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The *q*-Theory Approach to Understanding the Accrual Anomaly

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ABSTRACT

Interpreting accruals as working capital investment, we hypothesize based on *q*-theory that firms optimally adjust their accruals in response to discount rate changes. A higher discount rate means less profitable investments and lower accruals, and a lower discount rate means more profitable investments and higher accruals. Our evidence supports this optimal investment hypothesis: (1) adding an investment factor into standard factor regressions substantially reduces the magnitude of the accrual anomaly, often to insignificant levels; (2) accruals covary negatively with discount rate estimates from the dividend discounting model, and for the most part, with estimates from the residual income model; (3) accruals with low accounting reliability covary more with capital investment than accruals with high accounting reliability; and (iv) expected returns to accruals-based trading strategies are time-varying, suggesting that the deterioration of the accrual effect in recent years might be temporary and likely to mean-revert in the near future.

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1. Introduction

In a path-breaking article, Sloan [1996] documents that firms with high accruals earn abnormally lower returns on average than firms with low accruals, and interprets the evidence as investors overestimating the persistence of the accrual component of earnings when forming earnings expectations. These naive investors are systematically surprised later when realized earnings of high accrual firms fall short of, and those of low accrual firms exceed, prior expectations. Sloan's work has spurred a large literature in capital markets research. Following Sloan, almost all existing explanations for the accrual anomaly assume some form of irrationality (we provide detailed references later).

We take a fundamentally different approach by exploring an optimal investment hypothesis that is potentially consistent with rationality. Interpreting accruals as working capital investment, we hypothesize that firms optimally adjust investments in response to discount rate changes, as predicted by the q-theory of investment (e.g., Tobin [1969], Hayashi [1982], and Cochrane [1991]). When the discount rate falls, more investment projects become profitable, increasing accruals, and future returns decrease on average because the lower discount rate means lower expected returns going forward. When the discount rate rises, fewer investment projects become profitable, decreasing accruals, and future returns increase on average because the higher discount rate means higher expected returns going forward. As a result, accruals negatively predict future returns. We empirically test this optimal investment explanation from four different angles.

Factor Regressions. If investment drives the accrual effect, controlling for investment should substantially reduce the magnitude of the accrual anomaly. Using the Fama and French [1993] portfolio approach, we find that adding an investment factor (long in low-investment stocks and short in high-investment stocks) into the capital asset pricing model (CAPM) and the Fama–French three-factor regressions reduces Sloan's [1996] total accruals and Xie's [2001] discretionary accruals anomalies by more than 50% and Hirshleifer et al.'s [2004] net operating assets anomaly by more than 60%. We also find that the spread in investment dominates the spread in return-on-assets (*ROA*) in magnitude across extreme portfolios formed on the three measures of accruals, suggesting that investment is probably more important than earnings in driving the accrual anomaly.

Discount Rate Estimates. If the accrual effect results from the negative relation between investment and the discount rate, accruals should covary negatively with ex ante estimates of the discount rate. Following Blanchard [1993] and Fama and French [2002], we use dividend growth rates to measure expected rates of capital gain to estimate the discount rates for accrual portfolios. We find that high accrual firms have reliably lower ex ante discount rates than low accrual firms. For example, the low total accrual quintile has a high discount rate of 8.1% per annum, whereas the high total accrual quintile has a low discount rate of 2.2%, and the spread of 5.9% is more than 10 standard errors from zero. Using the estimates from the residual income model per Gebhardt, Lee, and Swaminathan [2001] yields somewhat weaker results. Low total accrual firms have higher discount rates than high total accrual firms: 9.76% versus 9.11% per annum, and the spread of 0.65% is more than four standard errors from zero. However, the magnitude of the discount rate spread is too small relative to the spread in average ex post returns. The discount rate spread across extreme net operating assets quintiles is 0.54% per annum, which is about four standard errors from zero. But the discount rate spread across extreme discretionary accrual quintiles is close to zero.

Accounting Reliability. Richardson et al. [2005] develop a comprehensive categorization of accruals and rank each category based on its accounting reliability, and show that less reliable accruals lead to lower earnings persistence and more mispricing. We argue that less reliable accruals are more correlated with investment than more reliable accruals. Intuitively, the less reliable change in non-cash working capital and change in net noncurrent operating assets represent direct forms of investment in short-term and long-term capital, respectively, and should covary more with investment. In contrast, because of its diverse components, including short-term and long-term marketable securities and financial liability, the more reliable change in net financial assets should be less correlated with investment. As such, we hypothesize that the negative relation between accounting reliability and the magnitude of the accrual effect is likely driven by the inverse relation between investment and the discount rate. Consistent with this prediction, we document that less reliable accruals are indeed more correlated with investment than more reliable accruals; that controlling for investment in factor regressions substantially reduces the predictive power of less reliable accruals for future returns but less so for more reliable accruals; and that less reliable accruals also covary more with ex ante discount rates than more reliable accruals.

Predictability. Finally, we document some evidence that returns to zero-cost accruals-based trading strategies are predictable. Building on the recent development in the time series predictability literature in finance (e.g., Bollerslev, Tauchen, and Zhou [2009]), we document that the variance risk premium, defined as the difference between implied and realized variance of the S&P 500 index, explains a significant fraction of the variation of returns to accruals-based trading strategies. The predictive R^2s up to 8.8% in quarterly horizon and 11.5% in annual horizon are comparable with those from forecasting market excess returns. Across different forecasting horizons from 1 to 24 months, the slopes of the variance premium are universally positive and mostly significant. Predictive regressions with more traditional conditioning variables such as the term premium, the relative Treasury bill rate, and the default premium yield somewhat weaker results. On balance, however, the overall evidence suggests that expected returns to accruals-based trading strategies are time-varying (and countercyclical), and that the deterioration of the accrual effect in recent years is temporary and likely to mean-revert in the near future.

