2000 and the contributions of analysts' Q and Tobin's Q.

**Chart 5**
**Cumulative change in investment rate and the contribution of Q**




In line with the previous literature, however, the performance of this aggregate model is quite poor. Movements in Tobin's or analysts' Q can account for only a small part of the substantial movements in actual Q observed (although the equation performs reasonably well in the most recent period). The equation residuals are serially correlated—if the equation overpredicts the investment rate this quarter, it is likely to do so again in the next quarter. And it is possible to find a role for other variables, such as sales, which is inconsistent with the idea that Q is a sufficient statistic for investment.

A superior approach may be to examine the role of analysts' Q using company-level data. This allows coefficients to be estimated with higher precision, by providing more observations with greater variability than aggregate data. This is particularly important because aggregate variables, such as share prices and investment, tend to move together over the business cycle.

### Analysts' Q: a disaggregate approach

Recent joint research between the Bank and the Institute for Fiscal Studies has investigated the role of the stock market and analysts' earnings forecasts for investment using company-level data (Bond *et al* (forthcoming)).(2) Because longer-term forecasts are not available for most UK companies, they use forecasts of expected earnings for the current and following year as a guide to short-term profitability. As such, their analyst-based measure of future profitability would not be expected to provide a sufficient statistic for investment. Nonetheless, they find an important role for these IBES forecasts. And Tobin's Q provides little information for investment when they control for forecasts of short-term profitability in this way.(3)

## Conclusion

Q theory states that companies invest until the cost of a unit of capital is equal to the profits that unit is expected to generate. As the stock market reflects investors' expectations of companies' discounted future earnings, stock market valuations have traditionally been used as a measure of expected future profits, the numerator in Q, but with unconvincing empirical results.

One possible reason for these empirical failures is a divergence between the market's expectation of future profits and managers' own opinions, so that Tobin's Q is no longer a sufficient statistic for investment. In this case, alternative measures of future earnings may contain more accurate information about investment intentions. One such measure—an analysts' Q based on IBES earnings forecasts—appears to perform better than a traditional Tobin's Q measure. But in line with other empirical evidence at the aggregate level, the equation estimated in this article performs quite poorly and can explain only a small part of the substantial movements in actual investment over the past two decades.

A more promising avenue for research appears to be at the disaggregate level. Recent research conducted by the Bank of England and the Institute for Fiscal Studies finds that Tobin's Q has limited information for investment, whereas analysts' earnings forecasts are more informative.

(1) Note that this result is consistent with analysts' forecasts of earnings being closer to managers' expectations of earnings than investors' opinions, or the constant risk premium being closer to managers' perceptions of risk than the market risk premium, or both.
(2) Bond and Cummins (2001) adopt a similar approach for the United States. The authors find that a standard stock market based Q has no additional explanatory power for investment when their analysts' measure is included.
(3) Interestingly, Bond *et al* also find that cash flow is insignificant under this specification. Their findings suggest that Tobin's Q may indeed be a poor measure of companies' expected future profitability, and that the cash flow variables widely used in investment equations might capture information about future profitability rather than financing constraints. Other variables, such as sales growth, are found to be significant, possibly because they contain information about longer-term profitability not included in analysts' short-term forecasts.

## Appendix

Each variable is expressed in natural logarithms, and (Newey-West adjusted) t-statistics are given in brackets. The model is estimated on quarterly data between 1982 Q1 and 2002 Q2.(1)

$$invrate_t = -3.68 + 0.02 q_t + 0.22 q^*_t$$
$$\quad\quad (-189.11)\ \ (0.18)\quad\ (2.15)$$

| | | | |
|---|---|---|---|
| R-squared | = 0.440 | Adjusted R-squared | = 0.426 |
| S.E. of regression | = 0.092 | Durbin-Watson statistic | = 0.218 |

where:

*invrate* = log of (constant-price) business investment divided by the previous period's (constant-price) capital stock at replacement cost.(2)
$q$ = Tobin's Q, defined as private non-financial corporations' net financial valuation divided by their capital stock at replacement cost.(3)
$q^*$ = analysts' Q, defined as value of FTSE-All Share index implied by three-stage dividend discount model divided by private non-financial corporations' capital stock at replacement cost.

(1) In line with traditional aggregate Q studies, this article estimates a constant-price investment rate equation. This approach is consistent with a one-sector growth model. In a model with several capital goods, the relationship between the investment rate at constant prices and Q is rather more complicated. Current Bank research is investigating potential implications for aggregate modelling in a multi-sector framework. See also Tevlin and Whelan (2002).
(2) The business sector capital stock at replacement cost was constructed using the method outlined in Oulton (2001). Specifically, the 'Perpetual Inventory Method' was used to calculate the cumulated depreciated stock of investment flows, estimated separately for whole-economy plant and machinery excluding computers, buildings and vehicles. An implied aggregate depreciation rate was then calculated and applied to aggregate business investment data (the ONS does not publish an asset breakdown of business sector investment) in order to construct the business sector capital stock series.
(3) Data limitations mean that $q$ and $q^*$ are calculated from data on the private non-financial corporations sector rather than the broader business sector.

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