DISCUSSION PAPER SERIES

No. 3826

THE REAL EFFECTS OF INVESTOR SENTIMENT

Christopher Polk and Paola Sapienza

FINANCIAL ECONOMICS

Centre for Economic Policy Research

www.cepr.org

Available online at: www.cepr.org/pubs/dps/DP3826.asp

ISSN 0265-8003

THE REAL EFFECTS OF INVESTOR SENTIMENT

Christopher Polk, Kellogg Graduate School of Management, Northwestern University
Paola Sapienza, Kellogg Graduate School of Management, Northwestern University and CEPR

Discussion Paper No. 3826
March 2003

Centre for Economic Policy Research
90–98 Goswell Rd, London EC1V 7RR, UK
Tel: (44 20) 7878 2900, Fax: (44 20) 7878 2999
Email: cepr@cepr.org, Website: www.cepr.org

CEPR Discussion Paper No. 3826

March 2003

ABSTRACT

The Real Effects of Investor Sentiment*

Does inefficiency of financial markets have real consequences? Or does it only result in transfers of wealth from noise traders to arbitrageurs? We study firm business investment to address this question. In our model, benevolent managers of overvalued companies invest in projects with negative net present value and managers of undervalued companies forego projects with positive net present value. Empirically, we find a positive relation between investment and a number of proxies for mispricing, controlling for investment opportunities and financial slack, suggesting that overpriced (underpriced) firms tend to over invest (under invest). Consistent with the predictions of our model, we find that investment is more sensitive to mispricing for firms with higher R&D intensity (suggesting longer periods of information asymmetry) or share turnover (suggesting that the firms' shareholders are short-term investors). We document similar patterns in the cross-section of average returns. Firms with relatively high (low) investment subsequently have relatively low (high) stock returns, after controlling for investment opportunities and other characteristics linked to return predictability. These patterns are stronger for firms with higher R&D intensity or higher share turnover.

JEL Classification: E22, G31 and G32
Keywords: behavioural finance and investments

Christopher Polk
Kellogg School of Management
Northwestern University
2001 Sheridan Road
Evanston IL 60208
USA
Tel: (1 847) 467 1191
Fax: (1 847) 491 5719
Email: e-polk@northwestern.edu

For further Discussion Papers by this author see:
www.cepr.org/pubs/new-dps/dplist.asp?authorid=158774

Paola Sapienza
Kellogg School of Management
Northwestern University
2001 Sheridan Road
Evanston IL 60208
USA
Tel: (1 847) 491 7436
Fax: (1 847) 491 5719
Email: paola-sapienza@northwestern.edu

For further Discussion Papers by this author see:
www.cepr.org/pubs/new-dps/dplist.asp?authorid=140615

*We thank Randy Cohen, Kent Daniel, Arvind Krishnamurthy, Owen Lamont, Vojislav Maksimovic, Bob McDonald, Mitchell Petersen, Fabio Schiantarelli, Andrei Shleifer, Jeremy Stein, Tuomo Vuolteenaho, Ivo Welch, Luigi Zingales, and participants at Harvard Business School, London Business School, McGill University, the NBER Behavioral Finance Program meeting, the Yale School of Management, the Western Finance Association annual meeting, and the Zell Center Conference on 'Risk Perceptions and Capital Markets.' We acknowledge support from the Investment Analysts Society of Chicago Michael J Borrelli CFA Research Grant Award. The usual caveat applies.

Submitted 19 February 2003

The market efficiency hypothesis states that security prices always fully reflect available information. Over the last decade that paradigm has come under attack. Shleifer (2000), Barberis and Thaler (2001), and Hirshleifer (2001) summarize three related strands of literature. First, theoretical work argues that arbitrage has limited effectiveness. Second, experimental evidence shows that agents hold beliefs that are not completely correct and/or make choices that are normatively questionable. Finally, empirical work documents phenomena where prices almost certainly deviate from fundamental value. Despite this success, behavioral finance has yet to document any significant impact of mispricing on the real economy.

An obvious channel through which mispricing in the stock market can influence the economy is business investment policy. In this paper, we consider how stock market inefficiencies might affect individual firms' investment decisions and document the extent to which it does.

We model the investment decision under asymmetric information of a manager that maximizes shareholders' wealth. We assume that the market evaluates investment in new projects based on the current market value of the company. Under this assumption, managers of overpriced firms, acting in the interest of their shareholders, have an incentive to undertake projects with negative net present value. Similarly, managers of underpriced firms may forego projects with positive net present values. Mis-allocation of investment in the model is more likely to occur when firms have project quality that is more difficult to evaluate and shareholders who are more short-term.

We test the predictions of this model using various mispricing proxies in firm-level regressions of investment on Tobin's Q and cashflow. We rely on three different proxies for mispricing of the stock - discretionary accruals, net equity issuances/repurchases, and price momentum. Several papers provide evidence that these variables are good predictors of subsequent negative returns. Thus, we use these variables to measure the extent to which a stock is "mispriced." However, the literature's justification of why these three variables might be related to mispricing relies on different conjectures on how investors form beliefs and different hypotheses explaining deviations from market efficiency. For this reason, we analyze the impact of each one of these measures separately and then study the overall impact when combined together into a summary "mispricing metric" produced from a firm-level vector autoregression.

Our first proxy, discretionary accruals, attempts to measure the extent to which the firm has abnormal non-cash earnings. Firms with high discretionary accruals have relatively low stock returns in the future (see Teoh, Welch, and Wong (1998a, 1998b), Sloan (1996)) suggesting that they are overpriced. One possible explanation for this relation is that discretionary accruals may measure the extent of earnings manipulation. For example, if investors are not sophisticated enough, a manager facing lower than expected sales could book a high level of accounts receivable today in order to keep stock prices high. Evidence shows that, though investors focus on earnings, they fail to distinguish between the accrual and cash flow components (see Hand (1990) and Maines and Hand (1996)).

Several papers present evidence on stock price drift following seasoned equity issues, repurchases, dividends initiations (see Ikenberry, Lakonishok and Vermaelen (1995), Loughran and Ritter (1997), and Michaely et al. (1995)). This evidence is interpreted as evidence of investors' underreaction to news or events. Recently, Daniel and Titman (2001) construct a measure of net equity issuance that combines firm's equity issuance, repurchase activity, dividends initiation (omission). They show that firms with high net equity issuance in the past five years have subsequent low stock returns in the next year suggesting that they are overpriced. Based on this evidence, we use net equity issuance in the past five years as our second mispricing proxy.

Our third measure exploits the firm and industry momentum documented by Jegadeesh and Titman (1993) and Moskowitz and Grinblatt (1999). According to this research, yearly excess returns at either the firm or industry level exhibit positive serial correlation. Also, Jegadeesh and Titman (1993, 2001) document long-term reversal of momentum profits. A portion of this literature has interpreted momentum as overreaction to private information, implying long-run negative autocorrelation. This interpretation explains the serial correlation of excess returns as a firm's stock price moving away from its fundamental price (overreaction). Consistent with this interpretation, we use lagged momentum as our third proxy for mispricing.

We find a positive relation between all these three proxies of mispricing and firm's investment. Our results are robust to several alternative specifications as well as to corrections for measurement error in our measure for investment opportunities, Tobin's Q. In agreement with the predictions of our model, we also find that firms with higher R&D intensity and share turnover have investment that is more sensitive to all three types of mispricing.

We summarize these results by estimating a firm-level vector autoregression (VAR) which includes our three mispricing proxies as well as estimates of CAPM beta. The VAR's forecasts of future returns and risks produces a mispricing metric. We find that investment moves positively with this measure.

Overall, these results provide evidence that our mispricing proxies and firm investment are positively correlated. But they do not provide direct evidence that overpriced firms take investment projects that have negative net present values. As a consequence, we analyze the relationship between investment and future stock returns. If firms are misallocating resources due to market mis-valuation, abnormal investment should predict risk-adjusted returns. We estimate cross-sectional regressions of future monthly stock returns on current investment, controlling for investment opportunities (Tobin's Q) and financial slack. We find that firms with high (low) investment have low (high) stock returns, after controlling for investment opportunities and other characteristics linked to return predictability.

The paper is organized as follows. The next section reviews the literature. In section II we motivate our empirical work by detailing a simple model of firm investment. We describe the data and report the results in section III. Section IV concludes.

I Previous research

Researchers have long known that stock prices contain information about real investment. A broader question concerns the exact nature of this relation. Perhaps the best known description of that relation is "Q" theory. Brainard and Tobin (1968) and Tobin (1969) propose that a firm will invest until $Q = 1$ where Q is defined as the ratio between the stock-market valuation of existing real capital assets and their current replacement cost. That theory explicitly depends on "the values of existing capital goods, or of titles to them, to diverge from their current reproduction cost." Clearly, that divergence can be due to mispricing.

However, in most of the subsequent theoretical literature, researchers assume that financial markets are efficient. In particular, models by Abel (1980) and Hayashi (1982) focus on marginal adjustment costs that prevent Q from equaling 1. Thus investment should be related to the firm's marginal Q. If asset pricing is rational, the stock market appropriately values the average Q of this out-of-steady-state outcome. As a consequence, a majority of empirical research explains investment with Tobin's Q. To the extent that the relation between Q and investment is weak, most researchers have looked to the twin problems of asymmetric information and agency without abandoning the efficient market hypothesis. See Stein (2001) for a survey of this literature.

However, several researchers have deserted the efficient markets assumption in this context. Abel and Blanchard (1986) argues that stock market inefficiencies might explain the weak performance of Q-theory. If markets are inefficient, deviation from fundamental values is random error that smears information in average Q concerning a firm's marginal investment opportunities. This skepticism concerning the equivalence of price and fundamentals has no real consequences. Abel and Blanchard (1986) presumes that managers ignore this noise and invest optimally. Only the econometrician is inconvenienced.

Some researchers have considered the possibility that inefficient capital markets may actually affect corporate investment policies. One of the early papers examining that possibility is Morck, Shleifer and Vishny (1990). The authors suggest that investor sentiment can exert pressure on managers to avoid under-priced long-term projects. Manager myopia facilitates this pressure as hiring and firing is usually linked to the performance of the stock. Stein (1988) and Shleifer and Vishny (1990) formally model such a short-horizons theory. In these models, market inefficiencies can lead to suboptimal business investment. More recently, Shleifer and Vishny (2001) use similar arguments to explain merger and acquisition activity. Stein (1996) provides a useful framework to consider such short-termism along with the standard problem of asymmetric information. Stein shows that the presence of financing frictions may cause managers that are financially constrained to respond to deviations from fundamental value more so than those that are not constrained. In those situations, market inefficiencies may actually be helpful.

Despite this theoretical promise, there are few empirical results documenting that investment does respond to mispricing. Morck, Shleifer and Vishny (1990) concludes "the market may not be a complete sideshow, but nor is it very central." An exception is Baker, Stein, and Wurgler (2001). They find that stock prices have a stronger impact on the investment of firms that need external equity to finance their investments. Their results provide evidence that undervaluation may deter investments.

II The Model

We present a model in which the firm's investment decisions are affected by market (mis)valuation of the company. We model this decision in order to motivate our empirical analysis and to identify the assumptions necessary for investor sentiment to cause inefficient investment. In the model benevolent managers with private information about the quality of the firm's investment may invest inefficiently on behalf of shareholders. We assume that investment in new projects is evaluated by the market based on the current market value of the company. Under this assumption, the manager of an overpriced firm may invest in projects with negative net present value in equilibrium because the investment decision has a positive impact to firm value in the short run. Similarly, managers of underpriced firms may forego investment projects with positive net present value, because if they otherwise decide to invest the market will undervalue the stock in the short run. Inefficient investment equilibria do not arise from any conflict of interest between owners and managers, but are the optimal investment policy when the stock market evaluates the firm on the basis of expected return on investment.

The model shares many features with the asymmetry-of-information literature (e.g., Myers and Majluf (1984), Lucas and MacDonald (1990)) with two major differences. First, we do not model equity issues in the model; we assume that the firm is able to finance the investment project with internal cash.

The second difference with the previous literature is that we assume that the firm's assets are mispriced and that the mispricing is not simply due to asymmetric information, but more generally to "investor sentiment."

A Setup

There is a continuum of firms. There are three types of agents: managers of firms, old shareholders, and new shareholders (or more simply the market). All agents are risk-neutral. The model has three dates and there is no discounting.

At time t_0, the firm value is the sum of V_0, the "true" value of the firm, and $\alpha * V_0$, where $\alpha \in (-1, +\infty)$ represents the extent to which the firm is mispriced.[1] Note that we do not model explicitly the *sources* of mispricing as we are more interested in studying the *consequences* of market inefficiency on investment decisions. At time t_1, the manager of the firm faces an investment opportunity. Only the manager sees the quality of the project $\theta^i \in \Theta = \{\theta^g, \theta^b\}$ with probability $P = \{P^g, 1 - P^g\}$. The manager can decide to invest or not $a^i \in A = \{I, DI\}$. The market and current shareholders cannot observe θ^i, but can observe a^i.

Assumption 1. V_0 and α are common knowledge.

Assumption 2. The return from a bad project $V_b < 0$ is common knowledge.

Assumption 3. The return from a high-quality project $V_g * (1 + f(\alpha))$ depends in part on temporary misvaluation, but in the long run reverts to its true value $V_g > 0$ when $\alpha = 0$. Project and firm misvaluation are driven by the same sentiment as we assume $f(0) = 0$ and $f'(\alpha) > 0$. However, pessimism ($\alpha < 0$) may cause the good project to have negative perceived value as we allow $f(\alpha) \in (-\infty, +\infty)$.

If the manager decides not to invest the true value of the firm is V_0. If the manager invests in a bad project $I(\theta^b)$ then the true value of the firm is $V_0 + V_b$ where $V_b < 0$. If the manager invests in a good project, $I(\theta^g)$, then the true value of the firm is $V_0 + V_g$, $V_g > 0$.

Assumption 4. At some point in time, $t_1 + m$, all project and firm misvaluation is corrected and all project uncertainty is resolved. Thus, $\alpha = 0$ and the market discovers the quality of the project θ^i. This discovery follows a Poisson process with mean arrival rate $p \in (0, +\infty)$. Therefore, a small p indicates, on average, a long period of information

[1] Stein (1996) and Baker, Stein and Wurgler (1996) also assume that firms may be mispriced.

asymmetry and misvaluation.[2]

B Shareholders' preferences

The utility function of each shareholder j is $U_j = U_j(c^t)$, where c^t denotes consumption at time t.

Assumption 5. Each shareholder j will need liquidity at some point in time, $t + u$, where u is distributed according to a Poisson process with mean arrival rate $q_j \in [0, \infty)$. A small q_j suggests that particular shareholder is a long-term shareholder that intends to sell his stocks many years after the initial investment. However, he does not know exactly when this will happen. A short-term investor has a large q_j.