The current literature has traditionally interpreted the accrual anomaly as driven by mispricing. One line of research follows Sloan [1996] in linking accruals to earnings persistence and mispricing from earnings expectational errors (e.g., Xie [2001], Barth and Hutton [2004], Richardson et al. [2005]). A more recent line of research links accruals to investment and growth and argues that investors overreact to past growth, failing to account for its unsustainability (e.g, Thomas and Zhang [2002], Fairfield, Whisenant, and Yohn [2003], Hirshleifer et al. [2004], Bradshaw, Richardson, and Sloan [2006], and Dechow, Richardson, and Sloan [2008]).

As a fundamental departure from the current literature, our explanation does not assume any form of irrationality. Building on recent development in investment-based asset pricing theories in finance (e.g., Cochrane [1991, 1996], Berk, Green, and Naik [1999], and Zhang [2005]), we use a simple q-theory model to formalize the optimal investment hypothesis. In particular, we show analytically that in the presence of either diminishing returns to scale or adjustment costs of long-term capital, accruals will respond negatively to changes in the discount rate. To the best of our knowledge, this theoretical insight is new to the investment-based asset pricing literature.

Our empirical work builds on the growing literature documenting that, similar to investment in fixed assets, accruals as changes in working capital represent one direct form of investment and are an integral part of firms' business growth (e.g., Stickney, Brown, and Wahlen [2003, Chapter 3], Bushman, Smith, and Zhang [2006], and Zhang [2007]). In particular, Zhang documents that accruals covary positively with employee growth, external financing, and other aspects of corporate growth. Our empirical work also adds to the body of evidence showing the importance of investment in driving capital markets anomalies (e.g., Anderson and Garcia-Feijóo [2006], Cooper, Gulen, and Schill [2008], Lyandres, Sun, and Zhang [2008], Xing [2008], and Chen and Zhang [2009]). Compared to other anomalies, the accrual anomaly is arguably a better setting to test investment-based theories because, as noted, accruals are a direct form of investment.

We view our work as providing an intuitive, economics-based framework that accommodates most empirical evidence in the accrual anomaly literature. Although our tests are informative, we recognize that distinguishing rational from behavioral explanations of the accrual anomaly is virtually impossible. The fundamental contribution of Sloan [1996] has fascinated the profession for one and a half decades. We do not intend to refute Sloan's earnings fixation hypothesis, which we regard as quite plausible. Instead, we interpret our work as providing at least some hope for rational forces in explaining the accrual anomaly. The world is gray and complex. As such, we echo the view of Dechow, Richardson, and Sloan [2008, p. 564]: "An alternative interpretation is that accruals measure changes in invested capital and changes in invested capital are associated with diminishing marginal returns to new investment (and related overinvestment). Note that these alternative interpretations are not mutually exclusive and probably coexist."

Section 2 develops our testable hypotheses. Section 3 describes our data. We present our main results in section 4, discuss several remaining issues in section 5, and conclude in section 6.

2. *Hypothesis Development*

We first derive the negative relation between accruals and the discount rate in a simple model. Based on the model's predictions, we develop testable hypotheses to guide our subsequent empirical work.

2.1 A SIMPLE MODEL

We incorporate working capital investment into the two-period q-theory setup in Li, Livdan, and Zhang [2008]. We use accruals and working capital investment interchangeably. Kaplan and Zingales [1997] use a similar setup to derive theoretical implications of financial constraints on corporate investment. The setup is deliberately designed to be simple (and analytically tractable), but the central economic mechanisms should subsist in more realistic, dynamic models.

There are two periods, 1 and 2. Firms use both long-term fixed capital and short-term working capital in their production. Firm j's operating profits are given by $k_{jt}^{\alpha} w_{jt}^{\beta}$, for $t = 1, 2$, in which k_{jt} is firm j's long-term capital and w_{jt} is the firm's working capital at the beginning of time t. We assume α, $\beta > 0$ and $\alpha + \beta < 1$. The last inequality captures decreasing returns to scale, meaning that a proportional increase in productive inputs causes operating profits to increase by a smaller proportion. Intuitively, firms grow by taking more investment projects, and because better projects are undertaken first, subsequent projects only increase operating profits at a lower rate. Alternatively, because managerial and organizational resources are limited, large multi-unit firms are harder to manage than small single-unit firms due to increasing costs of coordination (e.g., Lucas [1978]).

The long-term capital, k_{j1}, depreciates at a rate of δ, meaning $k_{j2} = i_j + (1 - \delta) k_{j1}$, in which i_j is firm j's long-term capital investment over period 1. To keep things simple, we assume that working capital is used up completely within one period, meaning that the stock of working capital at the beginning of time 2, w_{j2}, equals the working capital investment over period 1. There are no adjustment costs for either long-term or working capital (we relax this assumption for long-term capital later). Firm j has a gross discount rate, denoted r_j. The discount rate varies across firms due to, for example, firm-specific loadings on macroeconomic risk factors.

Firm j chooses k_{j2} and w_{j2} to maximize the market value of the firm at the beginning of period 1:

$$\max_{\{k_{j2}, w_{j2}\}} v_j \equiv k_{j1}^{\alpha} w_{j1}^{\beta} - (k_{j2} - (1 - \delta) k_{j1}) - w_{j2} + \frac{1}{r_j}\left(k_{j2}^{\alpha} w_{j2}^{\beta} + (1 - \delta) k_{j2}\right). \tag{1}$$

The objective function, v_j, is the firm's market value at the beginning of period 1, which is the sum of period 1's free cash flow, $k_{j1}^{\alpha} w_{j1}^{\beta} - (k_{j2} - (1 - \delta) k_{j1}) - w_{j2}$, and the present value of period 2's cash flow, $(k_{j2}^{\alpha} w_{j2}^{\beta} + (1 - \delta)\, k_{j2})/r_j$. Because the model has only two periods, the firm does not invest in the second period, meaning that period 2's cash flow is simply the sum of the operating profits and the liquidation value of the long-term capital.

