RANDALL MORCK
University of Alberta

ANDREI SHLEIFER
Harvard University

ROBERT W. VISHNY
University of Chicago

The Stock Market and Investment: Is the Market a Sideshow?

RECENT EVENTS and research findings increasingly suggest that the stock market is not driven solely by news about fundamentals. There seem to be good theoretical as well as empirical reasons to believe that investor sentiment, also referred to as fads and fashions, affects stock prices. By investor sentiment we mean beliefs held by some investors that cannot be rationally justified. Such investors are sometimes referred to as noise traders. To affect prices, these less-than-rational beliefs have to be correlated across noise traders, otherwise trades based on mistaken judgments would cancel out. When investor sentiment affects the demand of enough investors, security prices diverge from fundamental values.

The debates over market efficiency, exciting as they are, would not be important if the stock market did not affect real economic activity. If the stock market were a sideshow, market inefficiencies would merely redistribute wealth between smart investors and noise traders. But if the stock market influences real economic activity, then the investor sentiment that affects stock prices could also indirectly affect real activity.

We would like to thank Gene Fama, Jim Poterba, David Romer, Matt Shapiro, Chris Sims, and Larry Summers for helpful comments. The National Science Foundation, The Center for the Study of the Economy and the State, the Alfred P. Sloan Foundation, and Dimensional Fund Advisors provided financial support.

It is well known that stock returns by themselves achieve respectable R^2's in forecasting investment changes in aggregate data.[1] If stock returns are infected by sentiment, and if stock returns predict investment, then perhaps sentiment influences investment. There is also evidence, however, that investment has not always responded to sharp movements in stock prices. For example, real investment did not seem to rise sharply during the stock market boom in the late 1920s. Nor was there an investment collapse after the crash of 1987.[2] It remains an open question, then, whether inefficient markets have real consequences.

In this paper, we try to address empirically the broader question of *how* the stock market affects investment. We identify four theories that explain the correlation between stock returns and subsequent investment. The first says that the stock market is a passive predictor of future activity that managers do not rely on to make investment decisions. The second theory says that, in making investment decisions, managers rely on the stock market as a source of information, which may or may not be correct about future fundamentals. The third theory, which is perhaps the most common view of the stock market's influence, says that the stock market affects investment through its influence on the cost of funds and external financing. Finally, the fourth theory says that the stock market exerts pressure on investment quite aside from its informational and financing role, because managers have to cater to investors' opinions in order to protect their livelihood. For example, a low stock price may increase the probability of a takeover or a forced removal of top management. If the market is pessimistic about the firm's profitability, top management may be deterred from investing heavily by the prospect of further erosion in the stock price.

The first theory leaves no room for investor sentiment to influence investment, but the other three theories allow sentiment to influence investment through false signals, financing costs, or market pressure on managers. Our empirical analysis looks for evidence on whether sentiment affects investment through these three channels by investigating whether the component of stock prices that is orthogonal to future economic fundamentals influences investment.

1. See Bosworth (1975), Fama (1981), Fischer and Merton (1984), Barro (1990), Sensenbrenner (1990), and Blanchard, Rhee, and Summers (1990).

2. Barro (1990); Blanchard, Rhee, and Summers (1990).

Our tests measure how well the stock market explains investment when we control for the fundamental variables both that determine investment and that the stock market might be forecasting. These fundamental variables serve as a proxy for the profitability of investment projects as well as for the availability of internal funds for investment.[3] Essentially, we ask, "Suppose a manager knows the future fundamental conditions that affect his investment choice. Would the manager still pay attention to the stock market?" If the answer is yes, then there is an independent role for the stock market, and possibly for investor sentiment, in influencing investment. The incremental ability of stock returns to explain investment, when future fundamentals are held constant, puts an upper bound on the role of investor sentiment that is orthogonal to fundamentals in explaining investment.

For example, suppose that stock prices forecast investment only to the extent that they forecast fundamental factors influencing investment. In this case, that part of stock prices—including possible investor sentiment—that does not help predict fundamentals also does not help predict investment. Thus, investor sentiment may affect stock prices independent of future fundamentals, but that influence does not feed through to investment. If, conversely, the stock market helps predict investment beyond its ability to predict future fundamentals, then investor sentiment may independently influence business investment, through the channels of false signals, financing costs, and market pressure on managers.

Our analysis proceeds in several steps. In the first section, we review the evidence and theory behind the idea that investor sentiment affects stock prices. In the second section, we describe several views on why the stock market might predict investment, and how investor sentiment might itself influence investment through the stock market. In the third section, we describe the tests that we use to discover how the stock market influences investment. The fourth and fifth sections present evidence using firm-level data from the COMPUSTAT data base bearing on the alternative views. The next two sections turn to the aggregate data that most studies of investment examine. The final section presents our conclusions.

3. Meyer and Kuh (1957).

Investor Sentiment and the Stock Market

Since Robert Shiller's demonstration of the excess volatility of stock market prices, research on the efficiency of financial markets has exploded.[4] In subsequent work, Shiller suggested that fads and fashions, as well as fundamentals, influence asset prices.[5] Eugene Fama and Kenneth French as well as James Poterba and Lawrence Summers have managed to detect mean reversion in U.S. stock returns.[6] While this evidence is consistent with the presence of mean-reverting investor sentiment toward stocks, it is also consistent with time-varying required returns. Perhaps more compelling evidence on the role of investor sentiment comes from the studies of the crash of October 1987. Shiller surveyed investors after the crash and found few who thought that fundamentals had changed.[7] Nejat Seyhun found that corporate insiders aggressively bought stocks of their own companies during the crash, and made a lot of money doing so.[8] The insiders quite correctly saw no change in fundamentals and attributed the crash to a sentiment shift. The thrust of the evidence is that stock prices respond not only to news, but also to sentiment changes.

Follow-up studies to the work on mean reversion attempt both to prove the influence of investor sentiment on stock prices and to isolate measures of sentiment. One group of studies concerns closed-end mutual funds—funds that issue a fixed number of shares, and then invest the proceeds in other traded securities. If investors want to liquidate their holdings in a closed-end fund, they must sell their shares to other investors, and cannot just redeem them as in the case of an open-end fund. Closed-end funds are extremely useful in financial economics because it is possible to observe both their net asset value, which is the market value of their stock holdings, and their price, and compare the two. A well-known characteristic of closed-end funds is that their stock price is often different from their net asset value, suggesting that markets are inefficient.

4. Shiller (1981).
5. Shiller (1984).
6. Fama and French (1988); Poterba and Summers (1988).
7. Shiller (1987).
8. Seyhun (1990).

In fact, Bradford De Long, Andrei Shleifer, Lawrence Summers, and Robert Waldmann, following the work of Martin Zweig, have argued that the average discount on closed-end funds can serve as a proxy for individual investor sentiment.[9] When individual investors are bearish on stocks, they sell closed-end funds as well as other stocks. In doing so, they drive up the discounts on closed-end funds (that is, their price relative to those of the stocks in their portfolio) because institutional investors typically do not trade these funds and so do not offset the bearishness of individual investors. Conversely, when individuals are bullish on stocks, they buy closed-end funds so that discounts narrow or even become premiums. Charles Lee, Andrei Shleifer, and Richard Thaler present evidence suggesting that discounts might indeed serve as a proxy for individual investor sentiment.[10] We will not review the theory and evidence here, but will use closed-end fund discounts as one measure of investor sentiment, and will study the relationships between discounts, investment, and external financing.

The empirical evidence on the potential importance of investor sentiment has been complemented by a range of theoretical arguments that explain why the influence of sentiment on stock prices would not be eliminated through "arbitrage." Arbitrage in this context does not refer to riskless arbitrage, as understood in financial economics, but rather to risky, contrarian strategies whereby smart investors bet against the mispricing. Stephen Figlewski and Robert Shiller have both pointed out that when stock returns are risky, arbitrage of this sort is also risky and therefore not completely effective.[11] For example, if an arbitrageur buys underpriced stocks, he runs the risk that fundamental news will be bad and that he will take a bath on what had initially been an attractive trade. Because arbitrage is risky, arbitrageurs will limit the size of their trades, and investor sentiment will have an effect on prices in equilibrium. Others have taken this argument further.[12] They point out that if investor sentiment is itself stochastic, it adds further risk to arbitrage because sentiment can turn against an arbitrageur with a short horizon. An arbitrageur buying underpriced stocks runs the risk that they become even more underpriced in the near future, when they might have to be

9. De Long and others (1990); Zweig (1973).
10. Lee, Shleifer, and Thaler (1990).
11. Figlewski (1979); Shiller (1984).
12. De Long and others (1990).

sold. This noise-trader risk makes arbitrage even riskier, allowing the effects of sentiment on prices to be even more pronounced. The upshot of these models is that the theoretical argument that arbitrage prevents investor sentiment from influencing prices is simply wrong.

Most models of investor sentiment deal with sentiment that affects the whole stock market or at least a big chunk of it. When sentiment affects a large number of securities, leaning against the wind means bearing systematic risk, and is therefore costly to risk-averse arbitrageurs. If, in contrast, sentiment affects only a few securities, betting against it means bearing only the risk that can be diversified, and therefore arbitrageurs will bet more aggressively. Thus, investor sentiment can have a pronounced effect on prices only when it affects a large number of securities.

This conclusion holds in a perfect capital market, with no trading restrictions or costs of becoming informed about the mispricing of securities. More realistically though, arbitrage is a costly activity and arbitrage resources will be devoted to particular securities only if returns justify bearing the costs. As a result, investor sentiment toward individual securities will not be arbitraged away and will affect their prices, because arbitrageurs' funds and patience are limited. If a stock is mispriced, only a few arbitrageurs would know about it.[13] Those who do know may have alternative uses for funds, or may not wait until the mispricing disappears.[14] Waiting is especially costly when arbitrage requires selling a security short, and regulations do not give the short seller full use of the proceeds. Moreover, taking a large position in a security means bearing a large amount of idiosyncratic risk, which is costly to an arbitrageur who is not fully diversified. Finally, as stressed by Fischer Black, arbitrageurs often cannot be certain how mispriced a security is, further limiting their willingness to trade in it.[15] All these costs suggest that the resources leaning against the mispricing of any given security are quite limited, and, therefore, even idiosyncratic investor sentiment may influence share prices.

To conclude, recent research has produced a variety of empirical evidence suggesting that investor sentiment influences asset prices. A parallel research effort has demonstrated that the usual models in

13. Merton (1987).
14. Shleifer and Vishny (1990).
15. Black (1986).

financial economics, in which investors are risk averse, imply that investor sentiment *should* affect prices. The argument that marketwide investor sentiment affects prices is particularly strong, but one also expects firm-specific sentiment to affect individual stocks. These theories and evidence raise the obvious question: does the effect of investor sentiment on stock prices feed through to business investment spending? To address this question, we first review how stock prices affect investment in general.

The Stock Market and Investment

The fact that stock returns predict investment is well established. In this section, we present the four views that can plausibly account for this correlation. In the subsequent sections, we evaluate these views empirically.

The Passive Informant Hypothesis

According to the passive informant view of the stock market, the market does not play an important role in allocating investment funds. This view contends that the managers of the firm know more than the public or the econometrician about the investment opportunities facing the firm. The stock market, therefore, does not provide any information that would help the manager make investment decisions. The market might tell the manager what market participants think about the firm's investments, but that does not influence his decisions. This "sideshow" view of the stock market says not only that investor sentiment does not affect investment, but also that the manager does not learn anything from the stock price.

The passive informant hypothesis implies that the reason for the observed correlation between stock returns and subsequent investment growth is that the econometrician's information set is smaller than the manager's. If the econometrician knew everything that the manager does, the variation in investment could be accounted for using only the variables known to the manager when he decided how much to invest.

The passive informant hypothesis has some intuitive appeal. It is plausible that outsiders know very little about the firm that insiders do

not also know, since outsiders collect information that is largely devoted to understanding insiders' actions. Many a financial analyst's main responsibility is talking to company managers. This superiority of insiders' knowledge seems especially likely with respect to firm-specific fundamentals, where information about the firm is most likely to hit managers first. One might argue, however, that the market does teach insiders something new about the future state of the aggregate economy and so conveys information useful in making investment decisions.

Some support for the passive informant hypothesis comes from studies of insider trading.[16] Seyhun, for example, shows that insiders make money on trading in their firms' stock. Moreover, insiders successfully predict both future idiosyncratic returns and future market returns, suggesting that insiders' special knowledge helps them with both aggregate and firm-specific forecasts. At the same time, the evidence does not reject the view that even though insiders can forecast some components of returns that are firm-specific, they do not forecast other components. That is, they can make money trading and still learn something from stock returns. They may or may not use this knowledge in making investment decisions for their firms.

The Active Informant Hypothesis

The active informant hypothesis assigns a greater role to the stock market. It says that stock prices predict investment because they convey to managers information useful in making investment decisions. This information can accurately, or inaccurately, predict fundamentals. Even when the stock market is the best available predictor, it can err due to the inherent unpredictability of the fundamentals, or because stock prices are contaminated by sentiment that managers cannot separate from information about fundamentals. Even if the stock market sends an inaccurate signal, the information may still be used and so the stock return will influence investment.

The market can convey a variety of information that bears on the intrinsic uncertainty facing a firm—such as future aggregate or individual demand. Alternatively, the market can reveal investors' assessment of the competence of a firm's managers and their ability to make good

16. Seyhun (1986, 1988).

investments. Information conveyed by stock prices can also help resolve extrinsic or equilibrium uncertainty. For example, if an economy can be in one of several self-fulfilling equilibria, the stock market can aggregate beliefs—act as a "sunspot"—regarding which equilibrium is at work. Of course, this type of role can be played by the aggregate stock market only; it is not a consideration when evaluating the dependence of individual firms' decisions on their idiosyncratic returns.