Assumption 6. After a liquidity shock, the investor j sells his stocks at the market price, consumes, and dies.

Shareholders only care about consumption at the time at which they suffer the liquidity shock. Income comes only from selling the stock at that time and is S^{t_1+u}. The indirect utility function of shareholder j is linear in income. Define shareholder j's expected level of income at time t_1 as

$$Y_j^{t_1} \equiv \int_{u=0}^{\infty} S^{t_1+u} q_j e^{-q_j u} du \tag{1}$$

where $q_j e^{-q_j u}$ is the probability that the shareholder will not suffer from a liquidity shock until time $t_1 + u$, where $u \in [0, \infty)$.

Assumption 7: Managers maximize the wealth of the average existing shareholder. Denote q as the mean arrival rate of the mean shareholder.

C The value of the stock

The value of the stock depends on whether the quality of the project has been revealed or not. Define λ as the investors' belief concerning the probability that the project is a bad-quality project given that the manager invested, $\lambda \equiv Pr(\theta^i = \theta^b \mid a^i = I)$. Once the project type

[2] In principle, we could assume that the source of mispricing disappears and the quality of the project is revealed at different time. Our current specification simplifies the algebra.

is revealed and the mispricing is removed, the market is able to evaluate the change to the initial value of the firm correctly (V_g or V_b if the manager invested in a good or bad project and zero if the manager did not invest). For $t_1 + u$ where $u \geq m$ there is no asymmetric information concerning the quality of the project and all aspects of the firm are correctly valued. Thus, the market valuation of the firm at this point in time is:

$$
\begin{aligned}
S^{t_1+u} &= V_0 \text{ if } a^i = DI \\
S^{t_1+u} &= V_0 + V_b \text{ if } \theta^i = \theta^b \text{ and } a^i = I \\
S^{t_1+u} &= V_0 + V_g \text{ if } \theta^i = \theta^g \text{ and } a^i = I
\end{aligned}
$$

Before the quality of the project is revealed and the firm is still mispriced the market values the firm based on its beliefs concerning the quality of the project and therefore the expected value of the project. Thus, for $t_1 + u$ where $0 \leq u < m$, the market valuation of the firm depends on whether the manager of the firm has invested or not.

$$
\begin{aligned}
S^{t_1+u} &= V_0 * (1+\alpha) \text{ if } a^i = DI \\
S^{t_1+u} &= V_0 * (1+\alpha) + \lambda(V_b) + (1-\lambda)V_g * (1+f(\alpha)) \text{ if } \ a^i = I
\end{aligned}
$$

Define $\gamma \equiv \frac{q(1+\alpha)+p}{q+p}$. Therefore, the representative shareholder's expected income at time t_1, $Y^{t_1}\left(\theta^i, a^i\right)$, may be calculated by substituting for S^{t_1+u} in equation (1):

$$
\begin{aligned}
Y^{t_1}\left(\theta^i, a^i\right) &= \gamma V_0 \text{ if } a^i = DI \\
Y^{t_1}\left(\theta^i, a^i\right) &= \gamma V_0 + \frac{q\left[\lambda(V_b) + (1-\lambda)V_g(1+f(\alpha))\right] + p[V_b]}{q+p} \text{ if } a^i = I \text{ and } \theta^i = \theta^b \\
Y^{t_1}\left(\theta^i, a^i\right) &= \gamma V_0 + \frac{q\left[\lambda(V_b) + (1-\lambda)V_g(1+f(\alpha))\right] + p[V_g]}{q+p} \text{if } a^i = I \text{ and } \theta^i = \theta^g
\end{aligned}
$$

Intuition: Current shareholders' expected level of income is a weighted average of the share price before and after the value of the project becomes public information. The larger

q is (more impatient investors on average), the higher the weight on the informationally-inefficient share price. The larger p is (short-term maturity of the project), the higher the weight on the share price under symmetric information.

D The investment decision

Definition. Define $\delta \equiv Pr(\theta^i = \theta^b \mid a^i = DI)$.

In any period, firms are assumed to follow a pure strategy of investing or not. We define an equilibrium as a system of beliefs $[\delta^*(\theta^b \mid DI), \lambda^*(\theta^b \mid I)]$ and a strategy profile σ^* with support on a set of pure strategies $A = \{I, DI\}$. We will focus on pure strategy equilibria of this game

D.1 Overinvestment equilibrium

Proposition 1: The set of strategy and beliefs $[a^i = I$ if $\theta^i = \theta^g$, $a^i = I$ if $\theta^i = \theta^b, 1 - \lambda = P_g, \delta]$ is a pooling PBE equilibrium for any $\delta \in [0, 1]$ if and only if $P_g > \frac{(q+p)}{q} \frac{-V_b}{(V_g(1+f(\alpha))-V_b)}$.

Proof: see the Appendix.

This result shows that when the firm is overpriced (α is high) and the length of the period of asymmetric information is sufficiently large (small p), the manager invests in the project regardless of its real value. The overvaluation and long period of information asymmetry results in a high perceived value of the firm before the true quality of the project is revealed. For managers with bad projects, the market's tendency to overvalue the project during the expected period of asymmetric information, t_1 until $t_1 + m$, more than compensates for the future "punishment" the market imposes on the firm at time $t_1 + m$ when the firm becomes correctly priced at $V_0 + V_b < V_0$. Firms with poor investment opportunities may pretend as if these investments are positive NPV if the gains from having overpriced equity compensate for the eventual losses from the value-destroying investment.

Notice that misallocation of investment in our model may also occur when $\alpha = 0$ (investors are rational and the stock is correctly priced given all relevant available information). That case is similar to the analysis considered in Myers and Majluf (1984). In their model investment misallocation is due only to adverse selection problems: ex-ante valuation is correct based on all relevant public information. Similarly in our model, managers with private information may invest inefficiently depending upon the length of period of information asymmetry and whether current shareholders are short-term or long-term investors. In contrast, when $\alpha > 0$ overinvestment may also occur because investors overvalue the firm and thus good projects in the same industry.

These two cases have very different empirical implications. If there is no mispricing, overinvestment occurs but is not predictable using public information. If instead the firm is overpriced then public measures of investors' sentiment may predict overinvestment.

D.2 Underinvestment equilibrium

Proposition 2. The set of strategy and beliefs $[a^i = DI$ if $\theta^i = \theta^g$, $a^i = DI$ if $\theta^i = \theta^b, \delta = 1 - P_g, \lambda]$ is a pooling equilibrium in which the manager will never invest regardless on the quality of the project if and only if λ is such that

$$\lambda > \left[1 + \frac{p}{q}\frac{1}{(1+\alpha)}\right] / \left[1 - \frac{V_b}{V_g(1+f(\alpha))}\right]$$

Proof: see the Appendix.

The lower the probability the market attributes to the project being a good one after observing the manager's investment decision, the lower the payoff associated with the decision to invest. So, if the market is pessimistic about the quality of the project (λ is high or α is very negative), the manager will not undertake any investment regardless of the quality of the investment. If the true value of the project is revealed soon enough after the investment decision, the underinvestment outcome will not be an equilibrium. Specifically, the underinvestment outcome will not exist for $p > \frac{V_g}{-V_b}(1 + f(\alpha)) * q$.

D.3 Separating equilibrium

Proposition 3: The separating equilibrium of this game in which the manager invests if the project is good and does not invest if the project is bad $[a^i = I$ if $\theta^i = \theta^g$, $a^i = DI$ if $\theta^i = \theta^b, \delta = 1, \lambda = 0]$ exists if and only if $p > \frac{V_g}{-V_b}(1 + f(\alpha)) * q$.

Proof: see the Appendix.

This result shows that only when the period of asymmetric information and uncertainty about the quality of the project is short relative to the expected investment horizon of the average shareholder do managers have the incentive to invest efficiently.

A few remarks can be made. Note that in the model managers may invest inefficiently even though they do not have to rely on equity to finance the firm's investment. A possible extension of the model that allows for financially constrained firms would only make the misallocation of investment worst. Under the assumptions of our model, if firms would have to issue equity in order to invest, the inefficient allocation of resources would depend not only on the direct effect of mispricing on investment, but also on the indirect effect that mispricing has on the firm's ability to issue equity.[3] Our contribution is to show that the connection between mispricing and investment mis-allocation does not need to go through equity issues.

Finally, note that if the firm is overvalued the manager does not want to issue equity and distribute cash to the shareholders. This strategy is less profitable than taking negative net present value projects because investing results in a high perceived value of the firm. For managers with bad projects, the market's tendency to overvalue the investment project more than compensates for the losses from the value-destroying investment.

III Empirical analysis

Our model predicts that in the presence of overpricing (underpricing) firms may invest too much (too little). It is important to notice that there are two possible sources of mispricing in the model: mispricing may be due to investor sentiments ($\alpha \neq 0$) or alternatively investors are rational and the stock is correctly priced given all relevant available information ($\alpha = 0$), but the firm is mispriced relative to private information (ex-post mispricing). Misallocation in the model may occur in both cases. Empirically, however, we can only estimate whether ex-ante mispricing affects investment decisions. In this section we study this prediction for a large, unbalanced sample of Computstat firms.

[3]See also Stein (1996) and Baker, Stein, and Wurgler (2002). Both papers explicitly model the investment decision of financially constrained firms when the firm is mispriced.

A Data

Most of our data comes from the merged CRSP-COMPUSTAT database, made available to us through Wharton Research Data Services. Our sample includes firms over the period 1963-2000. We ignore firms with negative accounting numbers for book assets, capital, or investment. When explaining investment, we study only December fiscal year-end firms to eliminate the usual problems caused by the use of overlapping observations. We drop firms with sales less than 10 million, and extreme observations (details in Appendix II).

We intersect the initial sample with the Zacks database. That database provides analyst consensus estimates of earnings one, two, and five years out. We use the Spectrum database to calculate the percentage of shares outstanding owned by institutions.

Table 1 reports summary statistics for our sample of firms.

B Methodology

Our model in section I argues that the degree of firm mispricing (α) affects firm investments. Firms that are overpriced (underpriced) have a rational incentive to invest more (less). Throughout the paper, we estimate linear models of firm investment. A very large previous literature has studied the properties of that central firm decision.[4] Our typical specification regresses firm investment on a proxy for mispricing, on a proxy for Tobin's Q, and on firm cash flow, controlling for firm (f_i) and year (γ_t) fixed effects:

$$\frac{I_{i,t}}{K_{i,t-1}} = f_i + \gamma_t + b_1\alpha_{i,t} + b_2 Q_{i,t-1} + b_3\frac{CF_{i,t-1}}{K_{i,t-2}} + \varepsilon_{i,t} \tag{2}$$

The dependent variable is individual firms' investment-capital ratios ($\frac{I_{i,t}}{K_{i,t-1}}$) where investment, $I_{i,t}$, is capital expenditure and capital, $K_{i,t-1}$, is beginning-of-year net property, plant, and equipment. Tobin's Q, $Q_{i,t-1}$ is beginning of period market-to-book. Market value of assets equals the book value of assets plus the market value of common stock less the sum of book value of common stock and balance sheet deferred taxes. $CF_{i,t-1}/K_{i,t-2}$ equals the sum of earnings before extraordinary items and depreciation over beginning-of-year capital.

[4] See Stein (2001) for a recent summary of that literature.

Our analysis critically depends on identifying situations where firms are mispriced (α). The problem with that identification is the classic joint hypothesis problem of Fama (1970). Predictable movements in price may just as well be a result of compensation for risk as a consequence of bias in investors' expectations. The model of market equilibrium is what distinguishes those two possibilities: One researcher's anomaly is another researcher's risk factor.

As a consequence, we identify mispricing in the capital markets using three different measures. These measures operate through different channels: firm opaqueness / information distortion, slow incorporation of information, and overreaction to firm stock performance. The key characteristic that all three measures have in common is that they are linked to cross-sectional patterns in average returns that are not well explained by asset-pricing models.

C Discretionary accruals and investments

Accruals represent the difference between a firm's accounting earnings and its underlying cash flow. For example, large positive accruals indicate that earnings are much higher than the cash flow generated by the firm. Our first proxy relies on the evidence that firms that have atypically high accruals have low subsequent stock returns. Accruals ($ACCR_{i,t}$) are measured by

$$ACCR_{(i,t)} = \Delta NCCA - \Delta CL - DEP$$

where $\Delta NCCA$ is the change in non-cash current assets (given by the change in total current assets (Compustat data item 4) less the change in cash (Compustat item 1). ΔCL is the change in current liabilities (item 5) minus the change in debt included in current liabilities (item 34) and minus the change in income taxes payable (item 71). DEP is depreciation and amortization (item 14). See Sloan (1996) for more discussion of earning accruals.

The differences between earnings and cash flow arise because of accounting conventions as to when, and how much, revenues and costs are recognized. Within those conventions, managers have discretion over accruals adjustments and may use them in order to manage earnings.[5] In principle, if investors can detect earnings manipulation, higher accruals should not affect the stock price. However, a large body of evidence shows that though investors focus on earnings, they fail to distinguish between the accrual and cash flow components (see Hand (1990) and Maines and Hand (1996)).

In order to distinguish earning-manipulation from the non-discretionary component of accruals, the literature has focused on discretionary accruals, defined as those accruals which are abnormal given firm characteristics, relative to the past tendencies of the firm, and/or compared with other firms in the same industry. Several papers show a strong correlation between discretionary accruals and subsequent stock returns, suggesting that firms with high discretionary accruals are overpriced firms relative to otherwise similar firms.

For example, Sloan (1996) finds that those firms with relatively high (low) levels of abnormal accruals experience negative (positive) future abnormal stock returns concentrated around future earning announcements. Teoh, Welch, and Wong (1998a, 1998b) find that firms issuing secondary equity and IPO firms who have the highest discretionary accruals have the lowest abnormal returns. More recently, Chan, Chan, Jegadeesh, and Lakonishok (2001) also investigates the relation between discretionary accruals and stock returns. Confirming previous results, they find that firms with high (low) discretionary accruals do poorly (well) over the subsequent year. Most of the abnormal performance is concentrated in the firms with very high discretionary accruals.