The tradeoff for the firm when making investment decisions is simple: Investing means foregoing free cash flows today in exchange for higher cash flows tomorrow. Optimality means equating marginal cost with marginal returns to investment. Formally, taking the first-order derivatives of v_j with respect to k_{j2} and w_{j2} and setting them to zero yield the first-order conditions (we suppress the firm index j for notational simplicity):

$$r = \alpha k_2^{\alpha-1} w_2^{\beta} + 1 - \delta \tag{2}$$

$$r = \beta k_2^{\alpha} w_2^{\beta-1}. \tag{3}$$

The marginal cost of investing in either long-term capital or working capital is one: The prices of both capital goods are normalized to be one. Equation (1) says that increasing i or w_2 by \$1 costs period 1's free cash flow by \$1, which has a future value of r in period 2. Therefore, the discount rate, r, in the left-hand side of equations (2) and (3) is the marginal cost (measured in period 2's dollar terms) of investing in either long-term capital or working capital. The right-hand sides of equation (2) and (3) are the marginal returns to long-term capital and working capital investments, respectively, both of which are measured in period 2's dollar terms. Intuitively, the first-order conditions say that the marginal returns to investment in long-term capital and in working capital should both be equal to the discount rate, which is the marginal cost of investment.

We are interested in knowing how working capital investment responds to changes in the discount rate. To this end, we solve for k_2 from equation (3) and plug it into equation (2) to obtain:

$$r = \alpha \beta^{\frac{1-\alpha}{\alpha}} r^{\frac{\alpha-1}{\alpha}} w_2^{\frac{\alpha+\beta-1}{\alpha}} + 1 - \delta. \tag{4}$$

Implicitly differentiating both sides with respect to w_2 and solving for dr/dw_2 yields:

$$\frac{dr}{dw_2} = \frac{(\alpha + \beta - 1)\beta^{\frac{1-\alpha}{\alpha}} r^{\frac{\alpha-1}{\alpha}} w_2^{\frac{\beta-1}{\alpha}}}{1 + (1-\alpha)\beta^{\frac{1-\alpha}{\alpha}} w_2^{\frac{\alpha+\beta-1}{\alpha}} r^{-\frac{1}{\alpha}}} < 0. \tag{5}$$

The inequality holds because of decreasing returns to scale ($\alpha + \beta < 1$).

To understand how long-term capital investment responds to changes in the discount rate, we need to sign dr/di. We solve for w_2 from equation (3) and plug it into equation (2) to yield:

$$r = \alpha \beta^{\frac{\beta}{1-\beta}} r^{\frac{\beta}{\beta-1}} (i + (1-\delta) k_1)^{\frac{\alpha+\beta-1}{1-\beta}} + 1 - \delta. \tag{6}$$

Implicitly differentiating both sides with respect to i and solving for dr/di yields:

$$\frac{dr}{di}=\frac{\alpha(\alpha+\beta-1)\beta^{\frac{\beta}{1-\beta}}r^{\frac{\beta}{\beta-1}}k_2^{\frac{\alpha+2\beta-2}{1-\beta}}}{1-\beta+\alpha\beta^{\frac{1}{1-\beta}}r^{\frac{1}{\beta-1}}k_2^{\frac{\alpha+\beta-1}{1-\beta}}}<0. \tag{7}$$

The inequality again holds because of decreasing returns to scale. To summarize:

PROPOSITION 1. *In the presence of decreasing returns to scale, both long-term capital and working capital investments respond negatively to changes in the discount rate.*

Intuitively, more investments reduce marginal returns to investment, which mean lower discount rates (expected returns) because, according to the first-order conditions, firms will keep investing until the marginal returns to investment decrease to the level of the discount rate. This q-theory insight formalizes the intuition articulated by Thomas and Zhang [2002], Fairfield, Whisenant, and Yohn [2003], and Dechow, Richardson, and Sloan [2008]. The news is that neither investor overreaction to past growth nor managerial overinvestment is necessary: Optimal investment alone gives rise to the negative relation between investment and expected returns.

The corporate investment literature and the more recent investment-based asset pricing literature typically assume that adjusting long-term capital is costly (e.g., Cochrane [1991] and Zhang [2005]). Incorporating adjustment costs reinforces the negative accruals–discount rate relation. To see this point, we adopt the standard quadratic adjustment costs for long-term capital as in Cochrane, $(a/2)(i/k_1)^2k_1$, in which $a>0$. The adjustment costs are increasing and convex in i, but are decreasing in k_1 (economy of scale). Adjusting working capital remains costless. The objective function of firm j becomes (we continue to suppress the firm index j):

$$\begin{aligned}\max_{\{k_2,w_2\}}\ & k_1^{\alpha}w_1^{\beta}-(k_2-(1-\delta)k_1)-w_2-\frac{a}{2}\left(\frac{k_2}{k_1}-(1-\delta)\right)^2k_1\\ &+\frac{1}{r}\left(k_2^{\alpha}w_2^{\beta}+(1-\delta)k_2\right).\end{aligned} \tag{8}$$