We distinguish this sunspot role of the stock market from the influence of investor sentiment. If the stock market is a sunspot, all investors are rational and correctly predict the future state of the economy based on stock market performance. In this case, the stock market does not predict investment, after controlling for future fundamentals, because it is perfectly correlated with future fundamentals. In contrast, investors affected by sentiment hold erroneous beliefs about the future. If such investors affect stock prices, and if managers pay attention to stock prices and cannot separate investor sentiment from fundamental information, then investment decisions will be distorted by false signals from the market. In this case, then, the stock market will be a faulty active informant and will predict future investment even after controlling for future fundamentals.

The difference between the faulty informant and accurate informant hypotheses is a matter of degree, and can be explored empirically. If signals are relatively accurate and future fundamentals are controlled for, the stock market should not help predict investment. By contrast, if investor sentiment influences the stock market, and these false signals influence investment, then the stock market should influence investment even after controlling for future fundamentals. In our empirical work, we test for this difference.

One final point is that the false signals hypothesis seems less likely to apply to individual stock returns than to industry stock returns or to the market as a whole. It is easier to argue that managers learn more new things from the stock market about the economy as a whole or about industry conditions than they do about their own firms. On the other hand, it is quite possible that managers change their actions in response to idiosyncratic stock returns because they don't want to be fired or taken over—but that is a story we will address later. The false signals hypothesis is more plausible at the aggregate level, when managers are confused by the aggregate market and respond accordingly. For example,

there was a very brief slowdown in investment following the crash of October 1987, when managers had to combine their own information with what turned out to be a highly misleading signal from the stock market.

The Financing Hypothesis

According to the two previous hypotheses, the stock market's main role is to convey information: in the first case to the econometrician, and in the second case to the manager. The next two views assign the stock market a more active role. Many people believe that the stock market plays a key role in helping firms raise capital. This applies to new firms, in the case of initial public offerings (IPOs), and to more seasoned firms. The valuation that the market assigns to a company's equity determines the cost of capital to that company, a point made by Stanley Fischer and Robert Merton among others.[17] The higher the valuation, the cheaper is the equity. When the stock market is efficient, firms cannot find a particularly advantageous time to undertake equity finance. However, when the stock market is subject to investor sentiment, firms can choose equity finance when the market overvalues them, making the cost of capital irrationally low.

As pointed out by Olivier Blanchard, Changyong Rhee, and Lawrence Summers, in a sentiment-infected stock market, rational managers might not invest the proceeds from a new share issue.[18] Fischer and Merton presume that firms for which funds are irrationally cheap will invest in marginal projects. At a rational cost of funds, these projects would have a negative net present value.[19] Blanchard, Rhee, and Summers point out that firms instead may issue the overvalued equity and then invest the proceeds in financial securities, which are zero net-present-value investments, rather than in negative net-present-value projects. In other words, firms issue equity when equity is overpriced, but issue debt or finance internally when equity is not overpriced; investment is the same in either case. The Blanchard-Rhee-Summers view implies that even if

17. Fischer and Merton (1984).
18. Blanchard, Rhee, and Summers (1990).
19. Fischer and Merton (1984).

investor sentiment affects stock prices, it does not necessarily affect investment, only the way in which it is financed.

Of course, in some cases one would expect investor sentiment to affect investment through the issuance of new securities. For example, take a firm that has limited debt capacity and that cannot raise all the funds through borrowing that it could profitably invest. For this firm, the marginal return on investment exceeds the risk-adjusted cost of funds in a perfect capital market. If this firm, because of an irrational rise in its stock price, can get access to cheaper financing through the stock market, it would use the proceeds from the equity issue to invest. In this case, the marginal investment has a positive rather than a negative net present value, and is worth undertaking. On this reasoning, the influence of equity issuance on investment would be especially strong for smaller firms.

The discussion so far, as well as most of the literature, explains how stock market valuation determines the attractiveness of stock financing. But, for a variety of reasons, it also helps determine the attractiveness of bond financing and may, therefore, have a bigger effect on investment. While investor pessimism might simply cause the firm to switch from equity to debt financing, this substitution will be limited if the market value of the firm's debt deteriorates at the same time. The stock market conveys information about how much a company is worth. Potential lenders presumably use this information in deciding how much to lend and on what terms. Therefore, stock price increases would increase debt capacity and reduce the costs of debt, and the reverse would be true for stock price decreases. In addition, a critical determinant of debt capacity is how much the assets of the firm could be sold for should the firm fail to meet its debt obligations and therefore need to sell some assets. The more valuable the firm, the higher the prices its assets will fetch on resale, and therefore the greater the firm's debt capacity. In this way, an increase in the market value of the firm should also make debt financing of this firm more attractive.

The implication of the financing hypothesis—concerning both equity and debt finance—is that the key channel of the stock market's influence on investment is through the issuance of new securities. The hypothesis also implies that this channel is more important for smaller firms, particularly new firms that do not yet have public equity. If stock prices

have an important influence on financing decisions, there should be considerable room for investor sentiment to affect investment.

The Stock Market Pressure Hypothesis

Even without conveying any information to the managers, or affecting the cost of security issues, the stock market can influence investment by exerting pressure on managers. For example, if investors dislike oil companies and drive down the prices of their shares, then, for fear of being fired or taken over, managers of oil companies might try to disinvest and diversify, even if further investment in oil is profitable. If market participants vote their sentiment by selling and buying stocks, and if the hiring and firing of managers is tied to the performance of the stock, then these votes will affect investment even if they are uninformed.

One particular version of this hypothesis is the short horizons theory.[20] When arbitrage funds are limited, smart investors are reluctant to buy and hold underpriced, long-term investment projects because mispricing takes a long time to be corrected.[21] Managers who are averse to low stock prices, for fear of being fired or taken over, will avoid these long-term investments even if these projects have a positive net present value. Thus, investor sentiment can affect investment.

The crucial implication here is that the stock market has an influence on investment beyond its influence through financing costs and beyond its ability to predict future fundamentals. After controlling for financing costs and fundamentals, the stock market still affects investment. In this respect, the market pressure hypothesis resembles the faulty informant version of the active predictor hypothesis. The main difference is that false signals are most likely to be listened to when they come from the aggregate market, but are unlikely to influence an individual firm's managers when they are idiosyncratic. In contrast, while the market pressure hypothesis may apply on the aggregate level, it is most plausible at the individual firm level. Therefore, the finding of a residual role for the stock market would have different interpretations in aggregate and cross-sectional regressions.

20. Stein (1988); Shleifer and Vishny (1990).
21. Shleifer and Vishny (1990).

Empirical Design

The empirical approach taken in this paper is somewhat atheoretical. We use a fairly unstructured approach, placing few restrictions on how stock returns enter the investment equations in order to allow the maximum scope for the stock market to affect investment. For our analysis, we regress investment growth on stock returns and the growth in fundamental variables in order to see how important the stock market is after controlling for fundamentals. The idea of these regressions is to ask, "If managers knew future fundamentals, would orthogonal movements in share price still help predict their investment decisions?"

We do not attempt to estimate consistently the structural parameters of the investment and financing equations, as we are not prepared to make the necessary identifying assumptions. Realizing that investment, financing, and fundamentals are all simultaneously determined, we still wish to interpret our quasi-reduced-form results as evidence on a more narrow question—the incremental explanatory power of the stock market in predicting investment. Even with this more modest objective in mind, our interpretation of the evidence still rests on several key assumptions discussed below.

To identify the role of investor sentiment, we focus on the merits of the faulty informant, financing, and market pressure views of the stock market, with the caveat that the faulty informant view makes more sense in aggregate data than in cross-sectional data.[22] The financing view predicts that the main link from the stock market to investment is through financing; therefore, we examine financing data to evaluate this view. Our tests of the faulty informant and market pressure views are less direct. Essentially, these views maintain that the stock market plays an independent role in predicting investment beyond the information it provides about future fundamentals and beyond its effect on financing. It is important to stress that we can never reject the null hypothesis that investor sentiment does not affect investment through the stock market.

22. Because the *accurate* active informant view involves perfectly correct signals about future fundamentals, there is no room for the irrational influence of investor sentiment. This hypothesis, therefore, is irrelevant to this discussion. We also ignore for the time being the passive informant view because in it the stock market, and thereby investor sentiment, do not influence investment.

It could be that the ability of the stock market to predict investment simply reflects the econometrician's inability to properly measure the fundamentals that drive both investment and the stock market.

To implement the tests, we run four main types of regressions. In a general form,

(1) $\Delta I_t = f[\Delta F_t]$,

(2) $\Delta I_t = f[\Delta F_t, R_{t-1}]$,

(3) $\Delta I_t = f[\Delta F_t, \Delta N_t]$,

(4) $\Delta I_t = f[\Delta F_t, \Delta N_t, R_{t-1}]$,

where ΔI_t is the investment growth rate in year t, ΔF_t is the growth rate of fundamentals—cash flow and sales—in year t, R_{t-1} is the stock return in year $t-1$, and ΔN_t is the form of financing in year t, which includes debt and equity issues.[23] Like most researchers, we run all our regressions in changes rather than levels because residuals in the levels regressions are serially correlated. For example, in the firm-level data the "fixed effect" is the dominant influence in the investment-level equations, and one gets little information about what drives year-to-year changes in investment from these equations. Moreover, the cross-sectional relation between the fixed effect and the fundamentals produces some perverse results, with nothing but industry having much explanatory power.

The financing hypothesis says that adding financing variables should help explain the variation in investment. The coefficients on the financing variables in equation 3 should be significant and large, and the incremental R^2, as we move from equation 1 to equation 3, should be large. Moreover, if financing really is the main channel through which the stock market affects investment, then moving from equation 3 to equation 4 should produce an insignificant coefficient on the lagged market return, and should certainly not raise the R^2 much. Finally, if the financing view is important, then, as we move from equation 2 to equation 4, the coefficient on the lagged return should fall, since the sensitivity of investment to return should be reduced once the financing variables are included in the regression.

The faulty informant and market pressure hypotheses say that stock returns should help explain investment beyond their ability to predict

23. A slightly richer lag structure is allowed for in the aggregate data.

the firm's fundamental conditions and beyond their impact on financing. If so, the coefficient on R_{t-1} should be significant in equation 2, and the R^2 in equation 2 should be much larger than in equation 1. Also, when we control for financing as well as for fundamentals, the return variable in equation 4 should be significant and the incremental R^2 in equation 4 relative to equation 3 should be large. If the stock return has significant explanatory power for investment beyond its effect on fundamentals and financing, market sentiment very possibly influences investment.

Of course, we may not have specified the full set of fundamentals. In that case, the stock market matters only to the extent that we have an omitted variable, and the role of investor sentiment may evaporate with its inclusion. That is, the stock market may prove an "accurate passive informant" even if we find that equation 4 explains investment much better than equation 3. Our exercise is still useful, however, because the incremental R^2, as we move from equation 3 to equation 4, is an estimated upper bound on how much of the variation in investment can be explained by sentiment. A small incremental R^2 implies that investor sentiment is probably not very important. If the R^2 is large, the presumption that sentiment is important gains strength.

This approach raises several conceptual issues. First, our market value variable is a stock return rather than a change in q, the ratio of the firm's market value to replacement cost.[24] Since both the capital stock and the market value of debt move much more slowly than the market value of equity, the practical difference between using stock returns and changes in q is fairly small. Robert Barro conducts an empirical race between these approaches, and finds that the data favor stock returns over changes in q.[25] He attributes this finding to the fact that the capital stock is measured with error. Because we are interested in allowing the maximum scope for the stock market to predict investment, we use returns rather than changes in q in our analysis.

Second, by focusing only on the incremental explanatory power of stock returns, we may underestimate the scope for sentiment to influence investment. Because sales, cash flow, and investment are all simultaneously determined, some of the investment variation explained by sales may actually be driven by stock returns. For example, suppose that a

24. Since Brainard and Tobin (1968) first used q, many others have followed in their steps—Blanchard, Rhee, and Summers (1990), Hayashi (1982), and Summers (1981).

25. Barro (1990).

good stock return raises investment, which in turn improves sales through larger capacity or lower variable costs. Controlling for sales, we might find only a small effect of the stock return on investment, even when the true effect is large. We argue below that the data do not support this view, and assume that, at least over our one- to three-year estimation period, stock returns are not an important driving force behind the sales process.

A related concern is that investor sentiment is sometimes considered an overreaction to fundamental news. In fact, some recent evidence on stock returns suggests that fads and fundamentals are positively correlated.[26] If so, we may be underestimating the explanatory power of investor sentiment, because our tests focus only on its incremental explanatory power over and above fundamentals. The power of our tests will be particularly low if the stock market overreacts to fundamentals in a uniform fashion across all firms at all times. If this is not the case, however, our tests should detect some of the effects of overreaction. Our only goal is to calibrate the role of investor sentiment that is orthogonal to fundamentals.

A final conceptual issue is how to measure the importance of sentiment in explaining investment. Focusing on the incremental R^2 and the parameter estimate on stock returns, we pretty much ignore t-statistics in the firm-level regressions. We do so because most variables are highly significant with several thousand observations. The t-statistics will play a larger role in our discussion of the aggregate time series evidence.

We do not rely on R^2 to choose between two specifications on a statistical basis. Rather we use incremental R^2's to gauge the fraction of all investment variation that is conceivably due to investor sentiment. Because investment is extraordinarily volatile, especially at the firm level, even fairly large regression estimates of the marginal effect of stock returns may not explain much of the variation in investment. A large coefficient on stock prices indicates that the stock market can help predict significant changes in investment. Yet, if the incremental R^2 is low, an irrational stock market is an unlikely cause of widespread under- or overinvestment in many sectors of the economy, since stock market behavior helps predict only a small fraction of the variation in investment.