We use this past evidence on the correlation between discretionary accruals and stock returns to justify the use of discretionary accruals as our first mispricing proxy. We construct discretionary accruals following Chan, Chan, Jegadeesh, Lakonishok (2001) Accruals are scaled by total assets:

$$\begin{aligned} DACCR_{i,t} &= ACCR_{i,t} - NORMALACCR_{i,t} \\ NORMALACCR_{i,t} &= \left(\frac{\sum_{k=1}^{5} ACCR_{i,t-k}}{\sum_{k=1}^{5} SALES_{i,t-k}} \right) SALES_{i,t} \end{aligned}$$

[5] For example, manager can modify accruals by delaying recognition of expenses after cash is advanced to suppliers, by advancing recognition of revenues with credit sales, by decelerating depreciation, or by assuming a low provision for bad debt.

where $NORMALACCR_{i,t}$ is modeled as a constant proportion of firm sales. In other words, to capture the discretionary component of accruals we assume that the necessary accruals adjustments are firm specific. For example, asset-intensive firms typically have relatively high depreciation. Our main justification for using this model of discretionary accruals is merely that Chan, Chan, Jegadeesh, Lakonishok (2001) find a negative correlation between discretionary accruals and subsequent stock performance using this simple approach.[6]

We estimate the basic regression:

$$\frac{I_{i,t}}{K_{i,t-1}} = f_i + \gamma_t + b_1 DACCR_{i,t} + b_2 Q_{i,t-1} + b_3 \frac{CF_{i,t-1}}{K_{i,t-2}} + \varepsilon_{i,t} \qquad (3)$$

Column (1) of Table 2 displays the results of regression (3). Controlling for investment opportunities and financial slack, firms with high discretionary accruals invest more. The coefficient of investment on discretionary accruals measures 0.2010 with an associated t-statistic of 6.17. Firms with abnormally soft earnings invest more than the standard model would indicate. This effect is economically important. A typical (one-standard deviation) change in a typical firm's level of discretionary accruals is associated with roughly a two percent change in that firm's investment as a percentage of capital. Recall that Abel and Blanchard (1986) suggests that mispricing may smear the information in Q concerning investment opportunities. This possibility actually works against us finding any independent effect of discretionary accruals. If Q is correlated with mispricing, the coefficient of discretionary accruals underestimates the effect of mispricing on investment.

There are several potential problems in our baseline regression that might undermine the interpretation of the results. The most obvious arises from the fact that the disappointing performance of our measure of Q, even if consistent with the results in the rest of the literature, suggests that this measure may be a poor proxy for true marginal Q.[7]

[6] We have also estimated the discretionary component of accruals using the cross-sectional adaptation developed in Teoh, Welch, and Wong (1998a, 1998b) of the modified Jones (1991) model. Specifically, we estimated expected current accruals for each firm in a given year from a cross-sectional regression in that year of current accruals on the change in sales using an estimation sample of all two-digit SIC code peers. All our results are substantially the same when we use this alternative measure.

[7] Several papers have address this issue and found different results. For example, Abel and Blanchard

The existence of measurement error in Tobin's Q is a problem in our analysis if our mispricing variable is a good indicator of unobserved investment opportunities. For example, one may argue that firms with high discretionary accruals may have very profitable growth options that their average Q only partially reflects. These firms should invest more. Empirically, the existing evidence suggests the opposite: firms with soft earnings are firms with poor growth opportunities. Teoh, Welch, and Wong (1998b) document that firms with high discretionary accruals tend to be seasoned equity issuers with relatively low post-issue net income. Chan, Chan, Jegadeesh, and Lakonishok (2001) show that in general firms with high discretionary accruals are at a turning point in their fortunes. Firms with high discretionary accruals subsequently have a marked deterioration in their cash flows. Based on these findings, we think that it is hard to argue that the average Q for this type of firm systematically understates marginal Q.

Even if one cannot think of any plausible reason why abnormal non-cash earnings should be correlated with investment opportunities, we feel it is important to attempt to clean up Tobin's Q in our regression in order to account for possible measurement errors. We take several different approaches. First, we include in our baseline regression analysts' consensus estimate of future earnings. As long as analysts' forecasts are a good proxy for expected future profitability, this variable should be a good proxy for marginal Q: controlling for average Q, higher marginal Q should be positively correlated with higher expected future profitability. This correction is along the lines of the previous literature that has focused on obtaining better measures of Q. Columns (2) through (4) add the ratio of consensus analyst

(1986) construct aggregate marginal Q and find little support for the view that the low explanatory power of average Q is because it is a poor proxy for marginal Q. Similarly, Gilchrist and Himmelberg (1995) exploit Abel and Blanchard's technique at the level of the individual firm. Though their marginal Q series seems to perform better than Tobin's Q, their qualitative results are not very different from the previous literature. Of course their results critically depend on the quality of the alternative measure used. In a recent paper, Erickson and Whited (2000) point out that this alternative measure may also be flawed by similar errors-in-variables problems and suggest an alternative solution. Erickson and Whited use a measurement error-consistent generalized method of moments estimator that relies on information in higher moments of Q. With this estimator, they find that the accepted results in the previous literature (low explanatory power of Tobin's Q and high explanatory power of cash flow) disappear.

forecast of cumulative firm profitability over assets one, two, and five years out to our baseline specification. The one-year earnings forecast has a positive effect on investment decision. The effect is small, but statistically significant at the five percent level. A one-standard deviation change in one-year earning forecast is associated with roughly a .5 percent change in that firm's investment to capital ratio. This suggests that this non-financial measure of future profitability has some information, even when we control for Tobin's Q, as suggested by previous findings (Bond and Cummins, 2000). However, the coefficient on discretionary accruals actually increases from .2010 to .2329. Moreover, the estimate is measured with the same precision, even though the sample is cut almost in half due to data limitations.

Column (4) of Table 2 adds both one- and two-year profitability estimates to our baseline regression. Discretionary accruals continues to be quite significant. The final specification in Table 2 adds one-, two-, and five-year profitability forecasts. Interestingly, all three forecasts are significant at the five percent level or better.[8] The abnormally-soft earnings variable remains economically and statistically significant.

We also follow Abel and Eberly (2001) and use the mean long-term consensus earning forecast as an instrument for Q. That variable will be a useful instrument as long as it is not correlated with the measurement error in Tobin's Q. We report the results in Column (5). The magnitude and statistical significance of the discretionary accruals coefficient is similar to our previous results when we use instrumental variables estimation.[9]

The second way to deal with the measurement error problem is to follow the approach of Erickson and Whited (2000, 2002). Those papers exploit the information contained in higher moments to generate measurement-error consistent GMM estimators of the relation between investment and Q.[10] As in Erickson and Whited (2000), we find that using this

[8]One might be initially surprised by the negative coefficient on $E_{t-1}[EARN_{i,t+1}]/A_{i,t-1}$. However since earnings estimates are for cumulative earnings from $t-1$ to t, the negative coefficient indicates that consensus one-year earnings two years from now has a relatively smaller impact on investment than consensus one-year earnings one-year from now. In that light, the result seems reasonable.

[9]The increase in the coefficient of Tobin's Q is not as big as in Abel and Eberly (2001) due to the sample restrictions. When we estimate the same regression on a larger sample we find similar substantial improvement in the coefficient on Q.

[10]As in Erickson and Whited (2000) we only use the estimator in those cross-sections that satisfy the

estimator increases the coefficient on Q by an order of magnitude.[11] However, the coefficient on discretionary accruals remains economically and statistically significant. Those results are available on request.

Another potential problem with our baseline regression is that we measure average Q at the beginning of the year in which we measure the firm's investment. It may be the case that over the year the firm's investment opportunities change and as a consequence our discretionary accruals measure is picking up this change in investment opportunities.

Therefore, in column (6) of Table 2, we add to the baseline specification, end-of-period $Q_{i,t}$. Controlling for the change in Q over the investment period has no effect on our result. Investment opportunities as measured by end-of-period Tobin's Q are not statistically significant and the estimated coefficient is 1/20 less than that on $Q_{i,t-1}$ in the baseline regression. Moreover, the estimated coefficient on discretionary accruals and the statistical significance of that estimate do not change.

Our controls for investment opportunities may be inadequate if there is a lag between when a firm has investment opportunities and when the actual investment is measured. These lags may be for such superficial reasons as accounting practices or due to more fundamental sorts of frictions. The next two specifications include lags of Q in response. In column (7), we add Q_{t-2} to the specification in column (6). Though lagged investment opportunities explain firm investment, discretionary accruals still have a positive and significant effect on firm investment. Column (8) adds Q_{t-3} to our specification. This variable is not significant and our results do not change. We conclude that the timing of our Tobin's Q variable is not an issue.

Another objection to our results is that if discretionary accruals are correlated with lagged financial slackness, then our variable may picking up the fact that financially constrained firms have less financial slack to invest. Of course, firms with high discretionary accruals are those firms where earnings are not backed by cash flow. One would expect those firms to have little financial slack. However, to take care of this concern we augment our baseline regression with contemporaneous, two-years lag and three-years lag of our cash flow variable,

identifying assumptions concerning the information in higher moments.

[11] We thank Toni Whited for providing the Gauss code implementing their estimator.

$CF_{i,t-1}/K_{i,t-2}$ as well as with measures of the cash stock. The results (unreported) are robust to this modification. One possible reason for firms to manipulate earnings is in order to meet bond covenants; our results are also robust to including leverage as an additional explanatory variable.

There might be some concern that the relation between discretionary accruals and investment is hardwired. For example, firms with multi-year investment projects may pay for investment in advance. When doing so, firms will book future investment as a pre-paid expense, a current asset. As a consequence, current investment and discretionary accruals (the prepaid expense) will exhibit a positive correlation. Though we did not find that such a tactic is prevalent, we re-estimated regression (3) using only accounts receivable in the definition of discretionary accruals. In that regression (not reported) the coefficient and t-statistic associated with discretionary accruals was thirty percent higher. We conclude that this hardwired link is not driving our result.[12]

Previous literature provides additional tests of our hypothesis based on sub-sample and cross-sectional evidence. We explore these implications in Table 3. Chan, Chan, Jegadeesh, and Lakonishok (2001) as well as D'Avolio, Gildor, and Shleifer (2001) point out that the ability of discretionary accruals to predict negative stock returns is concentrated in the top 20% of firms ranked on accruals. In column (1) of Table 3, we add a dummy, $HIGHDACCR_{i,t}$, to our baseline discretionary accruals specification. The dummy takes the value of one if the firm is in the top 20% of firms based on discretionary accruals and zero otherwise. This dummy is significant at the one percent level of significance. Since we expect much of the relation to be between positive accruals and investment, it is comforting to find that the coefficient on discretionary accruals is reduced by 20 percent.

Teoh, Welch, and Wong (1998) show that firms issuing equity who have the highest

[12] As mentioned before we also used an alternative measure of discretionary accruals where the discretionary component is estimated using as benchmark all other firms in the same two-digit SIC code during the same year (Teoh, Welch, and Wong (1998a,1998b)). Since this alternative method of benchmarking accruals produces qualitatively similar results, we feel more confident that hardwired links, which presumably would be due to industry-wide practices, do not spuriously generate the relation between investment and discretionary accruals that we document.

discretionary earnings have the lowest abnormal returns. In column (2) of Table 3, we interact our discretionary accruals variable with a dummy, $HIGHEQISSUE_{i,t}$, that takes the value one if the firm has an equity issuance value in the top 25 percent. We find that the variable is statistically significant with an associated t-statistic of 2.36. We explore the relation between equity issuance/repurchase activity and investment more fully in the next section.

D'Avolio, Gildor, and Shleifer (2001) argue that in recent years the marginal investor may have become less sophisticated providing more incentives to distort earnings. In particular, they show that the mean discretionary accruals for the top decile has been increasing over the past twenty years, more than doubling since 1974. Mean discretionary earnings for the top decile was close to 30% in 1999. As a consequence, we re-estimate our baseline specification for the firm-years in the subperiod 1995-2000 in column (3) of Table 3. Consistent with the D'Avolio, Gildor, and Shleifer (2001) hypothesis, the estimated coefficient on discretionary accruals is roughly a third bigger, moving from 0.2010 to 0.2886. Though we are left with only a quarter of the number of observations, the estimate is statistically significant at the one percent level of significance. In column (4), we restrict the sample further, to only those firm-years in the subperiod 1998-2000. Consistent with the hypothesis that manipulating earnings has become more effective, we find that the coefficient on discretionary accruals is now 0.3240, 50 percent larger than in our baseline regression.

If the D'Avolio, Gildor, and Shleifer (2001) hypothesis is correct, one would more expect to see earnings manipulation in firms with less institutional investors. We find that this is the case as those firms in the top quartile in terms of institutional ownership have average discretionary earnings of -0.0068 while those firms in the lower quartile of institutional ownership have average discretionary earnings of -0.0006. A test of difference in means shows that this difference is statistically significant at the one percent level of significance.

Finally, in the last four columns of Table 3 we split the sample in accordance with the cross-sectional implications of our model. In particular, our model suggests that the greater the degree of informational asymmetry, the greater the incentive to overinvest (underinvest) when overpriced (underpriced). We use firm R&D intensity to proxy for firm transparency.

Column (5) re-estimates our baseline regression for those firms below the median value of R&D intensity. Note that we calculate medians yearly in order to isolate pure cross-sectional differences across firms. Column (6) shows the results for the sub-sample of firms with R&D intensity above the median. Consistent with our model, we find economically important variation across the two sub-samples. Firms that engage in a lot of R&D invest more when they have a lot of discretionary accruals. The sensitivity of these firms' investment to discretionary accruals, .3361, is over twice as large as the sensitivity of firms that we argue are relatively more transparent.

Our model also suggests that the incentive to overinvest or underinvest is stronger for those firms with short-term investors. We use firm share turnover to proxy for the relative amount of short-term investors trading a firm's stock. We measure turnover as the average, in December_{t-1}, of the daily ratio of shares traded to shares outstanding at the end of the day. Column (7) re-estimates our baseline regression for those firms each year with turnover below the yearly median, while column (8) reports the regression results for above-the-median firms. We find that the coefficient on discretionary accruals for high-turnover firms is .2093, over twice as large as the corresponding coefficient for firms with low turnover. This difference is statistically significant.

D Events signaling firm quality and investment

Several papers present evidence on stock price drift following seasoned equity issues, repurchases, dividends initiations (see Ikenberry, Lakonishok and Vermaelen (1995), Loughran and Ritter (1997), and Michaely et al. (1995)). This evidence is interpreted as evidence indicating that investors react slowly to the information revealed. Daniel and Titman (2001) construct a measure of net equity issuance that combines firm's equity issuance, repurchase activity, dividends initiation (omission). They show that firms with high net equity issuance in the past five years have subsequent low stock returns in the next year suggesting that they are overpriced.

Based on this evidence, we use net equity issuance in the past five years as our second mispricing proxy. This variable is positively correlated with discretionary accruals (0.1180) and the correlation is economically significant. The correlation confirms the results of the previous literature that firms that issue equity are more likely to have higher discretionary accruals (Teoh, et al.). However, the correlation is low enough that it is plausible to think of these two variables as two alternative ways of measuring mispricing. We analyze them separately here, and combine them later on.