The first-order conditions with respect to k_2 and w_2 are given by, respectively:

$$r\left(1+a\left(\frac{k_2}{k_1}-(1-\delta)\right)\right)=\alpha k_2^{\alpha-1}w_2^{\beta}+1-\delta \tag{9}$$

$$r=\beta k_2^{\alpha}w_2^{\beta-1}. \tag{10}$$

Solving for k_2 from equation (10) and plugging it into equation (9) yields:

$$r\left(1+a\left(\frac{r^{\frac{1}{\alpha}}\beta^{-\frac{1}{\alpha}}w_2^{\frac{1-\beta}{\alpha}}}{k_1}-1+\delta\right)\right)=\alpha\beta^{\frac{1-\alpha}{\alpha}}r^{\frac{\alpha-1}{\alpha}}w_2^{\frac{\alpha+\beta-1}{\alpha}}+1-\delta. \tag{11}$$

Implicitly differentiating both sides with respect to w_2 and solving for dr/dw_2, we obtain:

$$\frac{dr}{dw_2} = \frac{(\alpha+\beta-1)\beta^{\frac{\alpha-1}{\alpha}} r^{\frac{\alpha-1}{\alpha}} w_2^{\frac{\beta-1}{\alpha}} + a\left(\frac{\beta-1}{\alpha}\right)\beta^{-\frac{1}{\alpha}} r^{\frac{1+\alpha}{\alpha}} w_2^{\frac{1-\alpha-\beta}{\alpha}}}{1+a\left(\frac{k_2}{k_1}-(1-\delta)\right)+\frac{a}{\alpha k_1}\beta^{-\frac{1}{\alpha}} r^{\frac{1}{\alpha}} w_2^{\frac{1-\beta}{\alpha}} + (1-\alpha)\beta^{\frac{1-\alpha}{\alpha}} r^{-\frac{1}{\alpha}} w_2^{\frac{\alpha+\beta-1}{\alpha}}} < 0. \tag{12}$$

The inequality holds because of decreasing returns to scale and the existence of adjustment costs ($a > 0$). The news is that even with constant returns to scale ($\alpha + \beta = 1$), dr/dw_2 is negative because $a > 0$ means that the second term in the numerator of equation (12) is negative.

Using a similar line of argument yields a similar result for dr/di:

$$\frac{dr}{di} = \frac{\alpha(\alpha+\beta-1)\beta^{\frac{\beta}{1-\beta}} r^{\frac{\beta}{\beta-1}} k_2^{\frac{\alpha+2\beta-2}{1-\beta}} - a(1-\beta)r/k_1}{(1-\beta)[1+a(k_2/k_1-(1-\delta))]+\alpha\beta^{\frac{1}{1-\beta}} r^{\frac{1}{\beta-1}} k_2^{\frac{\alpha+\beta-1}{1-\beta}}} < 0. \tag{13}$$

Again, even with constant returns to scale, $dr/di < 0$ because $a > 0$. To summarize:

PROPOSITION 2. *In the presence of either decreasing returns to scale or adjustment costs of long-term capital, investments in long-term capital and working capital both respond negatively to changes in the discount rate.*

The intuition behind the effect of adjustment costs on the negative relation between long-term capital investment and the discount rate is well-known from the investment-based asset pricing literature (e.g., Cochrane [1991] and Li, Livdan, and Zhang [2008]). From equation (9):

$$1 + a\left(\frac{i}{k_1}\right) = \frac{\alpha k_2^{\alpha-1} w_2^{\beta} + 1 - \delta}{r}, \tag{14}$$

meaning that the marginal cost of long-term capital investment (the left-hand side) equals the marginal return (the right-hand side), and both sides are measured in period 1's dollar terms. In the language of Brealey, Myers, and Allen [2006], equation (14) says that investment increases with the net present values of new projects, and that these present values are inversely related to the discount rate of the new projects, given their expected cash flows (the numerator of the right-hand side). A high discount rate means low net present values, which in turn mean low investment, and a low discount rate means high net present values, which in turn mean high investment.

More important, Proposition 2 offers a (somewhat surprising) new insight: The relation between working capital investment and the discount rate is negative as long as adjusting long-term capital is costly. Decreasing marginal returns to investment, envisioned by Fairfield, Whisenant, and Yohn [2003] and Dechow, Richardson, and Sloan [2008], and working capital adjustment costs (our prior) are both unnecessary. Intuitively, long-term capital and working capital are complementary inputs in the production process, meaning that when firms optimally increase long-term capital in response to a falling discount rate, working capital rises simultaneously.[1]

By analyzing the value-maximization problem of firms, our investment-based approach allows us to link the discount rate endogenously to firm characteristics such as working capital investment. The basic question is: Suppose that the discount rate varies across firms and that firms behave optimally, what differences in firm characteristics should we expect to see across these firms? As such, this approach derives unobservable risk and expected returns from observable firm characteristics. Strictly speaking, the discount rate and characteristics are determined simultaneously in general equilibrium, but general equilibrium models are analytically intractable. To fix the intuition, we therefore have followed Cochrane [1991], Berk, Green, and Naik [1999], and Zhang [2005] in using a partial equilibrium model, in which the discount rate appears “exogenous.”

In the model the capital market participants are managers and shareholders (no agency costs). Managers have rational expectations when forming their conditional expectations about future prices. The frictions that lead to the cross-sectional heterogeneity in the discount rate discussed in this section include diminishing returns to scale and capital adjustment costs. Our analysis of the production side of the economy is important because risk and expected returns cannot be separated from the operating, investing, and (perhaps) financing activities of firms in general equilibrium. Our theoretical analysis crystalizes the interaction between expected returns and accounting variables.