26. Barsky and De Long (1989); Campbell and Kyle (1988).

Evidence from Firm-Level Data

Most of the recent empirical work on the ability of stock returns to forecast investment has focused on aggregate data. Yet we would argue that cross-sectional data are equally important. The distortion of the allocation of capital across firms that could arise from deviant share prices may be a greater source of harm than the false signals that distort aggregate investment. Investment variation over the business cycle caused by false signals from the stock market largely amounts to intertemporal substitution of investment. Misallocation of capital across sectors, however, can lead to more permanent damage, as socialist economies illustrate. Also, it seems likely that the stock market allocates investment across sectors and firms through relative share prices more than it allocates investment over time through the variation in returns over time. We therefore begin by examining the relationship between relative stock returns and investment.

Our main empirical results are based on the analysis of annual data from the COMPUSTAT data base between 1960 and 1987. The sample was constructed by Bronwyn Hall.[27] Because the coverage of firms by COMPUSTAT has expanded greatly over time, we have only 93 firms in 1960, rising to 1,032 firms in 1987. The sources and construction of all the data are described in the appendix.

The investment variable we use is the growth rate of real capital expenditures excluding acquisitions. The two measures of fundamentals are the growth rates of sales and cash flow, which we believe are the most important fundamental determinants of investment. We use sales growth as a measure of fundamentals because it reflects future demand for the firm's products and serves as a measure of investment profitability. Cash flow measures fundamentals both because it reflects current (and presumably future) profitability and because it facilitates investment if a firm is constrained in the capital market.[28] Our cash flow variable is after-tax corporate profits (net of interest payments) plus depreciation, and therefore closely approximates the inflow of funds available for investment. We have also experimented with other proxies, such as

27. Cummins, Hall, Laderman, and Mundy (1988).
28. Fazzari, Hubbard, and Petersen (1988).

different lags on sales and cash flow growth, but these variables did not noticeably increase the R^2.

The construction of new debt and new share issue variables is described in the appendix. Instead of using a continuous variable equal to the percent increase in actual debt or shares outstanding, we use dummy variables. The equity dummy variable equals 1 if a firm increased its equity by more than 5 percent and the debt dummy equals 1 if a firm increased its debt by more than 10 percent in the annual data. At three-year frequencies we use cutoffs of 10 percent for equity issues and 20 percent for debt issues. We use dummies rather than continuous variables because the data on security issues have many errors as well as many outliers. Some of these outliers may be traced to security issues made in conjunction with large acquisitions. Recall that we exclude acquisitions in our measure of capital expenditures. As a practical matter, using dummies rather than continuous variables results in a higher explanatory power of the regressions, so we are giving the financing hypothesis the benefit of the doubt.[29] In the financing section, we also present results on dollar proceeds from external financing normalized by investment.

Development of the Empirical Model

Because we are looking at a cross-section of firms, we compute capital asset pricing model (CAPM) alphas (abnormal returns) for all firms. We do that by regressing each firm's returns net of Treasury bill (T-bill) returns on the return of the value-weighted market index net of the T-bill return, using monthly data for the whole sample period. The regression coefficient on market return is the firm's beta, which is assumed to be constant during the whole period. We then define alpha as the residual in the regression for each firm. In a given year, alpha is the firm's excess stock return in that year, where returns are cumulated exponentially.

If the CAPM is an inappropriate model for generating expected returns, our alphas may compensate for risks that are not allowed for by the CAPM. In that case, a high alpha may be due to a high expected

29. Theoretically, it is not clear whether changes in investment should be predicted by the *level* of issuing activity or by the *changes* in issuing activity. Using changes has the problem that changes are negative after a large issue. The explanatory power of the specification in changes is also inferior to that in levels.

return that is simply compensation for the firm being riskier than implied by its market beta alone. Thus, while an unexpectedly high return may lead to a rise in investment, a high alpha due to a high expected return should not, and its presence will tend to bias the coefficient on alpha downward. Because firms may face different risks and different expected returns than implied by the CAPM, we have also estimated residuals from a market model that allows firms to have different expected returns even after controlling for beta. (Of course over any 15- to 20-year period the firm's average return may be due as much to luck as to expected return.) Using these market-model residuals rather than CAPM alphas changes the marginal explanatory power of the stock market in our investment equations by less than half of 1 percent.

Table 1 describes some of the variables. The top panel contains univariate statistics for our variables measured at annual frequencies. Investment growth is extraordinarily volatile. Over the period 1960–87, the mean investment growth rate is 23.7 percent, but the median is only 4.7 percent: there are quite a few small firms with enormous growth rates. In this sample, one-quarter of the observations, which are firm-years, have experienced investment growth rates of over 43 percent, and another quarter had investment declines of over 25 percent. The mean and the median cash flow growth rates are both around 5 percent. The mean sales growth rate is 6.5 percent, but the median is only 4.3 percent, again pointing to the presence of a few, very rapidly growing small firms. While the median alpha is close to zero, the mean of 0.07 indicates either a survivorship bias in COMPUSTAT or else some quirks in the CAPM. To partially address the survivorship bias, we have included the companies from the COMPUSTAT Research File in our sample, but, unfortunately, it does not include all firms that have disappeared from COMPUSTAT. In any case, the non-zero mean alpha should not affect the interpretation of our tests, which largely exploit cross-sectional variation in alphas.

In the sample of annual data, 10 percent of the firm-years show increases in outstanding equity shares of more than 5 percent, and over 30 percent of the firm-years show increases of book debt of more than 10 percent. For the firms that increased equity by more than 5 percent, the median ratio of the equity issue to investment is 0.91 and the mean is 1.47. For the firms that increased their debt by more than 10 percent, the median ratio of the debt issue to investment is 0.74 and the mean is

Table 1. Description of Firm-Level Financial Variables, One- and Three-Year Spans, 1960–87

Variable	*Median*	*Mean*	*Standard deviation*	*Minimum*	*Maximum*
One-year span[a]					
Investment growth[b]	0.047	0.237	0.911	−1.00	10.00
Alpha[c]	−0.003	0.070	0.441	−0.94	9.68
Cash flow growth[d]	0.056	0.046	0.878	−9.86	9.92
Sales growth	0.043	0.065	0.258	−1.00	7.09
New share dummy[e]	0	0.104	0.305	0	1
New debt dummy[f]	0	0.312	0.463	0	1
Three-year span[g]					
Investment growth[b]	0.097	0.482	1.390	−1.00	10.00
Alpha[c]	−0.004	0.205	0.930	−0.98	14.80
Cash flow growth[d]	0.123	0.209	1.060	−9.78	9.63
Sales growth	0.113	0.199	0.529	−1.00	8.75
New share dummy[e]	0	0.197	0.398	0	1
New debt dummy[f]	0	0.408	0.492	0	1

Source: COMPUSTAT data base and Center for Research in Security Prices (CRSP) data base, at the Graduate School, University of Chicago.

a. The sample for the annual analysis has 27,771 observations.

b. Investment is defined as "capital expenditures" from annual statement of changes in financial position, from COMPUSTAT, including COMPUSTAT Research File, 1959–87.

c. Alpha is the lagged abnormal stock returns. CAPM betas were estimated for each firm using all available monthly returns from CRSP, 1959–87. These betas were then used to calculate an alpha for each year.

d. Cash flow equals net income plus depreciation.

e. New share issue is the sale of common equity divided by the total market value of common equity at the beginning of the year, from COMPUSTAT, 1971–87. Where the above data were unavailable, including the years 1959–70, sale of common equity was estimated from the change in the number of shares outstanding reported in CRSP, filtering out changes due to liquidation, rights offering, stock splits, or stock dividends.

f. New debt issues is the change in book debt divided by the lagged value of book debt.

g. The sample for the three-year analysis has 7,950 observations.

1.30. These results show that outside financing roughly matches investment needs over a one-year period, although firms also have their internal cash flows. It appears that firms issue much more than they need for immediate investment. When we compute similar numbers over a three-year horizon, the number of firms that finance in excess of investment drops considerably.

The bottom panel of table 1 contains univariate statistics for our variables measured over nonoverlapping three-year periods. Again, the high degree of volatility of investment is confirmed. The standard deviation of investment growth is now 139 percent. Over an average three-year period, investment rises by more than 77 percent for a quarter of all firm-period observations. Roughly 20 percent of all firms expand their outstanding shares by 10 percent or more over a three-year period

while 41 percent of firms expand their book debt by 20 percent or more. Of those expanding equity shares by 10 percent or more, the median ratio of proceeds to three years' worth of investment is 0.46, while the mean is 0.81. The comparable numbers for those expanding debt by 20 percent or more are 0.44 and 0.75 respectively. These three-year proceeds-to-investment numbers are significantly lower than the one-year numbers.

A key question in our empirical analysis is over which horizon to estimate our growth rate regressions. They can be estimated over relatively short time periods, such as single years, or over relatively long time periods, such as three to four years. The problem with estimating over one-year periods is that the regression would not capture delayed changes in investment due to large changes in the firm's stock market valuation or in fundamental variables. As a practical matter, the explanatory power of all variables is quite low when investment growth equations are estimated annually.

On the other hand, as the horizon gets longer endogeneity problems become worse. One potential problem is the feedback from investment to sales discussed above. Another is that we move closer to estimating an identity between sources and uses of funds, though we are still very far from it. The right-hand side of our equation does not include dividends, acquisitions, or accumulation of liquid assets. All things considered, we prefer the three-year specification to the one-year specification.[30]

Regression of the Stock Market's Influence on Investment

The basic regressions for nonoverlapping three-year periods are presented in table 2. In these regressions, we use contemporaneous fundamentals, financing variables, and stock returns (represented by alpha) lagged one year. That is, we measure investment growth from year t to year $t + 3$ and the stock return from year $t - 1$ to year $t + 2$. All equations are estimated using a dummy variable for each three-year time period. We have also estimated these regressions using industry-period dummies. The results are not qualitatively different, but the

30. In regressions run using annual data, we found extremely low R^2's even in equations including both the stock returns and fundamental variables. For this reason, we proceed to the three-year regressions.

Table 2. Regressions of Growth in Real Investment on Selected Financial Variables, Firm-Level Data over Three-Year Spans, 1960–87

	Independent variables					
Equation	*Alpha*	*Cash flow growth*	*Sales growth*	*New share dummy*	*New debt dummy*	R^2
2.1	0.525	. . .	. . .	. . .	. . .	0.157
	(32.7)					
2.2	. . .	0.182	0.851	. . .	. . .	0.208
		(12.0)	(27.9)			
2.3	0.331	0.126	0.707	. . .	. . .	0.246
	(20.1)	(8.4)	(23.1)			
2.4	. . .	0.190	0.725	0.155	0.350	0.224
		(12.7)	(22.7)	(4.3)	(11.8)	
2.5	0.323	0.136	0.594	0.123	0.333	0.260
	(19.7)	(9.1)	(18.7)	(3.5)	(11.5)	
2.6	0.328	0.125	0.686	0.133	. . .	0.248
	(19.9)	(8.3)	(22.1)	(3.7)		
2.7	0.325	0.138	0.613	. . .	0.336	0.259
	(19.9)	(9.2)	(19.5)		(11.6)	

Source: Authors' own calculations using COMPUSTAT and CRSP data bases with 7,950 observations from 1963–87. See table 1 for an explanation of variables. The numbers in parentheses are *t*-statistics.

abnormal stock return does have noticeably lower incremental explanatory power. Omitting the industry-period dummies leaves more room for relative stock returns across sectors to predict differences in investment growth.

Equation 2.1 confirms the basic starting point of this paper—that stock returns predict investment. The parameter estimate suggests that a 10 percent excess return on a firm's stock over three years predicts an average 5.3 percent increase in annual investment by the end of the three years. The *t*-statistic is quite large, which is to be expected with this many observations. The explanatory power of this regression is 15.7 percent (13.1 percent without time-period dummies)—a respectable R^2 for relative stock returns, but less impressive considering that the stock return variable picks up the effect of any omitted fundamental variables. Equation 2.2 shows that our two fundamental variables, sales growth and cash flow growth, can explain 20.8 percent of the variation in investment over a three-year period. Both variables are significant: a 10 percent growth in sales is associated with an 8.5 percent growth in

investment over three years; a 10 percent growth in cash flow leads to a 1.8 percent growth in investment.

Equation 2.3 represents one test of the hypothesis that the stock market influences investment beyond its ability to predict future fundamentals, since the equation includes contemporaneous fundamentals together with the lagged stock return. Not surprisingly, the coefficient on alpha drops by about 40 percent from its level in equation 2.1. When future fundamentals are held constant, the responsiveness of investment to lagged stock returns is significantly smaller. The incremental R^2 of equation 2.3 is only 3.8 percent relative to that of equation 2.2. The lagged abnormal return explains only 3.8 percent of the variation in investment beyond what can be explained by fundamentals. This incremental R^2 is an estimated upper bound on how much investor sentiment toward individual stocks can affect investment.[31] Presumably, if we could measure and include other fundamental determinants of investment in the regression, the incremental R^2 would be even smaller. Simply by including the available crude measures of fundamentals, we can cut down the incremental explanatory power of relative stock returns by more than 70 percent, which seems to indicate that their ability to predict investment is largely based on their correlation with future fundamentals.

The comparison of equations 2.2 and 2.3 illustrates the general finding of this paper. The coefficient on the abnormal return, controlling for the fundamentals, is both statistically and economically significant. A 30 percent abnormal stock return over three years, which is large but not unusual, is associated with a 10 percent extra growth in investment over three years. So high stock returns indeed predict high investment. At the same time, because investment is so volatile, the incremental explanatory power of the stock market is typically small; in this case it is only 3.8 percent. Thus, variation in relative market valuation across firms and sectors cannot account for much of the variation in investment.