Following Daniel and Titman (2001), we construct a measure of a firm's equity issuance / repurchase activity, $EQISSUE_{i,t}$, over a five-year period.[13] They construct their measure to also capture the evidence in Michaely, Thaler, and Womack (1995) showing that abnormal returns are high (low) for five years subsequent to dividend initiations (omissions). We define $EQISSUE_{i,t}$ as the log of the inverse of the percentage ownership in the firm one would have at time t, given a one percent ownership of the firm at time $t-5$, assuming full reinvestment of all cash flows,

$$EQISSUE_{i,t} = \log(\frac{ME_{i,t}}{ME_{i,t-5}}) - r_{i,t-5:t},$$

where $N_{i,t}$ is the number of shares outstanding at time t, $ME_{i,t}$ is the market value of equity at time t, and $r_{i,t-5:t}$ is the log stock return from $t-5$ to t. Therefore our measure includes equity issues, employee stock options plans, share repurchase, dividends, and other actions that pay cash out of the firm, or trade ownership for cash or services (e.g., stock options plans).

Our specification is the following:

$$\frac{I_{i,t}}{K_{i,t-1}} = f_i + \gamma_t + b_1 EQISSUE_{i,t} + b_2 Q_{i,t-1} + b_3 \frac{CF_{i,t-1}}{K_{i,t-2}} + \varepsilon_{i,t} \tag{4}$$

Column (1) of Table 4 displays the results of regression (4). Controlling for investment opportunities and financial slack, firms that are net equity issuers over the past five years invest more. The coefficient of investment on the equity issuance activity measure, b_1, measures 0.0259 and is statistically significant at the one percent level of significance. The

[13]We also measured the same variable over a one-year period and produced similar results. Note that set our $EQISSUE_{i,t}$ variable equal in absolute magnitude to Daniel and Titman (2002)'s n' variable but opposite in sign in order to facilitate interpretation. Thus firms issuing equity have a positive $EQISSUE$.

economic importance of the effect seems on the order of magnitude as before. A typical (one-standard deviation) change in a firm's equity issuance indicator is associated with roughly a two percent change in that firm's investment as a percentage of capital.

Unlike the discretionary accruals measure, where it is hard to think of alternative stories generating a link with investment, one expects issuance activity to be tied to investment. Of course, our regressions acknowledge the direct link by controlling for investment opportunities and financial slack. However, these controls are now crucial. Specifically, it very important to rule out that $EQISSUE_{i,t}$ is correlated with Q's measurement error. Thus, the remaining columns in Table 4 repeat the robustness checks we did with our previous variable.

In columns (2) through (4) of Table 4, we add analysts' expectations of future profitability. Recall that these variables are designed to pick up variation in future investment opportunities not picked up by Tobin's Q. Consistent with our expectations that $EQISSUE_{i,t}$ may proxy for unobserved investment opportunity, the coefficient on $EQISSUE_{i,t}$ becomes smaller when we include analysts' consensus earning forecasts. However, we still find that controlling for investment opportunities, firms that are expected to underperform (overperform) benchmarks have investment that is too high (low).

In column (5) we instrument Q with the mean long-term consensus earning forecast. The magnitude and statistical significance of the $EQISSUE_{i,t}$ coefficient is similar to our previous results when we use instrumental variables estimation. Finally, our results are robust to using the Erickson and Whited (2000, 2002) measurement-error consistent estimator.

In columns (6) through (8) we control for future and past values of Q. Q_t and Q_{t-2} are statistically significant, though with the wrong sign. However, the coefficient on our equity issuance indicator is essentially unchanged. The effect remains economically and statistically significant.

Table 5 reports the results from sub-sample analysis. Column (1) of Table 5 restricts the sample to those firm-years in the subperiod 1995-2000 while column (2) restricts the sample to those firm-years in 1998-2000. We find that the effect is still strong in the longer subperiod. In the shorter subperiod, the effect disappears. As before, we split the sample in accordance with the cross-sectional implications of our model. Column (3) re-estimates our baseline regression for those firms below the median value of R&D intensity while column (4) re-estimates the regression for firms above the median value of R&D intensity. Firms with less R&D activity have a weaker relation between equity issuance and equity issuance activity. Firms involved in more R&D activity have a stronger relation between investment and equity issuance activity. In columns (5) and (6), we split the sample based on share turnover. Consistent with our model, firms with a relatively high amount of share turnover have a coefficient on equity issuance activity, .0493, that is twice as large as firms with a relatively low amount of share turnover.

E Price momentum and investment

Our next measure exploits the firm and industry momentum phenomenon documented by Jegadeesh and Titman (1993) and Moskowitz and Grinblatt (1999). Yearly excess returns at either the firm or industry level exhibit positive serial correlation. Also, Jegadeesh and Titman (1993, 2001) document long-term reversal of momentum profits. For example, Jegadeesh and Titman (2001) find that *cumulative* profits reach 12.17 percent after one year and then steadily decline to -0.44 percent after five years. Similar patterns exist in industry returns.

Several conflicting theories have been offered to explain momentum and reversal. According to Daniel, Hirshleifer and Subrahmanyan (1998), investor overconfidence results in overreaction to private information, implying long-run negative autocorrelation. Barberis Shleifer and Vishny (1998) assume that investors are subject to a conservatism bias and representativeness heuristic. Thus in their model investors underreact to earnings, causing short-lag positive autocorrelations. However, when investors observe trends of rising earnings, representativeness causes them to switch to overreaction, resulting in long-lag negative autocorrelation. In Hong and Stein (1999), there are two types of investors: investors who focus only on fundamentals and ignore the market price and investors who focus only on market price and follow price trends. The first group causes underreaction, the second group induces overreaction.

These three different theories agree that momentum is a mispricing phenomenon, but disagree on whether serial correlation of excess returns is consistent with stock prices slowly moving towards their fundamental price (underreaction) or stock prices moving away from their fundamental price (overreaction). The evidence is mixed as to which explanation best describes the data. For this reason, this measure is the weakest of our three. The interpretation of our result depends on which description is appropriate. Nonetheless, we think it is interesting to investigate the relationship between momentum and investment decisions. That is because this measure is tied more directly than the previous two measures to investor sentiment uncorrelated with managerial decisions. In fact, the correlation between this measure and the previous two is positive, but not very high (14 percent with $DACCR$ and 21 percent with $EQUISSUE$).

We use lagged firm and industry momentum as our final indicator of firm mispricing. Firm lagged momentum ($MOM_{i,t-1}$) is the cross-sectionally demeaned (using the universe of all CRSP stocks) stock return over the period January$_{t-1}$ to November$_{t-1}$. Industry lagged momentum ($IMOM_{t-1}$) is the cross-sectionally demeaned (using the universe of all CRSP stocks) industry return over the period January$_{t-1}$ to November$_{t-1}$.

We lag momentum for two reasons. The first is so that our Q variable will incorporate any news concerning future returns and/or cash flows contained in the price run-up. More importantly, we interpret momentum as a characteristic predicting future mispricing. Firms that are winners and losers are the firms that investors typically overreact to. Momentum firms have negative stock returns in the years following the initial year of positive stock return performance. This is in contrast to our other mispricing measures. We identify firms with extreme $DACCR_{i,t}$ and $EQISSUE_{i,t}$ as the firms which are typically currently mispriced.

Our specification is:

$$\frac{I_{i,t}}{K_{i,t-1}} = f_i + \gamma_t + b_1 MOM_{i,t-1} + b_2 IMOM_{i,t-1} + b_3 Q_{i,t-1} + b_4 \frac{CF_{i,t-1}}{K_{i,t-2}} + \varepsilon_{i,t} \qquad (5)$$

Column (1) of Table 6 displays the results of regression (5). Controlling for investment opportunities and financial slack, firms experiencing price momentum invest more. The coefficient of investment on firm momentum, b_1, measures 0.0516 with an associated t-statistic of 7.3. A similar response occurs for the industry momentum variable. The coefficient of investment on industry momentum, b_2, is 0.0468. Thus, firms in price momentum industries invest more than the standard model would indicate. This coefficient is statistically significant; the associated t-statistic is 3.9.

A typical (one-standard deviation) change in a firm's price momentum is associated with roughly a three percent change in that firm's investment as a percentage of capital.[14] One percent movements in investment ratios are associated with typical moves in a firm's industry momentum.

These results are consistent with at least two alternative explanations. First, if momentum firms are overpriced firms as in Daniel, Hirshleifer and Subrahmanyan (1998) our result is consistent with the story that overpriced firms invest more than otherwise identical firms. Alternatively, if momentum is evidence of underreaction (e.g., Hong, Lim, and Stein, 2000), our result may suggest that firms (at least those that are not cash constrained) invest optimally, ignoring the market's underreaction. Unfortunately, it is hard to distinguish between these two cases.

Furthermore, there is more concern than with our previous variables that momentum is correlated with our benchmark variables. First, price momentum may just reflect information concerning the firm's profitability and/or degree of financial constraints not contained in Q or $\frac{CF}{K}$. One could argue that sensitivity of investment to stock returns may indicate financial constraints being binding. More simply, firms with high stock returns may have very profitable growth options that their average Q only partially reflects. These firms should invest more.

For example, it is possible that the market has information about the firm that the manager does not have. Dow and Gorton (1997) model the investment decisions of rational managers under this hypothesis. In equilibrium stock prices convey information to managers

[14]These results relate to those of Morck, Shleifer, and Vishny (1990). That paper predicts three-year investment growth using lagged CAPM alphas over a three-year period. These alphas do a good job predicting investment alone. However, in a horse race with future fundamentals, CAPM alphas have little additional explanatory power. High alphas are related to high stock returns, our variable. However, we compare momentum to the level of stock market valuation, Q. Thus the variable we pit against momentum contains expectations of all future firm profitability. Morck, Shleifer, and Vishny's control variables are purely accounting ones and therefore are realizations of these expectations, and then only one year out.

that they use to allocate investment capital optimally. In their model rising stock prices cause higher investment and the resulting investment allocation is efficient. So far, we are not able to separate our model from this particular alternative interpretation. We address this possibility later in the paper.

Our response to these alternative interpretations is to point out that we find an effect not only at the firm level but also at the industry level. It seems harder to argue that entire industries are financially constrained or have systematic differences between average and marginal Q.

The rest of Table 6 estimates regressions with our traditional alternative specifications and control variables. In columns (2), (3), and (4) we add the consensus analyst's estimates of future earnings. Both momentum variables remain economically and statistically significant.[15] In column (5) when we instrument Q with analyst's long-term estimates of future earnings we instead find that the momentum coefficient increases by roughly 40 percent and the industry momentum coefficient increases by 100 percent.[16] Also, columns (6), (7), and (8) show that the timing of when we measure Q does not matter for our results. Finally, our results are robust to using the Erickson and Whited (2000, 2002) measurement-error consistent estimator as well.

In Table 7 we explore some of the cross-sectional findings in the literature concerning momentum. Various studies have shown that momentum is stronger for losers than for winners. Column (1) repeats the regression for firms experiencing negative momentum while column (3) estimates the relation among winner firms. Recall that the coefficient on firm momentum was 0.0282 in our baseline specification. The estimate for firms with negative momentum is twice as large, 0.0564, while the estimate for winning firms is 0.0188. Both estimates are significant at the one percent level of significance.

In an attempt to distinguish between the overreaction and the underreaction hypothesis

[15]The fact that in the final specification, which includes forecasts one, two, and five years out, the coefficient on firm momentum is over fifty percent higher than the baseline is mostly due to sample selection requirements due to using the five-year forecast.

[16]In this sample we find, consistent with Abel and Eberly (2001), that the coefficient of Q becomes one order magnitude bigger, but the cash-flow coefficient does not change significantly.

we rely on the finding of Lee and Swaminathan (2000). They find that overreaction patterns are more pronounced for losers with low turnover and for winners with high turnover. In columns (2) and (4) we interact firm momentum and turnover for loser firms and winner firms respectively. In column (2), the coefficient on the interaction term is negative and statistically significant at the ten percent level of significance. This is consistent with the results of Lee and Swaminathan (2000). In column (4) the coefficient on the interaction term is 0.0034 with an associated t-statistic of 1.55. Though not statistically significant, the result is in line with Lee and Swaminathan's result that winners overreact more when turnover is high.

Column (5) of Table 7 reports our baseline momentum specification with our sample restricted to only Internet firms. We define Internet stocks as all the firms that were included in the ISDEX Internet Stock Index. We identified 107 firms that belonged to the Index, thus we have only 121 firm-years observations. Our coefficient is an order of magnitude higher for these firms. This estimate is statistically significant at the one percent level. This result is very strong despite the limited number of observations. We think that this result is quite reassuring, since at least for this sample of firms it is hard to claim that momentum is evidence of underreaction. And it is difficult to interpret this subsample evidence as consistent with the Dow and Gorton (1997) model. Recall that their model argues that market returns are a signal from informed investors to managers to allocate investment efficiently. Most researchers would agree that much of the return volatility of Internet stocks was due to uninformative noise trading.

Column (6) of Table 7 restricts the sample to those firm-years in the subperiod 1995-2000 while column (7) restricts the sample to those firm-years in 1998-2000. We find that the effect is stronger in these two subperiods. As before, we split the sample in accordance with cross-sectional implications of our model. Column (8) re-estimates our baseline regression for those firms below the median value of R&D intensity while column (9) re-estimates the regression for firms above the median value of R&D intensity. The results are consistent with our model's conclusions. The momentum effect on investment is stronger for firms that engage in a lot of R&D. The coefficients on firm and industry momentum are more than twice as large for those firms that we argue are relatively opaque. Columns (10) and (11) report the sample split based on firm turnover. This split is not as successful as there is little or no difference in the coefficients on momentum for the two types of firms.

F Combining all three measures into a mispricing metric

Our final measure uses the three variables in a firm-level vector autoregression (VAR) in order to create a mispricing metric. This metric has the advantage that the information in the three variables used in previous sections is used simultaneously. More importantly, the ability of each of our measures to predict stock returns is measured at the price level. This is important as even if all variables predict one-period returns with the same magnitude, those variables which are more persistent have a larger price-level impact. Finally, the VAR lets us control for risks so that mispricing is explicitly dependent on a model of market equilibrium.