In contrast, traditional asset pricing literature derives asset pricing implications from consumers’ utility-maximization problem, which forms the other partial equilibrium that complements the q-theory framework in general equilibrium. Because the consumption-based approach simplifies firms as exogenous cash flow processes, it is largely silent on how risk and expected returns are connected with accounting variables. In particular, accruals are not modeled in the mean-variance framework of the CAPM or any consumption-based asset pricing models.

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[1] Adjusting working capital is likely to be costly. For example, costs in changing inventories can arise from costs of production, costs of changing production, and inventory holding and stock-out costs (e.g., Ramey and West [1999]). Stock-out costs arise when sales exceed the stock on hand, resulting in lost sales and delayed payment if orders are backlogged. Unfortunately, incorporating adjustment costs for both capital goods makes the derivations of dr/dw_2 and dr/di analytically intractable even in a simple two-period setup. However, the basic insight on the negative relation between working capital investment and the discount rate is unlikely to change. Building on Zhang [2005], Bazdresch, Belo, and Lin [2008] solve a dynamic investment-based asset pricing model with two costly adjustable productive inputs (capital and labor). Their simulation results show that, under plausible parameter values, both capital investment and labor hiring are negatively correlated with future returns in the cross section.

2.2 TESTABLE HYPOTHESES

Based on the model's predictions, we develop four testable hypotheses to guide our empirical tests.

2.2.1. Factor Regressions. If the accrual effect is driven by the negative investment-discount rate relation, controlling for investment should substantially attenuate the accrual anomaly.

Hypothesis 1: Adding the investment factor into standard factor regressions such as the CAPM and the Fama–French three-factor regressions should substantially reduce the magnitude of abnormal returns (alphas) earned by accruals-based trading strategies.

2.2.2. Discount Rate Estimates. Estimating the discount rate with measures other than average ex post returns should reveal:

Hypothesis 2: Firms with high accruals should have lower ex ante estimates of the discount rate than firms with low accruals.

2.2.3. Accounting Reliability. We also examine whether the negative investment-discount rate relation can explain Richardson et al.'s [2005] evidence that the magnitude of the accrual anomaly is stronger for less reliable accruals than for more reliable accruals. Specifically, we test:

Hypothesis 3: Less reliable accruals should covary more with investment than more reliable accruals; adding the investment factor into standard factor regressions should substantially reduce the magnitude of alphas earned by zero-cost trading strategies formed on less reliable accruals; and less reliable accruals should covary more with ex ante estimates of the discount rate than more reliable accruals.

To see why less reliable accruals should covary more with investment than more reliable accruals, we review Richardson et al.'s [2005] categorization of accruals. The initial decomposition has three broad categories: the change in non-cash working capital (ΔWC), the change in net noncurrent operating assets (ΔNCO), and the change in net financial assets (ΔFIN):

$$\text{Accruals} = \Delta WC + \Delta NCO + \Delta FIN. \tag{15}$$

All components are deflated by average total assets. Richardson et al. [2005] assign a reliability rating of medium to ΔWC, a low-to-medium rating to ΔNCO, and a high rating to ΔFIN.

In equation (15), ΔWC is the change in current operating assets, net of cash and short-term investments, less the change in current operating liabilities, net of short-term debt. ΔWC is close to the traditional accrual measure used by Sloan [1996]. Richardson et al. [2005] conduct an extended accrual decomposition that further decomposes ΔWC into its underlying assets (ΔCOA) and liability (ΔCOL) components:

$$\Delta WC = \Delta COA - \Delta COL. \tag{16}$$

The major assets within current operating assets, COA, are accounts receivable and inventories, both of which are short-term working capital. To sustain high business growth, high-investment firms are likely to generate high accounts receivable and high inventories. We therefore assess the correlation between ΔCOA and real investment to be high. The major liability driving ΔCOL is accounts payable, which are financial obligations to suppliers. On the one hand, fast growth in high-investment firms tends to produce high accounts payable, which serve as a source of financing for working capital. On the other hand, unlike ΔCOA, accounts payable do not represent a direct form of investment. As such, we assign the correlation between ΔCOL and investment to be medium-to-high.

In the initial decomposition ΔNCO is the noncurrent operating accruals measured as the change in noncurrent assets, net of long-term nonequity investments and advances, less the change in noncurrent liabilities, net of long-term debt. Richardson et al. [2005] decompose ΔNCO into its underlying assets ($\Delta NCOA$) and liabilities ($\Delta NCOL$) components:

$$\Delta NCO = \Delta NCOA - \Delta NCOL. \tag{17}$$

The major components of $NCOA$ are property, plant, and equipment ($PP\&E$) and intangibles. Changes in $PP\&E$ represent a direct form of investment in long-term fixed capital. It also is reasonable to conjecture that intangibles and other more tangible forms of capital are complementary inputs in firms' operating process. As such, investment in intangibles and investment in tangible capital goods should be positively correlated (see Proposition 2 and its related discussion in section 2.1).

The liability component of ΔNCO, $\Delta NCOL$, includes various liabilities such as long-term payables, deferred taxes, and postretirement benefits. We assess that long-term payables are similar in nature with accounts payable and should have medium-to-high correlations with investment. However, deferred taxes and postretirement benefits mostly result from firms' business activities in the past, and therefore should have low correlations with current investment. Because of its diverse components, we assess the overall correlation between $\Delta NCOL$ and investment to be medium.