Although equation 2.3 shows that lagged stock returns do not explain much of the variation in investment, it does not distinguish between the

31. This interpretation depends on our treating the fundamentals from equation 2.2 as the primary explanatory variables. Absent these priors, it would be just as appropriate to interpret the incremental R^2 when fundamentals are added to equation 2.1 as the independent contribution of the fundamentals. This would leave the upper bound on possible independent effects from stock prices and investor sentiment uncertain.

financing and the market pressure hypotheses. Equations 2.4–2.7 present some results using financing variables. Equation 2.4 shows that both contemporaneous stock and bond financing are positively correlated with investment. Firms that expand outstanding shares by 10 percent or more over three years on average show 16 percent higher investment growth than firms that do not expand their shares by so much, whereas firms that make a 20 percent or more bond issue on average show 35 percent higher investment growth. These magnitudes are fairly large, and the coefficients are estimated fairly precisely. The incremental R^2 of this regression, relative to equation 2.2 with fundamentals alone, is 1.6 percent. So financing can explain a bit more of the variation in investment than fundamentals alone. Presumably, the explanatory power of relative stock returns for investment through financing is a strict subset of this explanatory power.

Equation 2.5 adds the lagged stock return to equation 2.4. These results indicate that the stock market influences investment beyond its influence on financing, consistent with the faulty informant and market pressure hypotheses. At the same time, the incremental R^2 of this equation relative to equation 2.4 is only 3.6 percent. There is not much room for investor sentiment to predict investment.

One interesting question is how much of the explanatory power of the financing variables comes from share issues and how much from debt issues. Equations 2.6 and 2.7 address this question. Equation 2.6 shows that, with the debt dummy omitted, the R^2 drops from 0.26 to 0.25, and equation 2.7 shows that, with the equity dummy omitted, the R^2 does not really drop at all. Debt financing explains a greater fraction of the variation in investment than equity financing. Since stock returns presumably exert a greater influence on stock than on bond financing, this result does not bode well for the importance of the financing view of the stock market's impact on investment.

Interpretations and Alternative Specifications

The small incremental explanatory power of stock market variables, controlling for fundamentals, suggests that either the market does not matter much or we have misspecified the regressions. We have already mentioned that in some ways our incremental R^2 overstates the incremental explanatory power of the stock market, since some fundamental

determinants of investment have been left out of the regression. We have tried adding further measures of fundamentals, such as more lags on cash flow and sales growth, but these do not seem to help explain investment or reduce the explanatory power of returns.

There are also reasons why the stock market may be more important than we estimate. First, we may have used the wrong lag structure—the stock market may anticipate investment at either a longer or shorter horizon than we specified in table 2. We have experimented with several alternative lag structures. When the stock return is contemporaneous with the fundamentals, using alpha from t to $t + 3$ rather than $t - 1$ to $t + 2$, the R^2 for equation 2.1 is 0.12, and for equation 2.3 is 0.23. We have also allowed for returns to be measured over a longer period and with longer lags, but the incremental R^2 for the stock return is always lower than in table 2. Another possibility is to break up the three-year return into its component parts so that the return from $t - 1$ to $t + 2$ is replaced by the returns from $t - 1$ to t, from t to $t + 1$, and from $t + 1$ to $t + 2$. This change actually does raise the explanatory power of stock returns, but only slightly; the R^2 in the analog of equation 2.3 rises by a small amount. None of our alternative specifications of the effect of relative stock returns on investment has noticeably more explanatory power than the one we report in table 2.

Second, we may have underestimated the effect of the stock market by focusing only on relative stock returns and by using time-period dummies instead of the return on the aggregate stock market over time. We discuss the effects of the aggregate stock market at a later point in the paper. Here we report what happens when we substitute the return on the value-weighted stock market for time dummies.[32] The marginal explanatory power of the aggregate stock return in these equations is quite low. The R^2 in equation 2.3, without time dummies, rises by only 0.2 percent when the aggregate stock market is added to the regression. This finding makes sense if variation in investment growth in response to idiosyncratic factors accounts for most of the variation of investment in the pooled time-series/cross-section data.

As we discussed above, we are also concerned that stock returns drive the sales–cash flow process and that the effect of stock returns is therefore larger than the effect implied by its incremental explanatory

32. We use the value-weighted index developed by the Center for Research in Security Prices (CRSP) at the University of Chicago.

power over and above fundamental variables. Most importantly, the stock market may be influencing sales through investment. In our view, the data do not much support this possibility. One reason is that the coefficient on sales growth seems too low to be driven by feedback from investment to sales. The point estimates in table 2 indicate that a doubling of sales over three years is associated with a roughly 70 percent increase in investment. Given that the average ratio of investment to the capital stock is 8 percent, this means that a 70 percent increase in investment roughly corresponds to raising the capital stock by an additional 5.6 percent each year. Over three years, the capital stock would grow 17 percent. Hence over three years a doubling of sales is associated with a 17 percent increase in the capital stock. This seems to us to be too large an effect on sales to be driven by the increased investment itself.

Another piece of evidence against the investment to sales feedback is the following. If autonomous changes in investment feed into sales and largely account for the correlation between sales and investment, then sales should not explain the same variation in investment as the stock market. More plausibly, both increased sales and a high stock return are associated with widely recognized investment opportunities; therefore, they both explain much of the same variation in investment.

Finally, the observed weak relation between external financing and investment along with the weak correlation between stock returns and external financing represents more direct evidence that external financing, the most plausible mechanism for stock returns to affect investment, does not appear to be important.

We should also briefly mention that we ran regressions in which investment growth is measured over a four-year period. In these regressions using time period dummies, the R^2 of the stock market alone is 17.5 percent, that of fundamentals alone is 22.9 percent, and that of the market and fundamentals together is 26.5 percent. The market again has a small incremental R^2. The incremental explanatory power of the financing variables is less than 2 percent.

The financing hypothesis predicts that the influence of the stock market should be particularly great for smaller firms, which rely to a greater extent on external financing. One could also imagine that the smaller firms are more sensitive to pressure from the stock market. To examine these issues, we have reestimated our three-year regression for "small" firms. We define a firm as "small" if, when it entered COM-

Table 3. Regressions of Growth in Real Investment for Small Firms on Selected Financial Variables, Firm-Level Data over Three-Year Spans, 1960–87[a]

	Independent variables					
Equation	*Alpha*	*Cash flow growth*	*Sales growth*	*New share dummy*	*New debt dummy*	R^2
3.1	0.412	. . .	. . .	. . .	. . .	0.134
	(13.4)					
3.2	. . .	0.166	0.773	. . .	. . .	0.177
		(5.6)	(12.0)			
3.3	0.245	0.120	0.648	. . .	. . .	0.199
	(7.6)	(4.0)	(9.8)			
3.4	. . .	0.170	0.619	0.218	0.459	0.196
		(5.8)	(9.2)	(2.6)	(6.4)	
3.5	0.234	0.127	0.511	0.158	0.449	0.216
	(7.3)	(4.3)	(7.5)	(1.9)	(6.4)	
3.6	0.238	0.118	0.628	0.175	. . .	0.201
	(7.3)	(4.0)	(9.4)	(2.1)		
3.7	0.240	0.128	0.528	. . .	0.453	0.215
	(7.5)	(4.4)	(7.8)		(6.4)	

Source: Authors' own calculations using COMPUSTAT and CRSP data bases with 2,042 observations every third year from 1963–87. See table 1 for a description of the variables. The numbers in parentheses are *t*-statistics.

a. A firm is classified as "small" if it falls in the bottom quintile of all COMPUSTAT firms in terms of the market value of equity the first year it entered the survey.

PUSTAT, it fell in the bottom quintile of all COMPUSTAT firms measured by the market value of equity. This definition ensures that we do not make our classification based on in-sample performance. Table 3 presents the results. Overall, "small" firms do not appear to be very different from the rest of the sample. The stock market by itself explains 13.4 percent of the variation in investment—less than in the whole sample. Fundamentals explain 17.7 percent of the variation in investment, compared to 20.8 percent in the whole sample. This is not surprising, since for smaller firms the more distant fundamentals are probably a more important determinant of investment. The incremental R^2 of the stock market, once fundamentals are controlled for, is 2.2 percent, compared to 3.8 percent in the whole sample. There is no evidence that the stock market is a more important predictor or determinant of investment for "small" firms.

The fundamental and financing variables together explain 19.6 percent of the variation in investment. Interestingly, the coefficients on both the equity and debt financing dummies are larger than they are in the whole

sample, indicating the greater relative sensitivity of investment to external financing for "small" firms. Financing variables add 2 percent to the R^2, adding relative stock returns adds another 2 percent. For "small" firms, as for the whole sample, the faulty informant, financing, and market pressure views of the stock market help explain the data, but not a lot. As in the whole sample, most of the explanatory power of financing comes from debt issues.

A final test concerns the market pressure view of the stock market and investment. It has been argued that recently the stock market has become a harsher judge of managerial performance, with the takeover wave of the 1980s being a manifestation of its new role. The short horizons of corporate managers reflect these stock market pressures. If these views are correct, the sensitivity of investment to stock returns should have increased in the 1980s, and the coefficient on alpha in later years should be higher. We have tested this proposition and found no evidence to support this idea. There is no trend in the coefficient on alpha or in its marginal explanatory power over our sample period.

Financing Equations

We have established that there is a potential link from financing to investment and from the stock market to investment holding financing constant. We now look more closely at how responsive financing is to abnormal stock returns. The analysis provides more detail on the link between the stock market and investment, and sheds light on how much investor sentiment may affect financing itself.

To address these issues, we estimate logit models in which the dependent variables are the three-year financing dummy variables from the previous section. The stock financing dummy is equal to 1 if the firm increased its shares outstanding by over 10 percent. The debt financing dummy is equal to 1 if the firm increased its debt by over 20 percent. In the logits, we control for the growth of sales and cash flow, just as in the investment equations. Our measure of return for each firm is alpha over a three-year period, starting two years before the three-year issuing period. For financing equations, this return measure provides the best fit. The results of the logits are presented in table 4.

The results indicate that the probability of both debt and equity

Table 4. Financing Decisions of Firms over Three Years: Implied Probabilities of Issuing Debt or Equity, Given Selected Abnormal Stock Returns

		Value (and percentile) of alpha			
		0.02 (50th)	0.47 (75th)	1.16 (90th)	1.84 (95th)
Implied probability of issuing					
	Equity	0.172	0.186	0.207	0.230
	Debt	0.365	0.376	0.393	0.411

Logit equations for calculating probabilities			*Independent variables*			
Equation	*Issue*	*Constant*	*Alpha*	*Cash flow growth*	*Sales growth*	*Number in sample*
4.1	Equity	−1.670	0.200	0.060	0.840	7,774
			(7.0)	(1.9)	(12.3)	
4.2	Debt	−0.733	0.107	−0.227	1.860	7,971
			(3.8)	(7.6)	(22.2)	

Source: Authors' own calculations using COMPUSTAT and CRSP data bases. See table 1 for description of variables. The numbers in parentheses (bottom panel) are *t*-statistics. Given percentiles of alpha are chosen for illustration; other variables are evaluated at their medians in equations 4.1 and 4.2.

financing rises with fundamentals growth and abnormal market returns. Using equation 4.1, at the median three-year alpha of 1.7 percent, we find that the implied probability of an equity issue is 17.2 percent. That probability rises to 20.7 percent at the 90th percentile alpha of 116 percent, and to 23.0 percent at the 95th percentile alpha of 184 percent. We interpret these data to mean that the probability of an equity issue is moderately, but not strongly, responsive to the prior stock return. To get a 3.5 percent increase in the probability of an equity issue requires a 116 percent extra abnormal return over three years. Financing is sensitive to prior stock returns, but just as with investment, the sensitivity is weak. The results for bond issues are similar. At the median alpha, the probability of an issue is 36.5 percent, which rises to 39.3 percent at the 90th percentile and 41.1 percent at the 95th percentile. The stock market does not seem to have a strong effect on the frequency of either stock or bond financing.

Though the frequency of external financing does not respond strongly to stock returns, perhaps the *size* of issues (average dollar proceeds) rises significantly when the firm's value rises. This effect may be

particularly important for equity issues because if the number of shares issued is held constant, dollar proceeds are proportional to the value of equity. We therefore turn to regressions in which we estimate the relation between abnormal stock returns and money raised through debt and equity financing. We normalize these proceeds by the firm's investment. This allows us to calibrate the potential growth in investment that would result if the entire amount of the higher proceeds from external financing were devoted to additional investment. In this way, we can reconcile our estimates of the effect of stock returns on investment with the effects that can be attributed directly to financing.

Our analysis consists of separately regressing three-year proceeds from debt, equity, and both combined between $t - 3$ and t (normalized by the total amount of investment over the three years from $t - 5$ to $t - 2$) on abnormal returns from $t - 5$ to $t - 2$ (alpha) and sales and cash flow growth from $t - 3$ to t. These results are presented in table 5. As expected, stock returns have a much larger effect on proceeds from equity issues than on proceeds from debt issues.

The parameter estimate for alpha says that a 100 percent abnormal increase in the share price is associated with an increase in average equity proceeds equal to 14 percent of the three years' investment. On the other hand, debt proceeds rise by only 5 percent of the three years' investment. The effect on combined proceeds is 19 percent of three years' investment. This implies that, assuming *all* additional proceeds from external financing are used for investment, a 100 percent abnormal return produces a 19 percent rise in investment over three years. The effect on investment would be smaller if the firm used the proceeds to pay higher dividends to existing shareholders, make acquisitions, or accumulate liquid assets. If the high valuation and issuing opportunity is viewed as temporary, the firm may spread out the proceeds over more years and investment will rise by less.