Specifically, let $z_{i,t}$ be a vector of firm-specific state variables describing a firm i at time t. The first element of the vector is the firm's market-adjusted annual stock return, $r_{i,t}$. The second element of the vector is the yearly measure of the firm's systematic risk according to the CAPM, $\beta_{i,t}$, while other firm characteristics that predict future risks and returns make up the rest of the elements in $z_{i,t}$. An individual firm's state vector is assumed to follow a linear law:

$$z_{i,t} = \Gamma z_{i,t-1} + u_{i,t}$$

The linear nature of the VAR easily generates forecasts of the state, $E_t[z_{i,t+j}] = \Gamma^j z_{i,t}$. Define $e1' \equiv [1\ 0\ ...\ 0]$ and $e2' \equiv [0\ 1\ ...\ 0]$. At a particular point in time, we take the VAR's forecasts for J future cross-sections of returns, $e1'\Gamma^j z_{i,t}$, and risks, $e2'\Gamma^j z_{i,t}$, and run a cross-sectional regression of forecasted returns on forecasted risks, period by period.

$$e1'\Gamma^j z_{i,t} = a + be2'\Gamma^j z_{i,t} + e_{i,t+j}$$

We then compound the residuals from the J cross-sectional regressions into a mispricing metric, $MISPRICING_{i,t} = \prod_{j=1}^{J} (1 + e_{i,t+j})$. In theory, for each year of the sample we should predict returns and risk into the infinite future; in practice, any impact to $MISPRICING_{i,t}$ is negligible after 15 years.

In estimating the VAR coefficient matrix, we follow Vuolteenaho (2002) and use weighted least squares, deflating the annual data for each firm by the number of firms in the corresponding cross-section. We calculate standard error estimates correcting for clustering of the residual at the year level.

We consider the following parsimonious specification of the VAR. The vector contains the stock return, $r_{i,t}$; the market return beta measured over the previous 12 months, $\beta_{i,t}^{short}$; the market return beta, $\beta_{i,t}^{long}$, measured using at least 36 and as many as 60 of the previous months; log book-to-market equity, $BE/ME_{i,t}$; as well as our previous measures $DACCR_{i,t}$ and $EQISSUE_{i,t}$. All variables are market-adjusted, i.e. cross-sectionally demeaned. The appendix describes how we calculate book-to-market equity. Note that we use forecasts of future 12-month return betas as our measure of risk so that return forecasts exactly correspond to risk forecasts. However we also include a more precise three to five year estimate of beta to help us forecast that risk. Finally, we include four lags of the stock return in the vector, $z_{i,t}$, in order to measure the long term effect of our third variable, lagged momentum, on stock returns.[17]

Table 8 reports the result of the VAR. We find that point estimates of the coefficients on the lagged stock return, log book-to-market equity, and discretionary accruals are economically large and have the same sign as previous research. Due to the severe data restrictions required in order to measure discretionary accruals, only the coefficient on discretionary accruals is statistically significant at conventional levels, with a t-statistic of -2.41. The coefficient on book-to-market is close to being marginally statistically significant (t-statistic of 1.64). However the point estimates for book-to-market as well as the lagged stock return are similar to estimates from longer periods where we do not include discretionary accruals. The ability of the equity issuance variable to predict subsequent stock returns is subsumed by the other variables in the VAR.

The coefficients on lagged returns may help answer the question as to whether momentum profits reverse. Though the coefficients on returns three to five years in the past are large and jointly similar to the coefficient on the lagged stock return, in a test not reported we cannot

[17]We also estimated the VAR excluding four lags of stock returns and all the results reported in Table 9 are essentially the same.

reject the hypothesis that the coefficients are jointly equal to zero. This result suggests that overall the reversal of momentum profits is not significant. One possible explanation for this is as suggested by the corresponding theories, momentum may measure overreaction in some cases and underreaction in others, therefore for the overall sample we do not find that momentum profits reverse in a statistically significant way.

The remaining columns in Table document the predictability of each element in the VAR. Our measure of risk, $\beta_{i,t}^{short}$, is forecastable using both lagged own values as well as lagged values of $\beta_{i,t}^{long}$. Interestingly, firms with relatively high levels of discretionary accruals have relatively lower betas over the subsequent year. As is well-known, firms' book-to-market ratios are persistent. Other strong results include market-adjusted returns being positively related to subsequent market-adjusted discretionary accruals.

The one-period predictability of market-adjusted stock returns in combination with the estimates relating current characteristics to future characteristics generates a mispricing measure for each firm at each point in time. Figure 1 plots the histogram of these estimates. The average mispricing is about 1.64%. The standard deviation is approximately 18.65%. As one might guess, the distribution of the estimates is right-skewed.

Table 9 uses this mispricing metric in our investment regressions. We estimate the basic regression:

$$\frac{I_{i,t}}{K_{i,t-1}} = f_i + \gamma_t + b_1 MISPRICING_{i,t} + b_2 Q_{i,t-1} + b_3 \frac{CF_{i,t-1}}{K_{i,t-2}} + \varepsilon_{i,t} \qquad (6)$$

Column (1) of Table 2 displays the results of regression (6). Controlling for investment opportunities and financial slack, firms that are overpriced invest more. The coefficient of investment on our mispricing metric, b_1, measures 0.2124 with an associated t-statistic of 7.37. Firms whose current price is high relative to the CAPM invest more than the standard model would indicate. This effect is economically important. A typical (one-standard deviation) change in a typical firm's level of discretionary accruals is associated with roughly a four percent change in that firm's investment as a percentage of capital.

This finding is robust to using alternative specifications. In columns (2) through (4) of Table 8, we add analysts' expectations of future profitability. We hope these variables pick up variation in future investment opportunities not picked up by Tobin's Q. Though the coefficient on $MISPRICING_{i,t}$ is smaller, we still find that controlling for investment opportunities, firms that are "overpriced" ("underpriced") invest more (less). In columns (5) through (7) of Table 8, we include end-of-period Q as well lags of Q. Neither the point estimate nor the precision of that estimate is affected by these additional controls.

We also estimated a version of Tables 3, 5, and 7 using our composite mispricing proxy. That table is available upon request. We find that we are unable to reject the hypothesis that the sensitivity of investment to mispricing varies with R&D intensity. The coefficient on mispricing for firms with R&D intensity below the median is 0.2294 while for firms with higher R&D intensity, the coefficient is 0.1725. However the split based on share turnover lines up with the prediction of our model. The coefficient on mispricing for relatively high share turnover firms is 0.2183 while the coefficient on mispricing for relatively low share turnover firms is 0.1251.

The results in Table 9 are robust to varying the characteristics used to predict future returns and risks in the VAR. For example, using a long (1928-2000) panel, Cohen, Polk, and Vuolteenaho (2002) argue that mispricing relative to the CAPM is not an important factor in determining the prices of high and low BE/ME stocks if CAPM risk is measured using long-horizon covariances of cash-flow fundamentals. Our short panel precludes such an approach. Moreover, one might also be worried that BE/ME is too correlated with Tobin's Q causing collinearity in regressions of investment on Q and mispricing measures derived from BE/ME. Therefore we repeat the analysis in Table 8 but manually setting the ability of BE/ME to predict returns equal to zero. Those results are qualitatively similar; mispricing explains investment after controlling for investment opportunities and financial slack.[18]

In summary we find that our mispricing metric explains investment in a manner consistent with our model. This finding is comforting as many alternative explanations as to why our three proxies come in individually do not obviously extend to this composite measure.

[18] Mispricing continues to explain investment if we manually set the ability of both momentum and BE/ME to predict returns equal to zero.

G Efficient or inefficient investments?

So far, we have found a consistently strong positive correlation between our measures of mispricing and investment. According to the model, the positive correlation is due to the fact that over-priced firms take investment projects that have negative net present values. Similarly, underpriced firms forego investment projects with positive net present value. While the empirical results are consistent with inefficient allocation of resources in equilibrium, there are other potential explanations.

First, it is possible that equity-dependent firms with good investment opportunities manage earnings (i.e. generate high discretionary accruals) to manipulate their stock price, facilitating investment. The investment allocation in this case is efficient and temporary mispricing helps financially constrained firms make investments that they otherwise would not be able to make. This interpretation, though plausible, is not consistent with the previous findings that show that firms with abnormally soft earnings actually have relatively poor operating performance in subsequent years.

Another potential explanation for our results is outlined in Dow and Gorton (1997). In that model, when the market has information that managers do not have, it is efficient for managers to make investment decisions taking into account stock prices. While this story does not explain the relation between discretionary accruals and investment as discretionary accruals are set by the manager, the Dow and Gorton explanation may partially explain why firms with high equity issues and/or high stock returns invest more.

Finally, our mispricing proxies may instead represent rational heterogeneity in discount rates. In this alternative explanation, firms with high discretionary accruals and high equity issuance have low discount rates. It is hard to reconcile this explanation with our results relating investment and price momentum at the firm or industry level as those characteristics are associated with relatively higher realized returns.

One way we can provide additional evidence distinguishing our model from these alternative explanations is to measure the relation between investment and future stock returns. In our model there is a negative relation between investment and subsequent risk-adjusted returns as firm business investment is linked to the market's mis-valuation of the firm's equity.

No controls for unobserved profitability are needed; only a model of risk.[19]

We estimate cross-sectional regressions of monthly stock returns including investment, Tobin's Q and a control for cashflow sensitivity:

$$R_{i,t} = a_t + b_{1,t} \ln \frac{I_{i,t-1}}{K_{i,t-2}} + b_{2,t} \ln Q_{i,t-1} + b_{3,t} \frac{CF_{i,t-1}}{K_{i,t-2}}, \tag{7}$$

where returns are measured in percent. The regression identifies cross-sectional variation in returns that is correlated with investment, controlling for investment opportunities and financial slack, thus tying together return predictability and investment behavior.[20]

As in Fama and MacBeth (1976), we average the time-series of b_t's and report both the mean and the standard error of the mean estimate. Column (1) of Table 10 shows the result of estimating equation (7). The coefficient on investment is -0.1579 with an associated t-statistic of 3.96. Consistent with our model, firms that overinvest (underinvest) on average have returns that are low (high).

Note that identification is easier in this framework. In our previous investment regressions, controls for marginal profitability were crucial in order to isolate variation in investment linked to mispricing. In these return regressions, we need only control for risk. Column (2) of Table 10 includes three firm characteristics that are associated with cross-sectional differences in average returns: firm size (market capitalization), firm book-to-market equity, and firm momentum. These characteristics are arguably proxies for risk. As in previous literature, each characteristic predicts returns with a positive coefficient. More importantly, these controls do not subsume the investment effect as the relevant coefficient only drops two basis points and remains quite statistically significant.

Our model predicts that this effect will be stronger for firms facing a greater degree

[19]Titman, Wei, and Xie (2001) show that firms that spend more on capital investment relatively to their sales or total assets subsequently achieve negative benchmark-adjusted returns; they interpret these findings as support for market underreaction to excessive investment. In our model, this may be an equilibrium outcome even though investors correctly update the stock price given the manager's decision to invest.

[20]Unlike the previous sample which used only December year-end firms, we use all available data as long as there is a five-month lag between the month in which we are predicting returns and the fiscal year-end so that the regression represents a valid trading rule. As in the previous sample, we eliminate firms with negative investment and/or otherwise extreme accounting ratios.

of information asymmetry and/or short-term investors. In columns (3) through (6) we test these predictions by splitting the sample based on R&D intensity and share turnover. Column (3) of Table 10 re-estimates the relation between investment and subsequent stock returns for those firms with below-median R&D each year while column (4) re-estimates the relation using only those firms whose R&D is above the median each year. The effect is nearly two and a half times stronger for high R&D firms. The ability of investment to predict cross-sectional differences in returns is not statistically significant for low R&D firms. A full-sample regression (not shown) which interacts investment with a dummy for above-median R&D documents that the difference between the two coefficients on investment in columns (3) and (4) is statistically significant at the one percent level.

Column (5) of Table 10 re-estimates the full regression for those firms with below-median share turnover while column (6) re-estimates the relation using above-median share turnover firms. Our model predicts that the effect will be stronger for those firms with above-median turnover. The results in those two columns are consistent with our model. The coefficient on investment is eighty percent higher for firms with high turnover and the difference is statistically significant. Firms with low share turnover have a coefficient on investment that is not statistically significant from zero.

Of course, it is always possible that we are not appropriately controlling for risk. Perhaps all of the predictive power of investment is due to cross-sectional variation in discount rates.[21] However, it is hard to explain why variation in those discount rates is primarily found in firms with above-median R&D and above-median turnover.

The next two columns split the sample according to firms' Kaplan and Zingales index (1997). Kaplan and Zingales (1997) classify firms into discrete categories of financial constraint, and then use an ordered logit regression to relate their classifications to accounting variables (using the 49 firms in the Fazzari, Hubbard, and Petersen (1986) sample of low dividend manufacturing firms with positive real sales growth). As in Lamont, Polk, and

[21] Other papers find similar results at the aggregate or industry level. Cochrane (1991) finds that investment has significant forecasting power for aggregate stock returns. Lamont (2000) documents that planned investment has substantial forecasting power at both the aggregate and industry level. Both authors argue that their findings are consistent with variation in discount rates.

Saá-Requejo (2001), we construct a KZ index using their regression coefficients and five accounting ratios. The KZ index is higher for firms that are more constrained. The five variables, along with the signs of their coefficients in the KZ index, are: cash flow to total capital (negative), the market to book ratio (positive), debt to total capital (positive), dividends to total capital (negative), and cash holdings to capital (negative). We provide additional information in the appendix.

We split the sample according to firms' degree of financial constraints in order to distinguish our model, where unconstrained firms may invest in negative NPV projects when overpriced, from other models, where financially constrained firms are able to invest more efficiently when overpriced. Column (7) estimates the relation between investment and subsequent stock returns for below-median KZ firms; column (8) estimates the relation for above-median KZ firms. Though the coefficient of returns on investment is higher for firms with above-median KZ index, the difference is not statistically significant. The investment of unconstrained firms still predicts negative future returns.[22] This effect is economically and statistically strong.

The final regression in column (9) adds our previous mispricing proxies, discretionary accruals and equity issuance, to the right-hand side. If the ability of these two proxies to explain investment actually works through a mispricing channel rather than a profitability channel then we should see the coefficient on investment move closer to zero. This is exactly what happens. Recall that the coefficient on investment for the full sample was -0.1372. After the inclusion of our two mispricing proxies, that coefficient drops by almost fifty percent to -0.0702. In fact the coefficient is now no longer significant at the five percent level. This result brings the analysis full circle, linking the previous investment-Q regressions with these return predictability regressions in a manner consistent with our model.

IV Conclusions

We present a model of the firm's investment decision in which investment decisions are affected by the market (mis)valuation of the company. In the model managers with private

[22]See also Baker, Stein, and Wurgler (2002)

information about the quality of the firm's investment may invest inefficiently on behalf of shareholders. The reason is that investment decision serve as a signal of firm's value and can be used to manipulate stock prices to shareholders' advantage. If firms are mispriced, inefficient investment can be predicted with ex-ante variables.