The final major category of accruals is the change in net financial assets, ΔFIN, measured as the change in short-term investments and long-term investments less the change in short-term debt, long-term debt, and preferred stock. Following Richardson et al. [2005], we further decompose ΔFIN into its underlying short-term investment (ΔSTI), long-term investment (ΔLTI), and financial liability ($\Delta FINL$) components:

$$\Delta FIN = \Delta STI + \Delta LTI - \Delta FINL. \tag{18}$$

ΔSTI consists of marketable securities that are expected to be converted into cash within one year. We view ΔSTI as temporary cash reserves that are mainly used for daily transactions. As such, we assess its correlation with investment to be low. ΔLTI includes components such as long-term receivables and marketable securities that are expected to be held for more than one year. Long-term receivables should be similar in nature to short-term accounts receivable and, therefore, should have relatively high correlations with investment. However, we view long-term marketable securities as excess cash holdings that have low and potentially even negative correlations with investment. As such, we assess the correlation between ΔLTI and investment to be medium. Financial liabilities, $\Delta FINL$, include debt, capitalized lease obligations, and preferred stock, all of which are sources of financing. Financial liabilities are similar in nature to current operating liabilities, ΔCOL. Rapid growth in high-investment firms has to be funded. As such, $\Delta FINL$ is likely to be high for high-investment firms and low for low-investment firms, and we assess the correlation between $\Delta FINL$ and investment to be high.

Table 1 lists assessments of correlation with investment for both the initial and the extended decompositions of accruals. The table format is borrowed from Richardson et al. [2005, table 2]. The assessments for the initial decomposition represent a synthesis of the assessments for the categories from the extended decomposition. We assign the correlation between ΔWC and investment to be medium-to-high because it combines ΔCOA (with high investment covariation) and ΔCOL (with medium investment covariation). We also assign the correlation between ΔNCO and investment to be medium-to-high because it combines $\Delta NCOA$ (with high investment covariation) and $\Delta NCOL$ (with medium investment covariation). We assess the correlation between ΔFIN and investment to be medium because ΔFIN combines ΔSTI, ΔLTI, and $\Delta FINL$ with low, medium, and high investment covariation, respectively. The bottom line is that ΔWC and ΔNCO represent direct forms of investment and should covary more with investment, and that ΔFIN contains more diverse components and should covary less with investment.

2.2.4. Predictability. Green, Hand, and Soliman [2009] document that returns to trading strategies based on Sloan's [1996] accrual anomaly have decayed in the U.S. markets to the point that the average returns are no longer positive. The authors suggest that large sophisticated hedge funds have successfully arbitraged the anomaly away, thereby causing the markets to be more efficient. Motivated by similar evidence on the size and value anomalies, Schwert [2003] also argues that the activities of arbitrageurs who implement trading strategies to exploit these anomalies can cause them to disappear. While this learning hypothesis is plausible, we propose and test an alternative hypothesis, which says that returns to accruals-based trading strategies are predictable, and that this predictability reflects aggregate economic conditions.

TABLE 1

Summary of Assessments of Correlation with Real Investment by Accrual Category

Accrual Category	Decomposition Level	Reliability Assessment	Assessment of Correlation with Investment	Summary of Reasoning Behind Correlation Assessment
ΔCOA	Extended	Low	High	Category is dominated by receivables and inventory, both of which are short-term working capital.
ΔCOL	Extended	High	Medium/high	Category is dominated by accounts payable, which are financial obligations to suppliers. Fast growth in high-investment firms likely produces high accounts payable.
ΔWC	Initial	Medium	Medium-to-high/high	ΔCOA has high and ΔCOL has medium correlations with investment.
$\Delta NCOA$	Extended	Low	High	Category is dominated by *PP&E* and intangibles. *PP&E* is long-term fixed capital, and if *PP&E* and intangibles are complementary inputs in production, their changes are likely to be highly correlated.
$\Delta NCOL$	Extended	Medium	Medium-to-high	Category includes long-term payables (with medium to high correlations with investment), deferred taxes, and postretirement benefits (with low correlations with investment).
ΔNCO	Initial	Low/medium	Medium/high	Combination of $\Delta NCOA$ (high correlations) and $\Delta NCOL$ (medium correlations).
ΔSTI	Extended	High	Low	Category includes marketable financial securities expected to be sold within 12 months. These are temporary excess cash with low correlations with investment.
ΔLTI	Extended	Medium	Medium	Category includes long-term receivables (high correlations) and marketable securities expected to be held for more than a year (low correlations).
$\Delta FINL$	Extended	High	High	Category includes debt, capitalized lease obligations, and preferred stock, all of which are sources of financing for real investments.
ΔFIN	Initial	High	Medium	Combination of ΔSTI (low correlations), ΔLTI (medium correlations), and $\Delta FINL$ (high correlations).

ΔWC is the change in working capital accruals, $WC_t - WC_{t-1}$. WC is current operating assets (COA) − current operating liabilities (COL) in which COA is current assets (Compustat annual item 4) − cash and short-term investments (STI) (item 1). COL is current liabilities (item 5) − debt in current liabilities (item 34). ΔNCO is $NCO_t - NCO_{t-1}$. NCO is noncurrent operating assets ($NCOA$) − noncurrent operating liabilities ($NCOL$) in where $NCOA$ is total assets (item 6) − current assets (item 4) − investments and advances (item 32). $NCOL$ is total liabilities (item 181) − current liabilities (item 5) − long-term debt (item 9). ΔFIN is $FIN_t - FIN_{t-1}$. FIN is financial assets ($FINA$) − financial liabilities ($FINL$). $FINA$ is short-term investments (STI) (item 193) + long-term investments (LTI) (item 32). $FINL$ is long-term debt (item 9) + debt in current liabilities (item 34) + preferred stock (item 130). The reliability assessments are from Richardson et al. [2005, table 2].

Hypothesis 4: The expected returns to accruals-based trading strategies should be time-varying and countercyclical (high in bad times and low in good times).