It is interesting to contrast the potential financing effect on investment based on these estimates with the parameter estimates for abnormal returns in the three-year investment equations. Recall from equation 2.3 that, controlling for sales and cash flow growth, a 100 percent abnormal return is associated with a 33 percent rise in annual investment over three years. The upper bound on the financing effect estimated here is a 19 percent increase in investment. Thus, the impact of the financing effect on investment appears to be smaller than our estimated upper

Table 5. Regressions of the Ratio of Financing to Investment on Selected Financial Variables, Three-Year Spans, 1960–1987[a]

		Independent variables				
	Financing/Investment	*Alpha*	*Cash flow growth*	*Sales growth*	*Number in sample*	R^2
5.3	Equity/Investment	0.142	0.023	0.369	7,495	0.153
		(15.4)	(2.4)	(18.8)		
5.4	Debt/Investment	0.052	−0.071	0.867	7,630	0.148
		(4.0)	(5.3)	(29.1)		
5.5	(Debt + Equity)/Investment	0.189	−0.044	1.140	7,442	0.233
		(12.1)	(2.8)	(32.7)		

Source: Authors' own calculations using COMPUSTAT and CRSP data bases. Regressions include time-period effects. The numbers in parentheses are *t*-statistics.

a. The ratio is between the dollar proceeds from debt and equity issues made between time t and $t - 3$ and the sum of investments made between time $t - 5$ and $t - 2$. Alpha is from $t - 5$ to $t - 2$ and sales and cash flow growth are from $t - 3$ to t.

bound for the explanatory power of stock returns in the investment equations. At the same time, financing can plausibly account for a significant part of the explanatory power of stock returns in the investment equations. The residual component could be due to market pressure or faulty informant effects or to the ability of stock returns to explain fundamentals that are not captured by our simple sales and cash flow measures.

Taken together, the investment and the financing evidence do not leave much room for the influence of investor sentiment. External financing is not sufficiently sensitive to stock returns, and investment is not well explained by external financing. It is hard to explain much of the variation in investment through investor sentiment.

Aggregate Investment Equations

The results using firm-level data do not give relative stock returns much of a role beyond forecasting fundamentals. One possible reason for this result is that fads and fashions in the stock market are largely marketwide. Therefore, we would expect the financing and market pressure hypotheses to matter in the aggregate but not at the industry or firm level. This possibility is not self-evident; one could well imagine that financing would be particularly responsive to alphas rather than

marketwide returns. That is, if equity finance responds to extreme overpricing of equities, we should see a large effect from the alphas. On the other hand, theories of fads, such as those of Shiller and De Long and others, suggest that investor sentiment is likely to be more pronounced in the aggregate data.[33] The issue is largely empirical. We therefore test the influence of the stock market on investment in aggregate data.

The appendix describes the data we use on investment, fundamentals, and financing. The fundamentals that most clearly parallel the ones used in the firm-level data are cash flow (after-tax corporate profits plus capital consumption) and personal consumption expenditure. Personal consumption expenditure on durables, nondurables, and services seems to be the appropriate measure of final sales in the economy, which is our proxy for the growth of demand. Our investment variable is fixed nonresidential investment, which excludes inventory investment. We use annual data on most variables from 1935–88, excluding the war period 1942–46 as suggested by Robert Gordon.[34] We exclude the early 1930s because corporate profits were negative in some of these years. Our equity finance variable is aggregated over all equity issues by all firms in the data developed by the Center for Research in Security Prices (CRSP). The debt finance variable is from the Federal Reserve. Unfortunately, this variable starts in 1952; therefore, we rerun some of the regressions starting in 1952 to utilize debt financing data. An interest rate variable, the lagged change in yield on AAA corporate bonds, was also tried in the list of fundamentals, but came in with the wrong sign and borderline significance. The variable was dropped. As before, all regressions are estimated in changes rather than levels.

Unlike the firm-level data, we have found that two lags of stock returns as well as contemporaneous and lagged changes in fundamentals help explain investment growth in the aggregate data. Accordingly, we have adjusted the aggregate specifications to have one- and two-year lagged stock returns, as well as contemporaneous and lagged growth of consumption and cash flow. In addition, we allow for contemporaneous and one-year lagged effects from the financing variables. Typically, only the one-year lag is significant for the equity issues variable, while for the

33. Shiller (1984); De Long and others (1990).
34. Gordon (1986).

debt issues variable only the contemporaneous component is significant. Table 6 presents the results for the whole sample.

In the aggregate regression, the one- and two-year stock returns together explain 33 percent of the variation in investment. Both are statistically significant, with the coefficient on the one-year lagged return significantly higher. Fundamentals together explain a substantial 81.3 percent of the growth rate of investment. The fact that consumption growth is so strongly correlated with investment growth is not surprising—it comes out of any Keynesian multiplier model. Nonetheless, we stress that the correlation in growth rates is by no means perfect, and a significant amount of variation remains to be explained, possibly by stock returns.

If investor sentiment affects the stock market and thus investment, but *not* consumption, then we should expect the stock market to influence investment even after controlling for consumption. On the other hand, if the stock market works as a sunspot, coordinating agents' decisions, this role would not be captured after controlling for consumption. We test investor sentiment and not sunspot models. Our estimates should not be interpreted as structural parameters; we are simply describing quasi-reduced-form relationships between investment, financing, and fundamental variables.

Equation 6.3 shows that the explanatory power of the stock market, after we control for the fundamentals, is only 1.8 percent. Also, the coefficients on lagged returns are no longer significant. The market accounts for only 10 percent of the residual variation in investment, which is much smaller than the 33 percent of variation that the market explains by itself. The stock market appears to be more significant than in the firm-level equations, but is not very important after controlling for fundamentals. The coefficient on the stock market does not seem large either. A 10 percent rise in the lagged market return leads to a 0.8 percent increase in investment growth, which is not very large. The inclusion of the stock issues variable does not materially affect our conclusion; it is insignificant and does not have much explanatory power of its own. Given so small a role for the stock market, it is hard to see how the effect of investor sentiment through financing, market pressure, or false signals can be large.

The two alternative models of the stock market's impact on investment are the passive and active informant views. James Stock and Mark

Table 6. Regression of Real Annual Aggregate Investment Growth on Selected Financial Variables, 1935–41 and 1948–88[a]

Equation	Constant	Stock market return[b]		Corporate profits[c]		Personal consumption[d]		Firms with large equity issue[e]	R^2
		one lag	two lags	current	one lag	current	one lag		
6.1	0.014	0.346	0.105	. . .	. . .	. . .	. . .	. . .	0.330
		(6.76)	(2.28)						
6.2	−0.085	. . .	. . .	0.185	0.046	1.67	1.66	. . .	0.813
				(3.93)	(2.61)	(3.01)	(4.14)		
6.3	−0.074	0.088	0.039	0.181	0.047	1.35	1.38	. . .	0.831
		(1.88)	(0.73)	(3.76)	(2.09)	(2.28)	(3.13)		
6.4	−0.100	. . .	. . .	0.211	0.053	1.46	1.70	0.142	0.823
				(4.29)	(2.94)	(2.60)	(4.30)	(1.57)	
6.5	−0.087	0.082	0.027	0.200	0.055	1.18	1.47	0.115	0.838
		(1.77)	(0.51)	(3.99)	(2.36)	(1.97)	(3.31)	(1.27)	

Source: Authors' own calculations using Department of Commerce data and the CRSP data base. The sample includes 48 observations. The numbers in parentheses are *t*-statistics. Results shown are from OLS regressions, except for equation 6.1, which shows the Yule Walker regression results with up to three lags, since autocorrelation in the OLS residuals is significant at the 5 percent confidence level in that equation. OLS R^2 is reported for all equations.

a. Investment is gross private fixed investment, nonresidential, from the Commerce Department. Aggregate investment is deflated by the Commerce Department's implicit price deflator for investment prior to 1982, and by a "chain investment index" suggested by Robert Gordon, for 1983–88.

b. Stock return is the value-weighted index *cum* dividend return from CRSP.

c. Corporate profit is after-tax total corporate profits (with depreciation) from the Commerce Department.

d. Consumption is aggregate personal consumption (including nondurables, durables, and services) from the Commerce Department.

e. The large equity issue is the fraction of firms increasing the number of shares by more than 5 percent in a given year. Since the contemporaneous effects are statistically insignificant, only the one-year lagged effects are shown.

Watson demonstrate that, as a leading indicator of output, the stock market is dominated by a combination of other fundamental variables, including interest rates.[35] This finding means that managers do not need the stock market to make investment decisions when they have other fundamental data; if most explanatory power comes from fundamentals, and managers do not need the stock market to predict them, then managers do not need the stock market to make investment decisions. This argument favors the passive informant view of the stock market.

An important exception is the sunspot version of the active informant view. If the stock market informs investors and managers about which equilibrium is at work, the market determines both future consumption and investment. In this case, the stock market still plays an active role, even though it does not help predict investment growth after controlling for consumption growth. Our data do not enable us to distinguish the sunspot active informant model from the passive informant model.

The results in table 6 suggest that the role of the stock market, beyond its ability to predict fundamentals, is limited. Nonetheless, we try to evaluate how well financing explains investment. As noted above, our equity financing variable does not explain much. As for debt finance, we must look at the post-1952 sample. Table 7 reports the results for the post-1952 period. For this period, the R^2 for stock returns alone is 31.0 percent, that for fundamentals alone is 67.4 percent. The incremental R^2 for the market, after controlling for fundamentals, is a much higher 7.3 percent, which may mean more room for investor sentiment to influence investment.

Equation 7.4 shows that when the equity issues variable is included in an equation with the fundamentals, it adds 2.6 percent to the R^2 and is positive and nearly significant. When 10 percent more firms issue equity in excess of 5 percent, investment grows on average 1.5 percent faster. The debt issue variable alone adds 3.8 percent to the R^2 and is negative and statistically significant. Debt financing is high when investment is slowing down. Debt seems to be used to smooth investment so that in a recession, when cash flow falls sharply, investment does not fall as sharply. The sign on debt finance is different from that in firm-level data, which can be explained if debt is used to smooth cyclical variation in investment but not idiosyncratic variation in investment. Together, the stock issue and debt financing variables have an incremental R^2 of 9.5

35. Stock and Watson (1990).

Table 7. Regression of Real Annual Aggregate Investment Growth on Selected Financial Variables, 1952–88

		Stock market return		*Corporate profits*		*Personal consumption*		*Large equity issue*[a]	*Debt issue*[b]	
Equation	*Constant*	*one lag*	*two lags*	*current*	*one lag*	*current*	*one lag*			R^2
7.1	0.006	0.249	0.120	. . .	. . .	. . .	. . .	. . .	. . .	0.310
		(4.95)	(2.41)							
7.2	−0.039	. . .	. . .	0.164	0.188	1.47	0.54	. . .	. . .	0.674
				(2.34)	(2.64)	(2.45)	(0.89)			
7.3	−0.026	0.105	0.070	0.158	0.207	1.18	0.03	. . .	. . .	0.747
		(2.20)	(1.36)	(2.21)	(3.06)	(2.03)	(0.04)			
7.4	−0.061	. . .	. . .	0.180	0.195	1.38	0.52	0.154	. . .	0.700
				(2.62)	(2.81)	(2.35)	(0.89)	(1.63)		
7.5	−0.045	0.099	0.066	0.171	0.212	1.12	0.05	0.125	. . .	0.764
		(2.12)	(1.29)	(2.42)	(3.18)	(1.96)	(0.08)	(1.44)		
7.6	−0.021	. . .	. . .	0.124	0.148	1.56	0.91	. . .	−0.365	0.712
				(1.77)	(2.09)	(2.71)	(1.51)		(2.03)	
7.7	−0.015	0.097	0.055	0.125	0.179	1.25	0.39	. . .	−0.262	0.765
		(2.06)	(1.06)	(1.70)	(2.59)	(2.19)	(0.61)		(1.51)	
7.8	−0.049	. . .	. . .	0.133	0.142	1.45	1.05	0.242	−0.521	0.769
				(2.09)	(2.20)	(2.77)	(1.90)	(2.72)	(3.00)	
7.9	−0.039	0.083	0.038	0.128	0.170	1.20	0.64	0.203	−0.415	0.803
		(1.88)	(0.788)	(1.86)	(2.65)	(2.25)	(1.04)	(2.33)	(2.38)	

Source: Authors' own calculations using Department of Commerce and Federal Reserve data and the CRSP data base. The sample includes 37 observations. The numbers in parentheses are *t*-statistics. See table 6 for a description of the variables. Results shown are from OLS regressions, except for equation 7.1, which shows the Yule Walker regression results with up to three lags, since autocorrelation in the OLS residuals is significant at the 5 percent confidence level in that equation. OLS R^2 is reported for all equations.

a. The equity issue variable is lagged one year; the contemporaneous variable was dropped because it consistently received *t*-ratios below 1.

b. The debt issue variable is the ratio of net funds raised from corporate bonds to total outstanding liabilities. Only contemporaneous effects are shown here.

percent, which is much higher than in firm-level data. When the stock market is added to the equation with both fundamentals and financing variables, its incremental R^2 is 3.4 percent and the coefficients are borderline significant. Thus, the stock market net of financing matters little.