In the empirical part of the paper we show that variables which predict negative stock returns also predict investment, controlling for investment opportunities and financial slack. In particular we show that a typical change in one of our "mispricing proxies" results in roughly a two to four percent change in the firm's investment as a percentage of capital. This relation is robust to formally measuring mispricing using the output from a firm-level VAR. Our model predicts that these sensitivities should be greater, the greater the degree of asymmetric information between firms and investors. We find that that is generally the case as the effect is weaker for firms with relatively low R&D intensity. Our model also predicts that the effects should be stronger for firms with short-term investors. We find that this is generally the case as the effect is stronger for firms with relatively high share turnover.

We show that patterns in the cross-section of average returns are consistent with those patterns in investment. Firms with high (low) investment have low (high) subsequent stock returns, controlling for investment opportunities and other characteristics linked to return predictability. As in our model, this relation is stronger for firms with above-median R&D intensity or above-median turnover. We argue that these findings represent a first attempt at showing that mispricing in the capital markets may have significant consequences for the real economy.

V Appendix I

Sketch of the Proof of Proposition 1:

A manager who sees a bad investment project does not want to deviate. If he deviates and does not invest the (average) shareholder gets a payoff of γV_0. If he does not deviate the shareholder gets a payoff of $\gamma V_0 + \frac{q[(1-\lambda)V_g(1+f(\alpha))+\lambda V_b]}{q+p} + \frac{(V_b)p}{q+p}$. Such a payoff is greater than γV_0 if and only if $P_g > \frac{p+q}{q}\frac{-(V_b)}{V_g(1+f(\alpha))-V_b}$. Note that this result will hold for any out-of-equilibrium path belief δ due to the assumption that when no investment occurs the variation in the value of the firm is zero, independent of the quality of the project. Analogously, a manager who sees a good investment project does not want to deviate. If he does not deviate the shareholder gets a payoff of $\gamma V_0 + \frac{q[(1-\lambda)V_g(1+f(\alpha))+\lambda V_b]}{q+p} + \frac{(V_g)p}{q+p} > \gamma V_0$ under the above condition.

Sketch of the Proof of Proposition 2:

A manager who sees a good investment project (the binding case) will not want to deviate. If he deviates and does invest the (average) shareholder gets a payoff of:

$\gamma V_0 + \frac{q[(1-\lambda)V_g(1+f(\alpha))+\lambda V_b]}{q+p} + \frac{(V_g)p}{q+p} < \gamma V_0$ if $\lambda > \left[1 + \frac{p}{q}\frac{1}{(1+\alpha)}\right] / \left[1 - \frac{V_b}{V_g(1+f(\alpha))}\right]$

Note that this underinvestment equilibrium depends on non-Bayesian beliefs in the out-of-equilibrium case.

Sketch of the Proof of Proposition 3:

A manager who sees a good project will not want to deviate. If he deviates, the shareholder gets a payoff of γV_0. If the manager does not deviate the shareholder gets a payoff of $\gamma V_0 + \frac{q[V_g(1+f(\alpha))]+p[V_g]}{q+p}$ that is bigger than γV_0, for $V_g > 0$. A manager who sees a bad project will not want to deviate. If he deviates the shareholder gets $\gamma V_0 + \frac{q[V_g(1+f(\alpha))]+p[V_b]}{q+p} < \gamma V_0$, if $p > q\frac{V_g(1+f(\alpha))}{-V_b}$.

VI Appendix II

Investment (I_t) is capital expenditure (COMPUSTAT item 128). Capital (K_{t-1}) is net property, plant, and equipment (COMPUSTAT item 8). Q_{t-1} equals the market value of assets divided by the book value of assets (COMPUSTAT item 6). Market value of assets equals the book value of assets plus the market value of common stock less the sum of book value of common stock (COMPUSTAT item 6) and balance sheet deferred taxes (COMPUSTAT item 74) in year t-1. Cash flow (CF_{t-1}) equals the sum of earnings before extraordinary items (COMPUSTAT item 18) and depreciation (COMPUSTAT item 14) over beginning of year capital. Sales (COMPUSTAT item 12) is net sales. One-year expected profitability ($E_{t-1}[ROA_t]$) is the median analyst year t-1 forecast of earnings in year t divided by the book value of assets (COMPUSTAT item 6). Two-year expected profitability ($E_{t-1}[ROA_{t+1}]$) is the median analyst year t-1 forecast of earnings in year t+1 divided by the book value of assets (COMPUSTAT item 6) in year t-1. Five-year expected profitability ($E_{t-1}[ROA_{t+4}]$) is the median analyst year t-1 forecast of earnings in year t+4 divided by the book value of assets (COMPUSTAT item 6) in year t-1. R&D intensity is R&D expense (COMPUSTAT item 46) over the book value of assets (COMPUSTAT item 6). We ignore firms with negative accounting numbers for book assets, capital, or investment. We drop those firms with extreme values for the accounting ratios we study as those observations probably represent data errors.

We construct discretionary accruals following Chan, Chan, Jegadeesh, Lakonishok (2001). Accruals ($ACCR_t$) equal the change in accounts receivable (COMPUSTAT data item 2) plus the change in inventories (COMPUSTAT data item 3) plus the change in other current assets (COMPUSTAT data item 68) minus the change in accounts payable (COMPUSTAT data item 70) minus the change in other current liabilities (COMPUSTAT data item 72) minus depreciation (COMPUSTAT data item 178). Accruals are scaled by total assets (the average of COMPUSTAT data item 6 at the beginning and end of the fiscal year). The discretionary component of accruals is defined as

$$DACCR_t \quad = \quad ACCR_t - NORMALACCR_t$$

$$NORMALACCR_{i,t} \quad = \quad \left(\frac{\sum_{k=1}^{5} ACCR_{i,t-k}}{\sum_{k=1}^{5} SALES_{i,t-k}}\right) SALES_{i,t}$$

Therefore we model normal accruals as a constant proportion of firm sales.

Following Daniel and Titman (2002), we construct a measure of a firm's equity issuance / repurchase activity, $EQISSUE_{i,t}$, over a five-year period. We define $EQSSUE_{i,t}$ as the log of the inverse of the percentage ownership in the firm one would have at time t, given a one percent ownership of the firm at time $t-5$, assuming full reinvestment of all cash flows,

$$EQISSUE_{i,t} = \log(\frac{ME_{i,t}}{ME_{i,t-5}}) - r_{i,t-5:t},$$

where $N_{i,t}$ is the number of shares outstanding at time t, $ME_{i,t}$ is the market value of equity at time t, and $r_{i,t-5:t}$ is the log stock return from $t-5$ to t.

We compute book-to-market equity, $BE/ME_{i,t}$. Book equity is defined as stockholders' equity, plus balance sheet deferred taxes (COMPUSTAT data item 74) and investment tax credit (data item 208) (if available), plus post-retirement benefit liabilities (data item 330) (if available) minus the book value of preferred stock. Depending on availability, we use redemption (data item 56), liquidation (data item 10), or par value (data item 130) (in that order) for the book value of preferred stock. We calculate stockholders' equity used in the above formula as follows. We prefer the stockholders' equity number reported by COMPUSTAT (data item 216). If neither one is available, we measure stockholders' equity as the book value of common equity (data item 60) plus the par value of preferred stock. (Note that the preferred stock is added at this stage because it is later subtracted in the book equity formula.) If common equity is not available, we compute stockholders' equity as the book value of assets (data item 6) minus total liabilities (data item 181), all from COMPUSTAT.

The price-to-book ratio used to form portfolios in May of year t is book common equity for the fiscal year ending in calendar year t-1, divided by market equity at the end of May of year t. We require the firm to have a valid past price-to-book ratio. Moreover, in order to eliminate likely data errors, we discard those firms with price-to-book ratio less than 0.01 and greater than 100. When using COMPUSTAT as our source of accounting information, we require that the firm must be on COMPUSTAT for two years. This requirement alleviates most of the potential survivor bias due to COMPUSTAT backfilling data.

The KZ index is: -1.001909*[(Item 18+Item 14)/Item 8]+.2826389*[(Item 6+CRSP December Market Equity-Item 60-Item 74)/Item 6]+3.139193*[(Item 9+Item 34)/(Item 9+Item 34+Item 216)] -39.3678*[(Item 21+Item 19)/Item 8]-1.314759*[Item 1/Item 8]. Item numbers refer to COMPUSTAT annual data items. Data item 8 is lagged.

References

[1] Abel, 1980,, Empirical investment equations: an itegrative framework, in K. Brunner and A. Meltzer (eds.), *On the state of macroeconomics, Carnegie-Rochester Conference Series*, vol. 12.

[2] Abel, A. and O. Blanchard, 1986, The present value of profits and cyclical movements in investment, *Econometrica* 54, 249-274.

[3] Abel, A. and J. Eberly, 2002, Investment and q with fixed costs: An empirical analysis, Northwestern University working paper.

[4] Baker, M., J. Stein, and J. Wurgler, 2002, When Does the Market Matter? Stock Prices and the Investment of Equity-Dependent Firms, Harvard University, mimeo.

[5] Barberis, N., A. Shleifer, and R. Vishny, 1998, A Model of Investor Sentiment, *Journal of Financial Economics*, 49: 307-345.

[6] Barberis, N. and R. Thaler, 2001, A survey of behavioral finance, University of Chicago working paper.

[7] Benabou, R. and G. Laroque, 1992, Using priviledged information to manipulate markets: insiders, gurus, and credibility, *Quarterly Journal of Economics* 107, 921-948.

[8] Bernstein, L., 1993, Analysis of Financial Statements, 4th ed. Homewood, IL: Irwin.

[9] Bond, S. and J. Cummins, 2000, The stock market and investment in the new economy: some tangible facts and intangible fictions, Brookings Papers on Economic Activity 200:1, 61-124.

[10] Brainard, W. and J. Tobin, 1968, Pitfalls in financial model building, *American Economic Review Papers and Proceedings* 58, 99-122.

[11] Chan, K., K.C. Chan, N. Jegadeesh, and J. Lakonishok, 2001, Earnings quality and stock returns, NBER working paper 8308.

[12] Cochrane, J., 1991, Production-based asset pricing and the link between stock returns and economic fluctuations, *Journal of Finance*, 46: 209-237.

[13] Cohen, R., C. Polk, and T. Vuolteenaho, 2002, Does risk or mispricing explain the cross-section of stock prices?, Northwestern University working paper.

[14] D'Avolio, E. Gildor, and A. Shleifer, 2001, Technology, information production, and market efficiency, Harvard University working paper.

[15] Daniel, K., D. Hirshleifer and A. Subrahmanyam, 1998, Investor Psycohology and Security Market Under- and Overreaction, *Journal of Finance*, 52: 1-33.

[16] Daniel, K. and S. Titman, 2001, Market reactions to tangible and intangible information, Northwestern University working paper.

[17] Dow, James and Gary Gorton, 1997, Stock Market Efficiency and Economic Efficiency: Is There a Connection?, *Journal of Finance*, 52: 1087-1129.

[18] Erickson, Timothy and Toni M. Whited, 2000, Measurement error and the relationship between investment and q, *Journal of Political Economy*, 108: 1027-1057.

[19] Erickson, Timothy and Toni M. Whited, 2002, Two-step GMM estimation of the errors-in-variables model using high-order moments, *Econometric Theory*, 18: 776-799.

[20] Fama, E., 1970, Efficient capital markets: a review of theory and empirical work, *Journal of Finance* 25, 383-423.

[21] Fazzari, S., R. G. Hubbard, and B. Petersen, 1988, Financing constraints and corporate investment, *Brookings Papers on Economic Activity*, 141-195.

[22] Gilchrist, S. and C. Himmelberg, 1995, Evidence on the role of cash flow for investment, *Journal of Monetary Economics* 36, 541-572.

[23] Hand, J., 1990, Did firms undertake debt-equity swaps for an accounting paper profit or true financial gain?, *The Accounting Review 64*, 587-623.

[24] Hayashi, F., 1982, Tobin's average q and marginal q: a neoclassical interpretation, *Econometrica* 50,

[25] Hirshleifer, 2001, Investor psychology and asset pricing, *Journal of Finance* 56, 1533-1598.

[26] Hong, H. and J. Stein, 1999, A Unified Theory of underreaction, momentum trading and overreaction in financial markets, *Journal of Finance* 54, 2143-84.

[27] Hong, H., T. Lim, and J. Stein, 2000, Bad news travels slowly: size, analyst coverage, and the profitability of momentum strategies, *Journal of Finance* 55, 265-295.

[28] Ikenberry, D. and J. Lakonishok, and T. Vermaelen, 1995, Market underreaction to open market share repurchases, *Journal of Financial Economics* 39, 181-208.

[29] Jegadeesh, N. and S. Titman, 1993, Returns to buying winners and selling losers: Implications for stock market efficiency, *Journal of Finance* 48, 65-91.

[30] Jegadeesh, N. and Titman, 2001, Profitability of momentum strategies: an evaluation of alternative explanations, *Journal of Finance* 48, 699-720.

[31] Jones, J., 1991, Earnings management during import relief investigation, *Journal of Accouting Research* 29, 193-228.

[32] Kahneman, D. and A. Tversky, 1973, On the Psychology of Prediction, *Psychological Review* 80, 237-51.

[33] Kaplan, S. and L. Zingales, 1997, Do financing constraints explain why investment is correlated with cash flow?, *Quarterly Journal of Economics*112, 168-216.

[34] Lamont, O., 2000, Investment plans and stock returns, *Journal of Finance* 55, 2719-2745.

[35] Lamont, O., C. Polk, and J. Saá-Requejo, 2001, Financial constraints and stock returns, *Review of Financial Studies* 14, 529-554.

[36] Lee, C. and B. Swaminathan, 2000, Price momentum and trading volume, *Journal of Finance* 55, 2017-2069.

[37] Loughran, T. and J. Ritter, 1997, The operating performance of firms conducting seasoned equity offerings, *Journal of Finance* 52, 1823-1850.

[38] Lucas, D. and R. McDonald, 1990, Equity issues and stock price dynamics, *Journal of Finance* 45, 1019-1043.

[39] Maines, L. and J. Hand, 1996, Individuals' perceptions and misperceptions of the time series properties of quarterly earnings, *The Accounting Review* 71, 317-336.

[40] Morck, R., A. Shleifer, and R. Vishny, 1990, The stock market and investment: is the market a sideshow?, *Brookings Papers on Economic Activity* 157-215.

[41] Moskowitz, T. and Grinblatt, 1999, Do industries explain momentum?, *Journal of Finance* 54, 1249-1290.

[42] Myers, S. and N. Majluf, 1984, Corporate financing and investment decisions when firms have information that investors do not have, *Journal of Financial Economics* 13, 187-222.