We motivate this time-varying risk hypothesis from the theoretical work of Zhang [2005], who studies the cyclical properties of the expected value premium in a dynamic investment-based asset pricing framework. His central prediction is that the expected value premium is countercyclical. Zhang focuses on two important ingredients: costly reversibility and countercyclical price of risk. These ingredients cause value firms to be less flexible than growth firms in scaling down. As such, value firms are riskier than growth firms in bad times when the price of risk is high.

Costly reversibility means that it is more costly for firms to scrap than to expand the scale of productive capital. Because value firms are less profitable than growth firms, value firms want to disinvest more in recessions. Because disinvesting is restricted, the cash flows of value firms are more adversely affected by worsening economic conditions than the cash flows of growth firms. The countercyclical price of risk further reinforces this effect. Because the discount rates are higher in recessions when the price of risk is countercyclical, expected net present values of assets in place are even lower, meaning that value firms want to disinvest even more. As such, value firms are hurt even more in economic downturns. The expected value premium equals the product of the risk spread between value and growth firms and the price of risk, both of which are countercyclical. As a result, the expected value premium is time-varying and countercyclical.[2]

If accruals are linked to investment and growth attributes, firms with high accruals should be similar to growth firms and firms with low accruals should be similar to value firms. This argument seems plausible. Building on Beaver [2002], Desai, Rajgopal, and Venkatachalam [2004] argue that high accrual stocks are glamor stocks with low cash flow-to-price ratios and low accrual stocks are value stocks with high cash flow-to-price ratios. Desai et al. show that after controlling for the cash flow-to-price ratios, future returns are unrelated to accruals. Chen and Zhang [2009] show that investment is the common driving force of a wide range of anomalies, including the value effect of Rosenberg, Reid, and Lanstein [1985].[3] In view of the common link between accruals, value, and investment, we hypothesize that similar to

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[2] Evidence from the conditional asset pricing literature largely supports the notion that the returns to value-minus-growth strategies are predictable (e.g., Pontiff and Schall [1998], Ferson and Harvey [1999], Lettau and Ludvigson [2001], Cohen, Polk, and Vuolteenaho [2003], and Chen, Petkova, and Zhang [2008]).

[3] Besides the value effect, investment also goes a long way in explaining De Bondt and Thaler's [1985] reversal effect, Lakonishok, Shleifer, and Vishny's [1994] sales growth effect, Cooper, Gulen, and Schill's [2008] asset growth effect, Ritter's [1991] and Loughran and Ritter's [1995] net issues puzzle, Ikenberry, Lakonishok, and Vermaelen's [1995] buyback anomaly, and Daniel and Titman's [2006] and Fama and French's [2008] net stock issues effect.

the expected value premium studied by Zhang [2005], the expected returns to accruals-based trading strategies also should be countercyclical.

3. *Data*

Section 3.1 explains sample construction and section 3.2 reports descriptive statistics.

3.1 SAMPLE CONSTRUCTION AND VARIABLE DEFINITIONS

We obtain accruals and other accounting data from the Compustat Annual Industrial, Full Coverage, and Research files. Stock return data are from the Center for Research in Security Prices (CRSP) monthly return files for NYSE, AMEX, and NASDAQ firms. Starting with the universe of publicly traded firms, we exclude utility (SIC code between 4900 and 4999) and financial firms (SIC code between 6000 and 6999). These two industries are highly regulated and have accruals that are significantly different from those in other industries. We also exclude firms with negative book values of equity. Also, only firms with ordinary common equity are included in the tests, meaning that we exclude American depository receipts (ADRs), real estate investment trusts (REITs), and units of beneficial interest. The final sample spans 38 years from 1970 to 2007.

We use three accrual measures. Following Sloan [1996], we measure total accruals, denoted *TotA*, as changes in non-cash working capital minus depreciation expense (scaled by average total assets). The non-cash working capital is the change in non-cash current assets minus the change in current liabilities less short-term debt and taxes payable. Specifically,

$$TotA \equiv (\Delta CA - \Delta CASH) - (\Delta CL - \Delta STD - \Delta TP) - DEP \qquad (19)$$

in which ΔCA is the change in current assets (Compustat annual item 4), $\Delta CASH$ is the change in cash or cash equivalents (item 1), ΔCL is the change in current liabilities (item 5), ΔSTD is the change in debt included in current liabilities (item 34), ΔTP is the change in income taxes payable (item 71), and DEP is depreciation and amortization expense (item 14).

We also use discretionary accruals, denoted *DisA* in Xie [2001], who finds that a major portion of the accrual anomaly is due to discretionary accruals. We measure *DisA* using Dechow, Sloan, and Sweeney's [1995] modification of the Jones [1991] model:

$$\frac{TotA_t}{TA_{t-1}} = \alpha_1 \frac{1}{TA_{t-1}} + \alpha_2 \frac{\Delta REV_t - \Delta REC_t}{TA_{t-1}} + \alpha_3 \frac{PP\&E_t}{TA_{t-1}} + e_t. \qquad (20)$$

in which ΔREV_t is the change in sales in year t (Compustat annual item 12), ΔREC_t is the net receivables in year t less net receivables in year $t-1$, TA_{t-1} is total assets (item 6) at the end of year $t-1$, and $PP\&E_t$ is the gross property, plant, and equipment (item 7) at the end of year t. Following Dechow et al., we estimate the cross-sectional regression given by equation (20) for each two-digit SIC code and year combination, formed separately for NYSE/AMEX firms and for NASDAQ firms. The discretionary accruals (scaled by lagged total assets) are the residual from equation (20), e_t, whereas the nondiscretionary accrual is the fitted component.