The incremental R^2 from the stock market when financing variables are excluded is 7.3 percent; it is only 3.4 percent when financing variables are included. The stock market and financing variables, especially debt financing, are explaining the same variance, consistent with the financing view of the stock market. The trouble is that the coefficient on the debt financing variable is negative, so that it is not possible to tell the story that increases in stock prices make debt financing cheaper, more debt is issued, and investment rises. The equity version of the financing view receives a little more support from the data, but its role seems limited. When the equity financing variable is included, the incremental explanatory power of the stock market is still 6.4 percent, which is not much below 7.3 percent, the incremental explanatory power of the stock market over and above fundamentals alone. Finally, the fairly low incremental R^2 from stock prices when financing variables are included shows that the market pressure view and faulty informant view of the stock market are not particularly important either.

As one final test of the potential impact of investor sentiment on investment, we included a measure of the change in the discount on closed-end funds.[36] The coefficients on this variable, which we lagged like the stock market, were not significant when the stock market was included in the regression. This means that either discounts on closed-end funds are a poor measure of sentiment or, in keeping with the rest of our findings, investor sentiment does not affect investment.

In summary, the stock market appears to have greater incremental explanatory power, after controlling for fundamentals, in aggregate equations than in firm-level equations, though its independent role is still quite limited. Before the financing variables are added, the market has an incremental R^2 of over 7.0 percent over the post-1952 subperiod, although it is only 1.8 percent over the full period. This is respectable given that fundamental variables alone explain around 70 percent of the variation in investment. Once financing variables are added, however,

36. Some research indicates that discounts are a plausible measure of investor sentiment. See appendix for full description of this variable.

the incremental explanatory power of the market falls to about 3 percent in the post-1952 sample. This result does not support the financing view of the stock market, since the coefficient on the debt finance variable, while significant, is of the wrong sign. The results imply a fairly small residual role for the stock market beyond its ability to predict fundamentals. The two hypotheses that best fit the data are the passive informant hypothesis and the sunspot version of the active informant hypothesis.

Aggregate Financing Equations

In this section, we briefly present some financing equations using the aggregate data. Since the channel from the stock market to financing and from financing to investment did not appear to be important, these results will tell us little more about financing and investment. However, the results may shed light on financing decisions and their relationship to stock returns.

Table 8 presents three sets of results: for stock financing over the whole period, for stock financing starting in 1952, and for debt financing. From CRSP, our stock financing variable is the proportion of firms that expand their outstanding shares (other than splits and stock dividends) by 5 percent or more. We construct our own aggregate series directly from the firm-level data. For the debt variable, we use debt issues by nonfinancial corporations as a fraction of their outstanding liabilities, a series that is available from the Federal Reserve.

The financing equations show that stock returns are borderline significant in predicting stock financing, and not at all significant in predicting debt financing. In the full sample, a 10 percent higher stock return leads to a 0.3 percent increase in the fraction of firms that issue equity. The R^2 in the equation with stock returns alone is minuscule, but the incremental R^2 from the stock market, once fundamentals are controlled for, is 2.9 percent for stock financing in the whole sample, 1.3 percent for stock financing since 1952, and 1.9 percent for bond financing with a negative coefficient. The results are consistent with a weak stock market effect on equity financing, although it is hard to believe that the investor sentiment component of that return has a big effect on investment once all is said and done.

Debt financing responds negatively to the growth of after-tax profits,

Table 8. Proportion of Firms Making Large Equity Issues and the Proportional Increase in Aggregate Corporate Debt Regressed on Selected Aggregate Financial Variables, Selected Intervals

Equation	*Dependent variable*	*Constant*	*Stock return*[a]	*Growth in corporate profit*[b]	*Growth in personal consumption*[b]	*Annual investment growth*[c]	R^2	*Number in sample*
8.1	Equity issue, 1935–40; 1947–88	0.131	0.034 (1.42)	. . .	. . .	. . .	0.002	48
8.2	Equity issue, post-1952	0.161	0.046 (1.46)	. . .	. . .	. . .	0.005	37
8.3	Debt increase, post-1952	0.097	−0.027 (1.40)	. . .	. . .	. . .	0.009	37
8.4	Equity issue, 1935–40; 1947–88	0.131	. . .	−0.014 (1.07)	0.197 (0.72)	. . .	0.127	48
8.5	Equity issue, post-1952	0.137	. . .	−0.056 (0.94)	0.490 (1.10)	. . .	0.032	37
8.6	Debt increase, post-1952	0.088	. . .	−0.071 (1.90)	0.072 (0.24)	. . .	0.156	37
8.7	Equity issue, 1935–40; 1947–88	0.139	0.044 (1.33)	−0.015 (1.15)	−0.013 (0.05)	. . .	0.156	48
8.8	Equity issue, post-1952	0.140	0.044 (0.94)	−0.055 (0.94)	0.333 (0.70)	. . .	0.045	37
8.9	Debt increase, post-1952	0.086	−0.006 (0.26)	−0.070 (1.79)	0.115 (0.36)	. . .	0.175	37
8.10	Equity issue, 1935–40; 1947–88	0.132	0.068 (2.00)	−0.028 (1.95)	−0.022 (0.08)	0.147 (1.94)	0.169	48
8.11	Equity issue, post-1952	0.170	0.072 (1.76)	−0.016 (0.27)	−0.343 (0.68)	0.264 (2.12)	0.063	37
8.12	Debt increase, post-1952	0.074	0.004 (0.14)	−0.032 (0.68)	0.345 (1.03)	−0.198 (1.53)	0.271	36

Source: Authors' own calculations using Department of Commerce data and the CRSP data base. The numbers in parentheses are *t*-statistics. Because tests to detect up to third order autocorrelation in the residuals are significant at the 5 percent level, results from Yule Walker regressions are reported in place of OLS regressions. OLS R^2, however, are reported here.

a. Stock return is the lagged two-year real CRSP value-weighted *cum* dividend stock market return.

b. Corporate profit and consumption are defined in table 6. Here, however, we use two-year growth in profits and consumption as the independent variables.

c. Investment is defined in table 6. Here the annual growth in aggregate investment is led by one year in the equity issuance equations and contemporaneous in the debt issuance equation.

indicating that debt is used to smooth cash flows. Debt financing is also negatively correlated with lagged stock returns, and positively, but not significantly, with consumption growth. These results are consistent with our conjectures. During recessions, which follow low stock returns and exhibit low cash flow growth, companies issue debt to obtain cash. By doing so, they attenuate the declines in investment that would be even greater without debt finance. This story implies that debt finance is negatively correlated with investment growth in the aggregate data, even though debt finance actually keeps investment from falling even more. These results also support our earlier conjecture that the financing view of the stock market does not hold where debt is concerned—the need for funds determines when companies will issue debt, not the level of stock returns.

The preceding analysis pertains to the financing practices of companies already made public. It suggests that the stock market does not significantly influence the investment of these companies through financing, and that the market does not have a large impact on financing itself. This does not mean, however, that the stock market is a complete sideshow. It is important to remember that the stock market can be a key source of financing for new companies. Although we do not have the data to analyze new companies' investment, we do have data on the annual number of initial public offerings (IPOs) in the United States between 1960 and 1987, and can examine whether IPOs respond to stock returns and closed-end fund discounts.

The results are presented in table 9. Because the regressions are partly specified in levels, we test for linear and exponential trends and detrend accordingly. In the end, we regress the annual number of IPOs, which has been linearly detrended, on the CRSP value-weighted real stock market index, which has been exponentially detrended; on the value-weighted discount on closed-end funds (which does not have a significant trend); on the two-year growth of real personal consumption; and on the two-year growth of real after-tax corporate profits.

Equation 9.1 shows that both the market index and the value-weighted discount significantly explain the pace of IPOs, and together they explain 44 percent of the time series variation in the number of IPOs. This is a better fit than for any other financing or investment equation from stock market variables. The coefficient on the market index shows that as it rises from a median value of 134 to its 90th percentile value of 179, the

Table 9. Regression of the Detrended Number of Initial Public Offerings on Detrended Aggregate Financial Variables, 1960–87

Equation	*Constant*	*Stock index*[a]	*Discount on closed-end funds*[b]	*Growth in personal consumption*[c]	*Growth in corporate profits*[c]	R^2
9.1	−299	3.96	−10.30	. . .	. . .	0.441
		(2.61)	(1.95)			
9.2	−150	. . .	. . .	4,617	−796	0.300
				(2.55)	(3.18)	
9.3	−311	3.79	−8.10	363	−222	0.462
		(1.88)	(1.37)	(0.15)	(0.70)	

Source: Authors' own calculations using U.S. Department of Commerce data and the CRSP data base. The sample includes 28 observations. The numbers in parentheses are *t*-statistics.

a. Stock index is the exponentially detrended level of the real CRSP value-weighted stock market index.

b. The level of discount on closed-end funds is the year-end average discount on a portfolio of closed-end funds, from Lee, Shleifer, and Thaler (1990) for 1965–85, using a portfolio of 18 funds. For 1930–64 and 1986–89, five funds are used: Adams Express, General American, Lehman, Niagara Shares, and Tricontinental.

c. Corporate profits and consumption are described in table 6. Here, as in table 8, we use two-year growth in profits and consumption as the independent variable.

number of annual IPOs rises by 178, which is equivalent to rising from the median to roughly the 80th percentile of the number of IPOs. In contrast, when the closed-end fund discount rises from its 50th percentile value of 11.1 percent to its 90th percentile value of 17.8 percent, the number of IPOs falls by about 70. On this metric, the pace of IPOs is about 2.5 times more responsive to the value-weighted index than it is to the discount variable, but the fact that both are significant suggests that investor sentiment, as proxied by the closed-end fund discount, affects IPOs.

Equation 9.2 shows that the fundamental variables together have an R^2 of 30 percent, which is smaller than that of the stock market variables. Equation 9.3 shows that, after controlling for fundamentals, the value-weighted index remains significant and its coefficient loses little of its value. The coefficient on the closed-end fund discount does not change much either, but becomes much less significant. The incremental R^2 from the two market value variables is 16 percent, which is higher than we have seen elsewhere. In sum, the stock market itself and the closed-end fund discount, as a measure of sentiment, appear to influence initial public offerings both on an absolute scale and relative to their influence on equity and debt financing of seasoned firms. In the IPO market, investor sentiment may very well be important. Unfortunately, the

strength of our conclusions is limited by the short time series we have on IPOs.

Conclusions

This paper was motivated by the concern, present in both public policy discussions and in the economics literature, that the stock market's deviant behavior has real consequences for the economy. Is the stock market a sideshow, or does it instead direct investment, perhaps erratically? We have tried to evaluate empirically whether the stock market has a large, independent influence on investment using both firm-level and aggregate data.

The firm-level regressions show that movements in relative share prices are associated with fairly large and statistically significant investment changes when fundamentals are held constant, but the incremental R^2 from relative stock returns is fairly small. The cross-sectional variability of investment is sufficiently large that relative stock returns can account for only a small part of it. We have argued that the explanatory power of relative stock returns for investment is unlikely to be evidence that the stock market provides new information to managers, since managers probably learn little from the market about their own firms' idiosyncratic prospects. We have also provided evidence that the relation between relative stock returns and investment is not driven by the costs of external financing. The explanatory power of relative stock returns for investment may be evidence of the market exerting pressure on managers, although it also seems likely that the market is picking up the effect of imperfectly measured fundamentals. By simply including the contemporaneous growth rate in cash flow and sales we are able to reduce the explanatory power of relative stock returns from 13 percent to 4 percent. In any event, the 4 percent incremental R^2 from the return is small relative to what we expected. It suggests that even if the market does exert pressure on managers (or even inform them), it is not a dominant force in explaining why some firms invest and others do not.

In some respects, the firm-level evidence is much more important for policy discussions than the aggregate evidence. The allocation of capital across firms and sectors strikes us as more important than the timing of business cycles and the allocation of investment over time. The fact

that, in the firm-level data, the stock market has small explanatory power for investment, beyond its ability to predict fundamentals, suggests that complaints about the misallocation of resources due to the stock market may be exaggerated. For if managers respond strongly to the market's whims about their firms and that is a pervasive problem, we would expect these whims to explain a larger part of the variation in investment. The market may not be a complete sideshow, but nor is it very central.

The aggregate evidence speaks to the issue of allocation of capital over time. High stock prices can lead to high investment through low financing costs, and by signaling good economic times, thus encouraging managers to invest. Such encouragement can be misleading, as when sentiment leads corporate managers astray, or can be self-fulfilling, as when the market acts as a sunspot.

Our aggregate evidence rejects the importance of the financing effect of stock prices for seasoned firms. There is no evidence that high returns lead to significantly more equity or debt financing; in fact, debt financing is low following high stock returns. We have also found substantial evidence against the view that the stock market acts as a faulty informant about future activity. Controlling for fundamental and financing variables, the incremental R^2 from stock returns is 2 to 3 percent, and the coefficients are borderline significant. Incidentally, the fundamental variables that make the stock market redundant as a predictor go only as far as one year ahead. The notion that the stock market evaluates *long-term* prospects of the economy, and so guides long-term investment, is not supported by the data.

Two views of the stock market are consistent with the aggregate data. The first is the passive informant view, which says that the stock market simply captures information that people already know, and does not direct investment. The second view is that the stock market is the key sunspot, coordinating the investment decisions of corporate managers, which are then justified by the resulting boom or recession. Importantly, there is nothing irrational about the stock market in this case, it just determines which of the possible multiple equilibria is at work. The first view seems more appealing for several reasons. First, there is the Stock and Watson finding that the stock market gets knocked out as a predictor of the short-run future course of the economy once other predictors are included in regressions. One could argue that the stock market is the first sunspot and everything else follows, but this may be stretching it a

bit. Second, in episodes such as the late 1920s and post-October 1987 corporate managers have largely ignored this sunspot. Overall, a fair reading of the evidence is that the stock market is a sometimes faulty predictor of the future, which does not receive much attention and does not influence aggregate investment.