[43] Shleifer, A., 2000, Inefficient markets, an introduction to behavioral finance, Oxford University Press.

[44] Shleifer, A. and R. Vishny, 1990, Equilibrium short horizons of investors and firms', *American Economic Review Papers and Proceedings* 80, 148-153.

[45] Shleifer, A. and R. Vishny, 2001, Stock market driven acquisitions, Harvard University manuscript.

[46] Sloan, Richard, 1996, Do Stock Prices Fully Reflect Information in Accruals and Cash Flows About Future Earnings?, *The Accounting Review* 71, 289-315.

[47] Stein, Jeremy, 1988, Takeover threats and managerial myopia, *Journal of Political Economy* 96, 61-80.

[48] Stein, Jeremy, 1996, Rational capital budgeting in an irrational world, *Journal of Business* 69, 429-455.

[49] Stein, Jeremy, 2001, Agency, information and corporate investment, forthcoming in *The Handbook of the Economics of Finance*, editors: G. Constatinides, M. Harris, and R. Stulz.

[50] Teoh, S. H., I. Welch, and T. J. Wong, 1998, Earnings management and the long-term market performance of initial public offerings, *Journal of Finance* 53, 1935-1974.

[51] Teoh, S. H., I. Welch, and T. J. Wong, 1998, Earnings management and the underperformance of seasoned equity offerings, *Journal of Financial Economics* 50, 63-99.

[52] Tobin, J., 1969, A general equilibrium approach to monetary theory, *Journal of Money, Credit, and Banking* 1, 15-29.

[53] Vuolteenaho, T., What drives firm-level returns?, *Journal of Finance* 57, 233-264.

Table 1:

Summary Statistics

The data comes from both the merged CRSP-COMPUSTAT database and the Zacks database. Investment, $I_{i,t-1}$, is capital expenditure (COMPUSTAT item 128). Capital, $K_{i,t-1}$, is net property, plant, and equipment (COMPUSTAT item 8). We define discretionary accruals, $DACCR_{i,t}$, as the difference between realized accruals and a constant proportion of contemporaneous firm sales, $S_{i,t-1}$ (COMPUSTAT item 12). We calculate the proportion as the ratio of the sum of the past five years of accruals to the sum of the last five years of sales (see Chan et al. (2001)). Accruals are the difference between accounting earnings and cashflow. See Appendix II for details. Our measure of equity issuance activity, $EQISSUE_{i,t}$, captures equity issues, share repurchases, dividends, and other actions that pay cash out of the firm, or trade ownership for cash or services (e.g., stock options plans) over the period $t-5$ to t. Lagged firm momentum, $MOM_{i,t-1}$, is the cross-sectionally demeaned (using the universe of all CRSP stocks) stock return over the period January$_{t-1}$ to November$_{t-1}$. Lagged industry momentum, $IMOM_{i,t-1}$, is the cross-sectionally demeaned (using the universe of all CRSP stocks) industry return over the period January$_{t-1}$ to November$_{t-1}$ using the two-digit SIC classification. Tobin's Q, $Q_{i,t-1}$, is defined as the market value of assets divided by the book value of assets, $A_{i,t-1}$ (COMPUSTAT item 6). A firm's market value of assets equals the book value of assets plus the market value of common stock less the sum of book value of common stock (COMPUSTAT item 60) and balance sheet deferred taxes (COMPUSTAT item 74). Cash flow, $CF_{i,t-1}/K_{i,t-2}$, equals the sum of earnings before extraordinary items (COMPUSTAT item 18) and depreciation (COMPUSTAT item 14) over beginning of year capital which we define as net property, plant, and equipment (COMPUSTAT item 8). One-year expected profitability, $E_{t-1}[EARN_{i,t}]/A_{i,t-1}$, is the median analyst year $t-1$ forecast of earnings in year t divided by the book value of assets in year $t-1$. Two-year expected profitability, $E_{t-1}[EARN_{i,t+1}]/A_{i,t-1}$, is the median analyst year $t-1$ forecast of earnings in years t and $t+1$ divided by the book value of assets in year $t-1$. Five-year expected profitability, $E_{t-1}[EARN_{i,t+4}]/A_{i,t-1}$, is the median analyst year $t-1$ forecast of earnings in years t through $t+4$ divided by the book value of assets in year $t-1$. $R\&D_{i,t-1}/A_{i,t-1}$ measures R&D intensity (R&D expense (COMPUSTAT item 46) over the book value of assets). Share turnover, $TURN_{i,t-1}$ is the average, in December $_{t-1}$, of the daily ratio of shares traded to shares outstanding at the end of the day. $BE/ME_{i,t}$ is firm book-to-market equity (described in appendix II). $KZ_{i,t}$ is Kaplan-Zingales index of financial constraints, defined in appendix II

	Mean	Std. Dev.	Min	Max	Obs.
$I_{i,t}/K_{i,t-1}$	.31543318	.40981705	.000055	9.8948135	53585
$DACCR_{i,t}$	-0.0066178	.09982533	-1.373958	1.790586	31643
$EQISSUE_{i,t}$	.34047265	1.2368979	-8.5319862	16.595188	37761
$MOM_{i,t-1}$	.02231656	.8655887	-3.3779354	19.338051	53585
$IMOM_{i,t-1}$	.03217884	.89540824	-3.5319417	4.8756251	53585
$Q_{i,t-1}$	1.5613214	1.5692514	.074246	82.470253	53585
$CF_{i,t-1}/K_{i,t-2}$	.46286134	1.1810156	-9.9966278	9.9881659	53585
$S_{i,t-1}$	1017.1091	3938.6659	10.002	160883	53585
$A_{i,t-1}$	1277799.8	5897335.8	1878	3.281e+08	53585
$E_{t-1}[EARN_{i,t}]/A_{i,t-1}$	.04385347	.13160954	-6.1592259	13.147612	25249
$E_{t-1}[EARN_{i,t+1}]/A_{i,t-1}$	.07059737	.08605749	-3.8495162	2.0628276	24278
$E_{t-1}[EARN_{i,t+4}]/A_{i,t-1}$	1.746586	3.7817765	-2.403513	120.72811	20628
$R\&D_{i,t-1}/A_{i,t-1}$	.04555467	.07023887	0	2.051975	24153
$TURN_{i,t-1}$	1.4973921	2.3476327	0	252.16142	27834
$BE/ME_{i,t-1}$	0.975	0.992	0.100	47.287	106,960
KZ	-0.118	2.239	-4.999	46.843	90132

Table 2:

Discretionary accruals and Firm Investment

The dependent variable is the proportion of investment over beginning of year capital. For a description of this and the other variables see the legend of Table 1. All regressions include firm and year fixed effects. The standard errors reported in parentheses are corrected for clustering of the residual at the year level. Coefficients starred with one, two, and three asterisks are statistically significant at the ten, five, and one percent level respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$DACCR_{i,t}$	0.2010***	0.2329***	0.2454***	0.2723***	0.2619***	0.1866***	0.1798***	0.1748***
	(0.0326)	(0.0380)	(0.0364)	(0.0484)	(0.0298)	(0.0315)	(0.0324)	(0.0324)
$Q_{i,t-1}$	0.0544***	0.0532***	0.0538***	0.0550***	0.0849***	0.0553***	0.0576***	0.0568***
	(0.0040)	(0.0054)	(0.0032)	(0.0031)	(0.0236)	(0.0051)	(0.0054)	(0.0055)
$CF_{i,t-1}/K_{i,t-2}$	0.0743***	0.0508***	0.0511***	0.0571***	0.0490***	0.0774***	0.0731***	0.0724***
	(0.0124)	(0.0092)	(0.0110)	(0.0135)	(0.0146)	(0.0137)	(0.0126)	(0.0127)
$E_{t-1}[EARN_{i,t}]/A_{i,t-1}$		0.0405**	0.4200**	0.9252***				
		(0.0162)	(0.1920)	(0.2836)				
$E_{t-1}[EARN_{i,t+1}]/A_{i,t-1}$			-0.4912	-1.1824**				
			(0.3002)	(0.5044)				
$E_{t-1}[EARN_{i,t+4}]/A_{i,t-1}$				0.0113**				
				(0.0052)				
$Q_{i,t}$						0.0027	0.0016	0.0019
						(0.0051)	(0.0050)	(0.0053)
$Q_{i,t-2}$							-0.0097**	-0.0084
							(0.0039)	(0.0052)
$Q_{i,t-3}$								-0.0031
								(0.0055)
Observations	31643	16480	15862	13491	13705	30271	29567	29053
R-squared	0.430	0.538	0.550	0.534	0.0756	0.436	0.446	0.445

Table 3:

Discretionary accruals and Firm Investment: Cross-Sectional Analysis

The dependent variable is the proportion of investment over beginning of year capital. High discretionary accruals, $HIGHDACCR_{i,t-1}$, is a dummy equal to one if the firm has discretionary accruals in the top 20th percentile, and zero otherwise. High equity issuance activity, $HIGHEQISSUE_{i,t-1}$, is a dummy equal to one if the firm has equity issuance in the top 25th percentile, and zero otherwise. For a description of all the variables see the legend of Table 1. Columns (1) and (2) show results for the whole sample. Column (3) shows results for the firm-years in the subperiod, 1995-2000. Column (4) shows results for the firm-years in the subperiod, 1998-2000. Column (5) shows results for the firms that have below-median R&D intensity. Column (6) shows results for those firms that have above-median R&D intensity. Column (7) shows results for those firms that have below-median firm share turnover. Column (8) shows results for those firms that have above-median firm share turnover. We calculate medians on a year by year basis. All regressions include firm and year fixed effects. The standard errors reported in parentheses are corrected for clustering of the residual at the year level. Coefficients starred with one, two, and three asterisks are statistically significant at the ten, five, and one percent level respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$DACCR_{i,t}$	0.1593***	0.1617***	0.2886***	0.3240***	0.1496***	0.3361***	0.0873***	0.2093***
	(0.0369)	(0.0333)	(0.0572)	(0.1195)	(0.0449)	(0.0547)	(0.0327)	(0.0372)
$Q_{i,t-1}$	0.0542***	0.0543***	0.0545***	0.0501***	0.0671***	0.0475***	0.0229***	0.0727***
	(0.0040)	(0.0040)	(0.0042)	(0.0040)	(0.0118)	(0.0066)	(0.0069)	(0.0087)
$CF_{i,t-1}/K_{i,t-2}$	0.0743***	0.0743***	0.0376**	0.0228	0.1149***	0.0612***	0.1056***	0.1187***
	(0.0124)	(0.0124)	(0.0158)	(0.0252)	(0.0300)	(0.0138)	(0.0156)	(0.0309)
$HIGHDACCR_{i,t}$	0.0168***							
	(0.0057)							
$DACCR_{i,t} * HIGHEQISSUE_{i,t}$		0.0927***						
		(0.0392)						
Observations	31643	31643	8009	4076	7975	7385	8493	8674
R-squared	0.430	0.430	0.506	0.591	0.438	0.526	0.453	0.437

Table 4:

Equity issuance and Firm Investment

The dependent variable is the proportion of investment over beginning of year capital. For a description of this and all the other variables see the legend of Table 1. All regressions include firm and year fixed effects. The standard errors reported in parentheses are corrected for clustering of the residual at the year level. Coefficients starred with one, two, and three asterisks are statistically significant at the ten, five, and one percent level respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$EQISSUE_{i,t}$	0.0259***	0.0166***	0.0162***	0.0164***	0.0183***	0.0287***	0.0264***	0.0266***
	(0.0030)	(0.0033)	(0.0032)	(0.0043)	(0.0043)	(0.0032)	(0.0032)	(0.0033)
$Q_{i,t-1}$	0.0454***	0.0491***	0.0452***	0.0453***	0.0461***	0.0540***	0.0593***	0.0603***
	(0.0040)	(0.0055)	(0.0046)	(0.0064)	(0.0125)	(0.0059)	(0.0054)	(0.0055)
$CF_{i,t-1}/K_{i,t-2}$	0.0789***	0.0493***	0.0526***	0.0639***	0.0727***	0.0789***	0.0805***	0.0795***
	(0.0119)	(0.0098)	(0.0114)	(0.0146)	(0.0106)	(0.0121)	(0.0122)	(0.0120)
$E_{t-1}[EARN_{i,t}]/A_{i,t-1}$		0.3281***	0.4055***	0.4920***				
		(0.0831)	(0.0840)	(0.0921)				
$E_{t-1}[EARN_{i,t+1}]/A_{i,t-1}$			-0.0374	-0.1021				
			(0.1597)	(0.1993)				
$E_{t-1}[EARN_{i,t+4}]/A_{i,t-1}$				0.0021				
				(0.0038)				
$Q_{i,t}$						-0.0126**	-0.0113**	-0.0119***
						(0.0050)	(0.0047)	(0.0048)
$Q_{i,t-2}$							-0.0165***	-0.0162***
							(0.0039)	(0.0048)
$Q_{i,t-3}$								0.0004
								(0.0036)
Observations	37761	17283	16631	14220	14451	36212	35366	34867
R-squared	0.409	0.571	0.578	0.548	0.100	0.415	0.419	0.424

Table 5:

Equity issuance and Firm Investment: Cross-sectional Analysis

The dependent variable is the proportion of investment over beginning of year capital. High discretionary accruals, $HIGHDACCR_{i,t-1}$, is a dummy equal to one if the firm has discretionary accruals in the top 20th percentile, and zero otherwise. High equity issuance activity, $HIGHEQISSUE_{i,t-1}$, is a dummy equal to one if the firm has equity issuance in the top 25th percentile, and zero otherwise. For a description of all the variables see the legend of Table 1. Column (1) shows results for the firm-years in the subperiod, 1995-2000. Column (2) shows results for the firm-years in the subperiod, 1998-2000. Column (3) shows results for the firms that have below-median R&D intensity. Column (4) shows results for those firms that have above-median R&D intensity. Column (5) shows results for those firms that have below-median firm share turnover. Column (6) shows results for those firms that have above-median firm share turnover. We calculate medians on a year by year basis. All regressions include firm and year fixed effects. The standard errors reported in parentheses are corrected for clustering of the residual at the year level. Coefficients starred with one, two, and three asterisks are statistically significant at the ten, five, and one percent level respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
$EQISSUE_{i,t}$	0.0187***	0.0026	0.0210***	0.0279***	0.0224***	0.0493***
	(0.0055)	(0.0062)	(0.0039)	(0.0057)	(0.0039)	(0.0092)
$Q_{i,t-1}$	0.0566***	0.0517***	0.0534***	0.0432***	0.0177***	0.0283***
	(0.0063)	(0.0032)	(0.0104)	(0.0066)	(0.0056)	(0.0047)
$CF_{i,t-1}/K_{i,t-2}$	0.0403***	0.0245	0.0974***	0.0646***	0.0874***	0.1572***
	(0.0138)	(0.0245)	(0.0135)	(0.0158)	(0.0228)	(0.0257)
Observations	8346	4327	8631	8558	11784	11301
R-squared	0.563	0.668	0.454	0.543	0.328	0.406