An important exception to this finding is the evidence from the initial public offerings data, where both the stock market index and the discount on closed-end funds help predict the pace of new offerings. This evidence, though limited by the lack of data, suggests that in the market for new issues, the stock market and investor sentiment matter. It could still be that market conditions affect only the timing of IPOs, and not their volume over time. On the other hand, it could be that in low markets good ideas die because they cannot be financed. The effect of investor sentiment on the new issues market is an important area for further research.

APPENDIX

Description of Data

IN THE APPENDIX we describe the sources of our data and the methods used to calculate our variables.

Firm-Level Data

Investment: "Capital expenditures" are from annual statement of changes in financial position, from COMPUSTAT data base, 1959–87, including COMPUSTAT Research File; acquisitions are not included; observations with growth rates above 1,000 percent are excluded as outliers for this and all the other variables.
Sales: From COMPUSTAT, 1959–87.
Cash flow: Net income plus depreciation, from COMPUSTAT, 1959–87.

Net debt issues: ΔBook debt, divided by book debt$_{t-1}$, from COMPUSTAT, 1959–87.
New share issues: Sale of common equity divided by the beginning-of-year total market value of common equity, from COMPUSTAT, 1971–87; where above was missing, including between 1959 and 1970, sale of common equity is estimated from change in the number of shares outstanding reported in CRSP, filtering out changes due to liquidation, rights offering, stock splits, or stock dividends.
Alpha: CAPM betas were estimated for each firm using all available monthly returns. These betas were then used to calculate an alpha for each year. Data are from CRSP, 1959–87.

Aggregate Data

Investment: From U.S. Department of Commerce, "Gross Private Fixed Investment, Non-residential"; the series is the sum of investment in nonresidential structures and equipment for 1935–41 and 1947–88.
Consumption: Aggregate personal consumption (including nondurables, durables, and services) from the U.S. Department of Commerce, 1934–41 and 1947–88.
Cash flow: After-tax total corporate profits (without depreciation subtracted) from U.S. Department of Commerce, 1934–41 and 1947–88.
New debt issues: The ratio of net funds raised from corporate bonds to total outstanding liabilities, obtained from sector statements of savings and investment for nonfinancial corporate business; from Federal Reserve, 1952–89.
New share issues: Individual firm share issues were calculated using CRSP data as described above. Aggregate variable is the fraction of firms increasing the number of shares by more than 5 percent in a given year.
Stock return: Value-weighted index return from CRSP, 1933–41 and 1947–88.
Closed-end fund discount: Year-end average discount on a portfolio of closed-end funds; from Lee, Shleifer, and Thaler for 1965–85, using a portfolio of 18 funds; for 1930–64 a portfolio of five funds is used (Adams Express, General American, Lehman, Niagara Shares, and Tricontinental); the same five funds also used for 1986–89.

Inflation: Most firm-level and aggregate variables are deflated using the GNP deflator. One exception is aggregate investment, which is deflated by the U.S. Department of Commerce's implicit price deflator up to 1982 and by the "chain investment index," suggested by Gordon for 1983–88. Also, aggregate personal consumption is deflated by implicit price deflator for personal consumption expenditures.

Comments and Discussion

Matthew Shapiro: The stock market and investment are positively correlated. This well-known empirical finding provides the point of departure for the authors' theoretical discussion. In it, they provide an interesting and useful classification scheme for explanations of this correlation. For the most part, they put aside the question of whether or not the stock market is efficient in the sense that it appropriately discounts future cash flows. Instead they ask a more interesting question. Namely, do the fundamentals, specifically the accumulation of fixed capital, respond to movements in the stock market? Of course, the extent to which investment responds to the stock market depends on the efficiency of the stock market. The authors' theoretical section clearly addresses this simultaneity.

Most economists think of the relationship between the stock market and investment in terms of q, the ratio of market value to replacement cost. John Maynard Keynes viewed stock market fluctuations as largely irrational and hence not useful signals about the profitability of investment projects. In William Brainard and James Tobin's formalization of Keynes's chapter 12, managers react to potentially irrational movements in the market by financing expansion either through new issues, when q exceeds one, or through mergers and acquisitions, when q is less than one.[1] Andrew Abel's and Fumio Hayashi's derivations of q-theoretic models of investment implicitly assume rational stock market valuation to the extent that the shadow value of the fixity of capital is associated with financial variables.[2] Under certain assumptions, their q-theoretic models are observationally equivalent to Brainard and Tobin's. But in

1. Brainard and Tobin (1968).
2. Abel (1979); Hayashi (1982).

these derivations, q diverges from one only because adjustment costs keep the actual capital stock from equaling its desired level. The stock market appropriately reflects this out-of-steady-state outcome.[3]

Randall Morck, Andrei Shleifer, and Robert Vishny do not use q to discuss the relationship between the stock market and investment. Nonetheless, their lucid theoretical discussion clarifies how the stock market's decision to rationally discount future cash flow affects the correlation. The authors consider four hypotheses. One of their hypothesis, which is closely related to the Keynes-Brainard-Tobin q-model, is that the market is irrational, but managers use its swings to finance investment. In another hypothesis, the managers of firms actually learn about the profitability of their investments from the stock market. In a third, the managers have superior information about their profits, so they do not learn from the market, but the econometrician gets a signal about profitability from the stock market. These latter two hypotheses maintain that the stock market is rational; both hypotheses are related to adjustment-cost based implementations of the q-theoretic models, but the signaling hypothesis is closest to Abel's and Hayashi's models. Finally, the authors consider a fourth hypothesis—that the investment–stock market correlation arises because managers try to increase reported profits by curtailing investment when their stock price falls.

Most of the authors' evidence bears on the first and third hypotheses. They have no sharp tests of the fourth hypothesis. They dismiss the second hypothesis—that managers learn about the profitability of their investments from the stock market—because they believe that managers have superior information about the profitability of their investments and describe evidence based on managers' stock trading that supports this belief. The authors' arguments about managers' superior knowledge of their firms' cash flows are convincing. Yet, even if managers have superior knowledge of the profitability of their projects, the market may still provide information useful to them in making investment decisions. Morck, Shleifer, and Vishny discuss stock returns as if they were governed only by innovations in current and expected future cash flows. But stock returns also move with changes in the rates by which cash

3. Tobin and White (1981) note that Summers's (1981) estimates of a q-theoretic equation imply incredibly high adjustment costs. Although they make this point as a *reductio ad absurdum* of models that link the stock market and investment only through adjustment costs, many have taken this finding as impetus for formulating more complicated, but still adjustment-cost driven, q-models.

flows are capitalized. Capitalization rates may change because of either changes in the economywide required rate of return or changes in the risk discount for the individual firm. Managers of firms may well change the rate at which they discount future cash flows based on movements on their firms' values. The decomposition of stock returns into innovations in required rate of return and cash flow bears on their empirical work.

The authors' basic regression relates investment growth to stock returns. Their discussion of the specification proceeds totally innocent of previous work on the demand for capital. There is little mention of the q-theory in their paper despite its obvious relevancy. Indeed, the equation that they estimate is roughly equivalent to differencing the q-theoretic investment equation. In the q-theoretic specification, the left-hand-side variable is the investment-capital ratio. In the authors' specification, it is the percentage change in investment. Hence, they approximately difference the numerator of the q-theory's investment-capital variable while letting the change in the capital stock (the denominator) be subsumed into the error term of their regression. Similarly, the right-hand-side variable of the q-theoretic equation is average q, the ratio of market value to replacement cost. Variation in the numerator of average q is dominated by revaluation of equities, so differencing average q yields a variable related to stock returns. In their empirical work, the authors quantify stock returns as the lagged idiosyncratic movement in the sum of price change and dividend yield. Thus, their equation differs somewhat from differencing the q-theoretic equation: it does not account for replacement cost or the revaluation of nonstock financial claims; it looks at just the idiosyncratic movements in stocks where the q-theory would equally include the aggregate component; and the return is lagged rather than contemporaneous.

Despite these differences with the q-theoretic specification, the authors' empirical results echo the more familiar ones. First, in both their results and those obtained from q equations, the stock market gets a small coefficient. Second, one of the empirical shortcomings of estimated q-investment equations is the extreme serial correlation of their residuals. The authors' differenced equations can be understood as acknowledgments of this empirical problem with the q equation. Third, in both sets of equations, variables such as cash flow and sales come in much more strongly than the stock market.

Putting aside whether or not the authors' results should be understood

in terms of the q-theory, one should note that examining the growth of investment is a perilous way to study the demand for capital. Lawrence Summers, in his "Requiem for the Investment Equation," points out that having the level of investment as the left-hand-side variable does not make sense unless the right-hand side controls for the deviation of the current capital stock from the desired level (as does the q-theory).[4] Firms demand a stock of capital; investment is merely the regulation of that stock. Most investment equations sin by slipping a derivative. The authors slip two derivatives by examining the growth in investment. Consequently, the authors' choice of specification makes it very difficult to interpret the magnitude of their estimated coefficient and makes it hard to believe that these coefficients do not vary across firms depending on how actual capital stock departs from its desired level.

The authors claim that there is too much firm-level heterogeneity for them to model the relationship in levels. Their inability to get sensible results in a levels specification arises because they have omitted key factors, such as the stock of capital, from their analysis. Unless the omitted factors are deterministic trends, differencing does not solve the specification problem.

The authors run the reverse regression with the financing variables on the left-hand side to see how they are correlated with stock returns. One can see from the first set of regressions (with investment growth on the left-hand side) that stock returns and the financing variables cannot be highly correlated. Including the financing factors does not greatly affect the estimated sign of the stock return variable. Therefore, the authors could make their point without recourse to the second set of regressions.

The authors present results at both the firm and the aggregate level. Their main equation has investment growth as the dependent variable and includes lagged stock returns, other variables (cash flow and sales) to capture the fundamental determinants of stock returns, and still others (dummies for large new issues of equity and debt) to capture new financing. In the firm-level regression, the stock return is purged of its correlation with the aggregate return. In these estimates, the stock market is highly significant and has a large coefficient compared to the aggregate estimates. When the fundamentals variables are included in

4. Summers (1985).

the regression, they are also very significant and have important explanatory power. Their inclusion makes the coefficient on the stock return fall somewhat, but it is still large compared to the aggregate estimates. Hence, the fundamental factors are important in explaining investment, but leave a significant role for the stock return. The financing factors are also significant in the regression. Their inclusion leads only to a further small reduction in the coefficient of the stock returns variable, so the stock returns and financing factors are essentially independent.

While the absence of the theoretical model makes these results hard to interpret, it is possible to draw some conclusions. The finding that the stock return is a significant explanatory factor for investment, but is hardly a sufficient statistic, is consistent with the large body of empirical work on q-theoretic investment models.

The significance of the sales and cash flow variables is hard to interpret. Steven Fazzari, Glenn Hubbard, and Bruce Peterson include them in similar equations, but those authors include them to show that liquidity affects investment. On the other hand, the present authors interpret these variables as the fundamental determinants of stock values. Absent more information, both the Fazzari, Hubbard, and Peterson and the Morck, Shleifer, and Vishny explanations of the correlation of investment and cash flow are consistent with the data.[5]

The significance of the coefficients of the new equity and new debt dummy variables does not imply that financing causes investment. Suppose that the world is Modigliani-Miller on the margin, that is, that firms choose a capital structure that equates the marginal cost of funds across different types of financial claims. New investment must be financed by some means. On the margin, a firm should desire to use all means; thus, it is not surprising to see investment correlated with both forms of financing. Therefore, the financing-investment correlation is not evidence against the economic independence of real decisions from financing decisions.

The authors abstract from aggregate movements in the stock market in their firm-level regressions by only including the idiosyncratic component of stock returns and also by including year dummies in the regressions. While neglect of these aggregate components does not bias their estimates, it does reduce the power of their procedure. There is no

5. Fazzari, Hubbard, and Peterson (1988).

theoretical justification for abstracting from the aggregate component of stock returns. By omitting this component, the authors reduce the potential role of their returns variable. Moreover, it would be interesting to see how the aggregate component enters the regressions. They could either report the annual dummies or, better, exclude them in favor of including the systematic component of stock returns (the beta times the aggregate return). As noted earlier, managers should respond to changes in the required rate of return, about which the aggregate market return carries an important signal.[6] Consequently, by abstracting from the aggregate, the authors potentially understate the role of the stock market for investment. Doing so also makes it difficult to compare the aggregate and firm-level results.

In the aggregate regressions, the stock market has roughly the same coefficient as the firm-level regressions when the univariate relationship is considered, but falls dramatically when the fundamentals are included. The text of the paper reads as if the stock market explains more in the aggregate regressions than the firm-level regressions. The authors come to this conclusion because they rely inappropriately on the R^2. Comparing R^2's across samples is misleading because the error variances are so different at the firm and aggregate levels. Indeed, as judged by the size and significance of the coefficient of the stock returns variable, the relationship between investment and the stock market is much larger in the firm-level regressions.

James M. Poterba: Stock market anomalies—the January effect, the weekend effect, the alphabet effect—are a favorite topic of conversation at Brookings Panel meetings. If asked to justify these anomalies as legitimate subjects of macroeconomic interest, most economists would argue that the stock market provides vital signals for investment and consumption decisions. An understanding of its movements is therefore important to an understanding of macroeconomic fluctuations.