Table 6:

Momentum and Firm Investment

The dependent variable is the proportion of investment over beginning of year capital. For a description this and all the other variables see the legend of Table 1. All regressions include firm and year fixed effects. The standard errors reported in parentheses are corrected for clustering of the residual at the year level. Coefficients starred with one, two, and three asterisks are statistically significant at the ten, five, and one percent level respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$MOM_{i,t-1}$	0.0282***	0.0356***	0.0381***	0.0461***	0.0700***	0.0262***	0.0282***	0.0276***
	(0.0032)	(0.0050)	(0.0052)	(0.0065)	(0.0106)	(0.0030)	(0.0034)	(0.0034)
$IMOM_{i,t-1}$	0.0126***	0.0057**	0.0042*	0.0073**	0.0113***	0.0137***	0.0147***	0.0135***
	(0.0025)	(0.0024)	(0.0024)	(0.0030)	(0.0404)	(0.0026)	(0.0022)	(0.0023)
$Q_{i,t-1}$	0.0532***	0.0508***	0.0460***	0.0419***	0.1345***	0.0606***	0.0467***	0.0476***
	(0.0068)	(0.0084)	(0.0069)	(0.0063)	(0.0241)	(0.0055)	(0.0051)	(0.0054)
$CF_{i,t-1}/K_{i,t-2}$	0.0732***	0.0642***	0.0662***	0.0696***	0.0561***	0.0755***	0.0675***	0.0678***
	(0.0081)	(0.0083)	(0.0089)	(0.0092)	(0.0144)	(0.0087)	(0.0097)	(0.0093)
$E_{t-1}[EARN_{i,t}]/A_{i,t-1}$		0.1071***	0.0805	0.5430**				
		(0.0275)	(0.1603)	(0.2216)				
$E_{t-1}[EARN_{i,t+1}]/A_{i,t-1}$			0.2221	-0.4319				
			(0.2669)	(0.3733)				
$E_{t-1}[EARN_{i,t+4}]/A_{i,t-1}$				0.0132***				
				(0.0035)				
$Q_{i,t}$						0.0060	0.0055	0.0020
						(0.0056)	(0.0048)	(0.0050)
$Q_{i,t-2}$							-0.0061	-0.0026
							(0.0040)	(0.0054)
$Q_{i,t-3}$								-0.0052
								(0.0036)
Observations	53585	25249	24278	20290	20628	51045	43008	39255
R-squared	0.495	0.603	0.611	0.630	0.070	0.495	0.442	0.444

Table 7:

Momentum and Firm Investment: Cross-Sectional Analysis

The dependent variable is the proportion of investment over beginning of year capital. For a description of the other variables see the legend of Table 1. Columns (1) and (2) show results for the sample of firms that have negative momentum. Columns (3) and (4) show results for the sub-sample of firms that have positive momentum. Column (5) shows the results only for internet stock firms. Internet stock firms are defined as the firms that have been included in the ISDEX (Internet Stock Index). Column (6) shows results for the firm-years in the subperiod, 1995-2000. Column (7) shows results for the firm-years in the subperiod, 1998-2000. Column (8) shows results for the firms that have below-median R&D intensity. Column (9) shows results for those firms that have above-median R&D intensity. Column (10) shows results for those firms that have below-median firm share turnover. Column (11) shows results for those firms that have above-median firm share turnover. We calculate medians on a year by year basis. All regressions include firm and year fixed effects. The standard errors reported in parentheses are corrected for clustering of the residual at the year level. Coefficients starred with one, two, and three asterisks are statistically significant at the ten, five, and one percent level respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
$MOM_{i,t-1}$	0.0564***	0.0366***	0.0188***	0.0176**	0.2358*	0.0340***	0.0348**	0.0157***	0.0339***	0.0215***	0.0204***
	(0.0084)	(0.0074)	(0.0048)	(0.0086)	(0.1228)	(0.0065)	(0.0147)	(0.0056)	(0.0057)	(0.0049)	(0.0037)
$IMOM_{i,t-1}$	0.0111***	0.0112***	0.0165***	0.0136***		0.0060	0.0024	0.0046**	0.0170***	0.0094***	0.0115***
	(0.0032)	(0.0029)	(0.0033)	(0.0029)		(0.0051)	(0.0137)	(0.0027)	(0.0049)	(0.0022)	(0.0032)
$Q_{i,t-1}$	0.0733***	0.0336***	0.0397***	0.0342***	0.0271	0.0489***	0.0364***	0.1153***	0.0443***	0.0250***	0.0531***
	(0.0089)	(0.0046)	(0.0050)	(0.0060)	(0.0173)	(0.0111)	(0.0064)	(0.0143)	(0.0066)	(0.0038)	(0.0078)
$CF_{i,t-1}/K_{i,t-2}$	0.0660***	0.0880***	0.0863***	0.1144***	0.0536	0.0434***	0.0206	0.0918***	0.0558***	0.0672	0.1259***
	(0.0093)	(0.0126)	(0.0121)	(0.0241)	(0.0830)	(0.0075)	(0.0169)	(0.0199)	(0.0119)	(0.0124)	(0.0195)
$MOM_{i,t-1} * TURN_{i,t-1}$		-0.0035*		0.0034							
		(0.0018)		(0.0022)							
Observations	30216	15232	23369	12602	121	14069	7136	12086	12067	13957	13877
R-squared	0.539	0.487	0.646	0.451	0.671	0.610	0.746	0.558	0.579	0.469	0.440

Table 8:

Firm-level VAR of risk and return

The table reports the parameter estimates for a firm-level VAR. The model variables include the market-adjusted stock return, $r_{i,t}$ (the first element of the state vector z); the market-adjusted 12-month beta, $\beta_{i,t}^{short}$ (the second element), the market-adjusted beta, $\beta_{i,t}^{long}$, estimated using from 36 to 60 months of data, the market-adjusted log of the firm book-to-market equity, $lnBE/ME_{i,t}$; market-adjusted discretionary accruals, $DACCR_{i,t}$; and market-adjusted equity issuance activity, $EQISSUE_{i,t}$. For a description of the variables see the legend of Table 1. The standard errors reported in parentheses are corrected for clustering of the residual at the year level. Coefficients starred with one, two, and three asterisks are statistically significant at the ten, five, and one percent level respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	r_t	$\beta_{i,t}^{12}$	$\beta_{i,t}^{36-60}$	$B/ME_{i,t}$	$DACCR_{i,t}$	$EQISSUE_{i,tt}$
$r_{i,t-1}$	0.0241	-0.2905***	0.0019	0.0872***	-0.0031	-0.1542*
	(0.0243)	(0.0100)	(0.0059)	(0.0283)	(0.0023)	(0.0264)
$\beta_{i,t-1}^{12}$	0.0056	0.0328**	0.0418***	-0.0057	0.0004	0.0051
	(0.0050)	(0.0141)	(0.0065)	(0.0040)	(0.0016)	(0.0117)
$\beta_{i,t-1}^{36-60}$	-0.0119	0.4110***	0.8006***	0.0161	-0.0067**	-0.0715*
	(0.0220)	(0.0447)	(0.0398)	(0.0198)	(0.0025)	(0.0411)
$lnBE/ME_{i,t-1}$	0.0365	-0.0347	-0.0213**	0.8746***	-0.0082***	-0.0556
	(0.0223)	(0.0322)	(0.0100)	(0.0217)	(0.0017)	(0.0347)
$DACCR_{i,t-1}$	-0.1021**	0.0042	-0.0016	-0.0081	0.0202***	0.6140***
	(0.0423)	(0.0637)	(0.0199)	(0.0267)	(0.0293)	(0.0872)
$EQISSUE_{i,t-1}$	-0.0021	0.0290	-0.0736***	0.1248***	-0.0064	0.5408***
	(0.0081)	(0.0822)	(0.0260)	(0.0084)	(0.0021)	(0.0691)
$r_{i,t-2}$	-0.0030	0.0369	0.0127	0.0729***	0.0225***	0.2398***
	(0.0221)	(0.0379)	(0.0153)	(0.0171)	(0.0052)	(0.0404)
$r_{i,t-3}$	-0.0166	0.0642	0.0255	0.0547**	0.0002	0.1722***
	(0.0171)	(0.0494)	(0.0167)	(0.0203)	(0.0019)	(0.0152)
$r_{i,t-4}$	-0.0160	0.0053	0.0098	0.0286**	-0.0039	0.2392***
	(0.0147)	(0.0240)	(0.0123)	(0.0106)	(0.0025)	(0.0293)
$r_{i,t-5}$	-0.0178	0.0571**	0.0025	0.0216*	-0.0100**	-0.2303***
	(0.0153)	(0.0270)	(0.0123)	(0.0118)	(0.0036)	(0.0325)
Observations	45440	45440	45440	45440	45440	45440
R-squared	0.005	0.057	0.749	0.704	0.028	0.552

Table 9:

Mispricing and Firm Investment

The dependent variable is the proportion of investment over beginning of year capital. $MISPRICING_{i,t}$ is the mispricing metric derived from the firm-level VAR model of Table 8 and described in the text. All the other variables are described in the legend of Table 1. All regressions include firm and year fixed effects. The standard errors reported in parentheses are corrected for clustering of the residual at the year level. Coefficients starred with one, two, and three asterisks are statistically significant at the ten, five, and one percent level respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$MISPRICING_{i,t}$	0.2124***	0.2102***	0.2229***	0.2221***	0.1535***	0.1464***	0.1542***
	(0.0288)	(0.0286)	(0.0294)	(0.0296)	(0.0312)	(0.0275)	(0.0278)
$Q_{i,t-1}$	0.0390***	0.0376***	0.0437***	0.0440***	0.0394***	0.0398***	0.0383***
	(0.0048)	(0.0062)	(0.0060)	(0.0059)	(0.0043)	(0.0047)	(0.0075)
$CF_{i,t-1}/K_{i,t-2}$	0.0909***	0.0910***	0.0914***	0.0914***	0.0652***	0.0611***	0.0641***
	(0.0146)	(0.0146)	(0.0146)	(0.0146)	(0.0083)	(0.0080)	(0.0108)
$Q_{i,t}$		0.0026	-0.0009	-0.0004			
		(0.0051)	(0.0058)	(0.0057)			
$Q_{i,t-2}$			-0.0209***	-0.0169**			
			(0.0052)	(0.0068)			
$Q_{i,t-3}$				-0.0084			
				(0.0071)			
$E_{t-1}[EARN_{i,t}]/A_{i,t-1}$					0.3145***	0.4774***	0.4610***
					(0.0955)	(0.1344)	(0.1626)
$E_{t-1}[EARN_{i,t+1}]/A_{i,t-1}$						-0.0984	-0.1310
						(0.1814)	(0.2105)
$E_{t-1}[EARN_{i,t+4}]/A_{i,t-1}$							0.0060
							(0.0062)
Observations	23347	23347	23347	23347	12914	12520	10787
R-squared	0.460	0.460	0.461	0.461	0.587	0.608	0.576

Table 10:

Investment and future stock returns

The table reports the results from Fama-MacBeth cross-sectional monthly stock return regressions. The independent variables include investment over beginning of year capital, Tobin's Q, cash flow, book-to-market equity, firm size, price momentum, discretionary accruals, and equity issuance. For a description of the variables see the legend of Table 1. Columns (1), (2), and (9) show results for the whole sample. Column (3) shows results for the firms that have below-median research and development intensity. Column (4) shows results for those firms that have above-median research and development intensity. Column (5) shows results for the firms that have below-median firm share turnover. Column (6) shows results for those firms that have above-median firm share turnover. Column (7) shows results for the firms that have below-median values of the Kaplan-Zingales index of financial constraints, defined in appendix II. Column (8) shows results for those firms that have above-median values of the KZ index. Standard errors are reported in parentheses. Coefficients starred with one, two, and three asterisks are statistically significant at the ten, five, and one percent level respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
intercept	1.1561***	3.2108***	2.7542***	3.9667***	1.9802***	3.0249***	2.7679***	3.7459***	3.7119***
	(0.3109)	(0.6949)	(0.7680)	(0.8771)	(0.6625)	(0.7845)	(0.6639)	(0.7248)	(0.7449)
$\ln I_{i,t-1}/K_{i,t-2}$	-0.1579***	-0.1372***	-0.1058	-0.2489***	-0.0670	-0.1151***	-0.1182***	-0.1624***	-0.0702*
	(0.0399)	(0.0342)	(0.0794)	(0.0887)	(0.0417)	(0.0491)	(0.0451)	(0.0417)	(0.0385)
$\ln Q_{i,t-1}$	-0.4161***	0.3061***	0.2219	0.1909	0.3818**	-0.0970	0.2946	-0.0307	0.1055
	(0.1067)	(0.1131)	(0.2723)	(0.2355)	(0.1882)	(0.1664)	(0.2008)	(0.1663)	(0.1355)
$\ln CF_{i,t-1}/K_{i,t-2}$	0.0714*	0.0179	0.0310	-0.1420	-0.0266	0.0193	-0.0089	0.0413	-0.0089
	(0.0389)	(0.0318)	(0.1315)	(0.1737)	(0.0640)	(0.0512)	(0.0733)	(0.1030)	(0.0404)
$\ln ME_{i,t-1}$		-0.1900***	-0.1447***	-0.2351***	-0.0901**	-0.1755***	-0.1400***	-0.2488***	-0.2044***
		(0.0474)	(0.0514)	(0.0588)	(0.0451)	(0.0518)	(0.0440)	(0.0518)	(0.0525)
$\ln BE/ME_{i,t-1}$		0.3541***	0.5003***	0.2643	0.2888***	0.1681	0.3443**	0.2199**	0.1625*
		(0.0762)	(0.1815)	(0.1893)	(0.1183)	(0.1033)	(0.1518)	(0.0995)	(0.0867)
$\ln MOM_{i,t-1}$		0.9665***	0.8603***	0.7332***	0.7992***	1.2381***	0.9160***	0.9153***	0.7033***
		(0.1840)	(0.2472)	(0.2457)	(0.2115)	(0.2066)	(0.1977)	(0.1939)	(0.2036)
$DACCR_{i,t-1}$									-0.6917***
									(0.2678)
$EQISSUE_{i,t-1}$									-0.1814
									(0.1490)

Figure 1: Histogram of the mispricing metric