In this provocative paper, Randall Morck, Andrei Shleifer, and Robert Vishny attempt to end these discussions. They argue that the conventional view of the stock market as an important determinant of corporate

6. They should also respond to firm-specific changes in required rates of return caused for example by changes in the risk-structure of their returns. These could be captured by changes in the betas. Since the authors assume them to be constant, these changes are included in the estimated alphas.

investment is misplaced. Drawing on a rich base of firm-level investment data and stock return data, the authors argue that to a first approximation, *swings in the stock market are irrelevant for firm investment decisions.* The findings are significant not only because they illuminate what determines investment, but also because they carry strong implications for the welfare cost of "noise trading" and other forces that cause transitory divergences between asset prices and fundamental values. This paper suggests that even if prices gyrate inappropriately, they may have little effect on real activity.

The findings in this paper may come as a surprise to some subscribers to the q-theory of investment, which links stock price and investment. Even without this paper, however, a skeptic would have found grounds for concern regarding the stock market's predictive power. James Stock and Mark Watson's recent work on leading indicators finds that in predicting real output the stock market is dominated by a collection of other variables. A twenty-year BPEA tradition of running horseraces between competing investment equations has shown that q-models are outpaced by equations including cash flow, output, and other flow measures of corporate activity.[1]

The central contributions of the current paper are the use of firm-level data in studying the forecast power of the stock market and the focus on the *incremental* explanatory power of the stock market. Although the basic conclusions seem relatively robust, both the choice of data and the statistical analysis in this paper invite scrutiny.

First, the timing convention in the regression equation excludes current stock returns, but includes current cash flow or sales. Since the fundamentals are all dated later than the stock market variable, they have an informational advantage. This concern applies both to the firm-level and aggregate estimates. However, results provided to me by the authors suggest that this issue is not of critical importance: inclusion of the current stock return rather than the lagged stock return in the firm-level equations actually *reduces* explanatory power; in the aggregate equation, the current stock return enters with a negative coefficient. Thus, the timing convention is unlikely to be central to the empirical conclusion.

1. Sensenbrenner (1990) suggests that q- and neoclassicial accelerator models can perform similarly if a sufficiently rich lag structure is considered.

A second issue of specification concerns the use of time effects in the analysis of individual firm investment. Their use removes the effect of aggregate stock market movements, even though these may be an important source of the market's explanatory power for each firm. One can easily imagine that managers invest more (given their firm's cash flow) when the stock market *overall* is high, signaling future good times. Even if the broad market movements were uninformative for investment of a given firm, the results would be far stronger than the current findings.

A third difficulty is that the paper does not perform the appropriate test of how stock returns affect investment. The ideal test would examine the stock market's explanatory power at $t - 1$ after controlling for expectations of future fundamentals that were formed by information at $t - 1$. This would argue for development of a firm-level or aggregate model to predict dividends. Then, the change in the optimal forecast of the present discounted value of dividends should be compared with the stock return in forecasting future investment.

A final concern is that the findings are sensitive to changes in specification and sample period. Two other studies—those by Robert Barro and Olivier Blanchard, Changyong Rhee, and Lawrence Summers—that the authors cite estimate similar models with aggregate investment data.[2] Barro reports stronger evidence on the link between stock returns and investment than this paper finds. The difference between his results and those of the current paper is apparently due to his inclusion of lagged investment, and his somewhat longer sample period. Blanchard, Rhee, and Summers's paper uses a more formal methodology to construct the expected present value of dividends and to contrast the predictive power of this series with the predictive power of actual stock prices. Using this approach, they were not able to draw strong conclusions about the real effects of sentiment-induced swings in share prices. Thus, I remain nervous that the current findings, particularly in aggregate data, are not definitive.

Turning from data to statistical methods, I believe this paper also alters the focus of prior debate. By concentrating on the stock market's incremental explanatory power for investment spending, the authors shift from the traditional analysis of q-investment spending. It is important to distinguish, as the authors do, the claim that the stock market is

2. Barro (1990); Blanchard, Rhee, and Summers (1990).

not incrementally important from the claim that it is not important in explaining investment. Unless two variables are orthogonal, there is no way to decompose the share of the variance in another series that they explain. This is not a critical issue with respect to the firm-level data—where the stock return alone can explain roughly 5 percent of the investment variance compared to an "incremental" explanation of 2 percent. The issue is more important, however, with respect to the time series findings (see table 6). In this case, the R^2 of the stock market alone is 0.33, while that of corporate profits and personal consumption is 0.81. The incremental R^2 of the stock market is only 0.02, but this may be a misleading guide to the stock market's power.

The finding of low total explanatory power for the stock market does not necessarily imply that sentiment-driven shifts in stock prices do not have significant real effects. There could easily be two sources of variation in stock prices—one fundamental, one fad. If managers could distinguish the two, and respond more to one than the other, the reduced-form relation between stock returns and investment could be very weak, even if fad-induced price movements had very large positive, or negative, effects on investment.

Despite these concerns, the empirical results in this paper are striking for the ease with which other specifications reduce the stock market's explanatory role in investment. Knowing only the firm's cash flow and sales, one could predict future investment nearly as well without the stock price as with it. Should one believe the findings? They are consistent with anecdotal evidence on firm behavior during recent years. In January 1988, a Conference Board survey asked top executives if the stock market crash had affected their investment plans. More than three-quarters said no. They are also consistent with "episode analysis" performed by Blanchard, Rhee, and Summers, who report that in 1986 and 1987 the rapid increase in U.S. equity values was not matched by higher levels of investment. The other natural experiment, provided by the 1929 stock market crash, disagrees with the current findings. Investment did not rise in the late 1920s by as much as the market would have predicted, but it declined precipitously in 1930–31, just as the market signals would have suggested.

The final question this paper raises is whether the presence of noise traders or other sources of nonfundamental variation in stock prices affects investment. While the paper's general theme is that such effects

are small, there are other channels which may be important. An example illustrates this. If noise traders raise the general level of required returns in the equity market, these traders will reduce the level of investment in all periods, without regard to particular stock market movements. Exploring these channels is a natural direction for future work.

General Discussion

Several panelists questioned the authors' view that the R^2 of the regression of investment on stock prices was an upper bound to the distortionary impact that noise in stock prices might have on investment. Christopher Sims observed that some shocks, unlike changes in expected future earnings or discount rates, can push stock prices and investment in the opposite direction. Without controlling for such shocks, the R^2 would underestimate the response of investment to noise. Sims gave, as an example, a reduction in the price of capital goods, which would lower stock prices for firms with existing capital stocks but would increase the amount of investment. William Brainard noted that any of the several reasons that have been given for why marginal q, which provides the incentive for investment, may move in the opposite direction from average q, are reasons why the R^2 of these equations could underestimate the potential damage from noise. One frequently cited example is the run-up of energy prices after OPEC, which reduced quasi-rents on existing energy-intensive capital goods, but stimulated investment in new, more efficient capital.

Robert Barro noted that to the extent that changes in investment had a multiplier-type effect on consumption, consumption could appear to explain investment, even if animal spirits were in fact the primary driving force. Benjamin Friedman pointed out that large changes in stock prices are often accompanied by large changes in other variables. For example, after the crash of 1987 interest rates fell and the dollar depreciated; both worked to increase the attractiveness of investment. These phenomena argued for the inclusion of interest rates and other variables in the aggregate equations. Robert Gordon replied that the absence of an investment response to the stock market crash was less surprising when one remembered that at the end of 1987 the market was at the same level as at the end of 1986. The fact that firms did not revise investment down

because of the crash may reflect the fact that they had not revised it up in response to the stock price boom in the first half of 1987.

Some panelists were concerned that the authors had not paid enough attention to the possible intertemporal relationships among the variables and therefore may have underestimated the potential influence of market noise and given too much weight to fundamentals. Sims suggested that a positive signal could lead to an increase in sales contemporaneous with, or even leading, investment. To examine this issue, he suggested running vector autoregressions and looking at the proportion of variance at various horizons explained by stock market innovations.

Lawrence Klein suggested testing for robustness, possibly by comparing estimates for different sample periods. Since the noise component was so large in the cross-sectional estimates, he conjectured that small changes in specification could lead to large changes in coefficient estimates. Gordon pointed out that the 1950s saw two big booms in the stock market with sluggish investment and wondered if the results would be robust to splits of the sample into pre- and post-1952 periods.

References

Abel, Andrew B. 1979. *Investment and the Value of Capital.* New York: Garland Publishing.

Barro, Robert J. 1990. "The Stock Market and Investment." *Review of Financial Studies* 3: 115–32.

Barsky, Robert, and J. Bradford De Long. 1989. "Why Have Stock Prices Fluctuated?" Harvard University (October).

Black, Fischer. 1986. "Noise." *Journal of Finance* 41: 529–43.

Blanchard, Olivier, Changyong Rhee, and Lawrence Summers. 1990. "The Stock Market, Profit and Investment." Working Paper 3370. Cambridge, Mass.: National Bureau of Economic Research (May).

Bosworth, Barry. 1975. "The Stock Market and the Economy." *BPEA, 2:1975,* 257–90.

Brainard, William C., and James Tobin. 1968. "Pitfalls in Financial Model Building." *American Economic Review, Papers and Proceedings* 56: 99–122.

Campbell, John Y., and Albert S. Kyle. 1988. "Smart Money, Noise Trading and Stock Price Behavior." Technical Working Paper 71. Cambridge, Mass.: National Bureau of Economic Research (October).

Cummins, Clint, Bronwyn H. Hall, Elizabeth S. Laderman, and Joy Mundy. 1988. "The R & D Master File Documentation." Technical Working Paper 72. Cambridge, Mass.: National Bureau of Economic Research (December).

De Long, J. Bradford, and Andrei Shleifer. 1990. "The Bubble of 1929: Evidence from Closed-End Funds." Harvard University (May).

De Long, J. Bradford, Andrei Shleifer, Lawrence H. Summers, and Robert J. Waldmann. 1990. "Noise Trader Risk in Financial Markets." *Journal of Political Economy* 98: 703–38.

Fama, Eugene F. 1981. "Stock Returns, Real Activity, Inflation and Money." *American Economic Review* 71: 545–65.

Fama, Eugene F., and Kenneth R. French. 1988. "Permanent and Temporary Components of Stock Prices." *Journal of Political Economy* 96: 246–73.

Fazzari, Steven M., R. Glenn Hubbard, and Bruce C. Petersen. 1988. "Financing Constraints and Corporate Investment." *BPEA, 1:1988,* 141–95.

Figlewski, Stephen. 1979. "Subjective Information and Market Efficiency in a Betting Market." *Journal of Political Economy* 87: 75–88.

Fischer, Stanley, and Robert C. Merton. 1984. "Macroeconomics and Finance: The Role of the Stock Market." *Carnegie-Rochester Conference Series on Public Policy* 21: 57–108.

Gordon, Robert J. 1986. "Introduction: Continuity and Change in Theory, Behavior, and Methodology." In *The American Business Cycle: Continuity and Change,* edited by Robert J. Gordon. Chicago: University of Chicago Press, for NBER.

Hayashi, Fumio. 1982. "Tobin's Marginal q and Average q: A Neoclassical Interpretation." *Econometrica* 50: 213–24.

Lee, Charles, Andrei Shleifer, and Richard Thaler. 1990. "Investor Sentiment and the Closed-End Fund Puzzle." Working Paper 3465. Cambridge, Mass.: National Bureau of Economic Research (October).

Merton, Robert C. 1987. "A Simple Model of Capital Market Equilibrium with Incomplete Information." *Journal of Finance* 42: 483–510.

Meyer, John R., and Edwin Kuh. 1957. *The Investment Decision: An Empirical Study*. Cambridge, Mass.: Harvard University Press.

Poterba, James M., and Lawrence H. Summers. 1988. "Mean Reversion in Stock Prices: Evidence and Implications." *Journal of Financial Economics* 22: 27–59.

Sensenbrenner, Gabriel. 1990. "Aggregate Investment, the Stock Market, and the Q Model: Robust Results for Six OECD Countries." Northwestern University (July).

Seyhun, H. Nejat. 1986. "Insiders' Profits, Costs of Trading, and Market Efficiency." *Journal of Financial Economics* 16: 189–212.

———. 1988. "The Information Content of Aggregate Insider Trading." *Journal of Business* 61: 1–24.

———. 1990. "Overreaction or Fundamentals: Some Lessons from Insiders' Response to the Market Crash of 1987." *Journal of Finance* 45: 1363–78.

Shiller, Robert J. 1981. "Do Stock Prices Move Too Much to Be Justified by Subsequent Changes in Dividends?" *American Economic Review* 71: 421–36.

———. 1984. "Stock Prices and Social Dynamics." *BPEA, 2:1984*, 457–98.

———. 1987. "Investor Behavior in the October 1987 Stock Market Crash: Survey Evidence." Working Paper 2446. Cambridge, Mass.: National Bureau of Economic Research (November).

Shleifer, Andrei, and Vishny, Robert W. 1990. "Equilibrium Short Horizons of Investors and Firms." *American Economic Review, Papers and Proceedings* 80: 148–53.

Stein, Jeremy C. 1988. "Takeover Threats and Managerial Myopia." *Journal of Political Economy* 96: 61–80.

Stock, James H., and Mark W. Watson. 1990. "Business Cycle Properties of Selected U.S. Economic Time Series, 1959–1988." Working Paper 3376. Cambridge, Mass.: National Bureau of Economic Research (June).

Summers, Lawrence H. 1981. "Taxation and Corporate Investment: A q-Theory Approach." *BPEA, 1:1981*, 67–127.

———. 1985. "Requiem for the Investment Equation." Remarks presented at Conference on Impact of Taxation on Business Activity. Ottawa, Canada, November 12–13.

Tobin, James, and Philip M. White. 1981. "Discussion." *BPEA, 1:1981*, 132–39.

Zweig, Martin E. 1973. "An Investor Expectations Stock Price Predictive Model Using Closed-End Fund Premiums." *Journal of Finance* 28: 67–78.