We use discretionary accruals because the current literature primarily uses them as a proxy for earnings management (e.g., Xie [2001]). As such, the discretionary accruals anomaly represents an important hurdle for the optimal investment explanation to overcome. More important, why should discretionary accruals be related to investment? It is conceivable that *PP&E* and changes in the current sales in the modified Jones model do not fully capture corporate investment and growth. In particular, Zhang [2007] shows that investment, such as changes in inventory, is not only related to current sales but also related to future sales, which are ignored in the modified Jones model. In addition, managerial decisions can cause discretionary accruals to be positively correlated with investment. Teoh, Welch, and Wong [1998a, 1998b] show that managers are more inclined to increase discretionary accruals by managing earnings upwards when issuing initial equity and seasoned equity. However, Lyandres, Sun, and Zhang [2008] show that initial equity and seasoned equity issuers also are high-investment firms.

The third accrual measure is net operating assets from Hirshleifer et al. [2004], who find that net operating assets (scaled by lagged total assets) is a strong negative predictor of stock returns. Following Hirshleifer et al., we define the scaled net operating assets, denoted *NoaA*, as $NoaA_t \equiv (OA_t - OL_t)/TA_{t-1}$ in which OA_t is operating assets calculated as total assets (Compustat annual item 6) minus cash and short-term investment (item 1). OL_t is operating liabilities calculated as $TA_t - STD_t - LTD_t - MI_t - PS_t - CE_t$, in which STD_t is debt included in current liabilities (item 34), LTD_t is long-term debt (item 9), MI_t is minority interests (item 38), PS_t is preferred stocks (item 130), and CE_t is common equity (item 60). We use *NoaA* because it is closely related to the comprehensive measure of accruals from Richardson et al. [2005].

Following Lyandres, Sun, and Zhang [2008], we measure investment-to-assets, denoted *I/A*, as the annual change in gross property, plant, and equipment (Compustat annual item 7) plus the annual change in inventories (item 3) divided by the lagged book value of assets (item 6). Our goal is to use a simple measure from the existing literature to capture fundamental investment: We have not experimented with different measures to maximize the explanatory power for the accrual anomaly. We use the change in *PP&E* to capture investment in long-lived assets for operations over many years, such as buildings, machinery, furniture, and other equipment. Although Richardson et al. [2005] have recently categorized the change in property, plant, and equipment as long-term accruals, this variable has long been a standard measure of firm-level investment in macroeconomics and corporate finance (e.g., Abel and Blanchard [1986], Whited [1992], Erickson and Whited [2000], Hennessy, Levy, and Whited [2007], and Eberly, Rebelo, and Vincent [2008]). We use the change in inventories to capture investment in short-lived assets within a normal operating cycle, such as merchandize, raw materials, supplies, and work in progress. Our definition of investment is consistent with National Income Accounting, in which gross private domestic investment is the sum of fixed investment and the net change in business inventories.

3.2 DESCRIPTIVE STATISTICS

Table 2 reports descriptive statistics. To alleviate the effect of outliers, we winsorize all variables at 1% and 99%. Panel A shows that, consistent with Sloan [1996], total accruals tend to be negative with a mean of −0.01. By construction, the mean and median of discretionary accruals are close to zero. The average net operating assets are 0.77 with a standard deviation of 0.47. The three accrual measures are positively correlated. *TotA* has Pearson correlations of 0.71 and 0.31 with *DisA* and *NoaA*, respectively, and the correlation is 0.30 between *DisA* and *NoaA*. All the correlations are significantly different from zero. As expected, accruals are positively correlated with investment. The correlations of *I/A* with *TotA*, *DisA*, and *NoaA* are 0.23, 0.20, and 0.66, respectively, all of which are significantly different from zero. In particular, discretionary accruals are almost as highly correlated with investment as total accruals.

Discount rate changes should affect investment, current returns, and future returns simultaneously. When the discount rate falls, more investment projects become profitable and accruals increase. Current returns should increase because stock prices increase from the lower discount rate. In contrast, future returns should decrease on average because the lower discount rate means lower expected returns going forward. Therefore, if investment adjusts instantaneously to changes in the discount rate, accruals should be positively correlated with current returns and negatively correlated with future returns. To the extent that investment adjusts with time lags because investment projects often take multiple periods to complete (e.g., Kydland and Prescott [1982], Lamont [2000], and Lettau and Ludvigson [2002]), accruals also should be positively correlated to past returns.

Our tests largely confirm these implications. Using the Fama and French [1993] portfolio approach, we sort stocks in June of each year t into deciles on the accruals over the fiscal year $t-1$ (known at the end of the fiscal year). The value-weighted portfolio returns, denoted r_{t+1}, are calculated from July of year t to June of year $t+1$. (We only report value-weighted results to save space: The basic results with equal-weighted returns are similar.) From table 3, the average return (r_{t+1}) decreases from 14.3% per annum for the low-*TotA* decile to 7.3% for the high-*TotA* decile with a spread of 7.1% ($t = 2.9$). We also observe a similar average return spread of 7.8% per annum ($t = 4$) across the extreme *DisA* deciles and an average return spread of 7.1% ($t = 2$) across the *NoaA* deciles.

Accruals also increase with past and current stock returns. We associate accruals at the fiscal year end of year $t-1$ to the annual stock returns from the beginning to the end of calendar year $t-1$, which we call current returns, denoted r_t. To allow for investment lags, we also associate accruals

TABLE 2

Descriptive Statistics (January 1970–December 2007)

Panel A: Descriptive Statistics

	Mean	Std.	Min	25%	Median	75%	Max
TotA	−0.01	0.10	−0.50	−0.06	−0.02	0.03	0.50
DisA	0.01	0.16	−1.66	−0.05	0.00	0.05	2.39
NoaA	0.77	0.47	−0.61	0.58	0.74	0.88	8.60
Cash flows	0.07	0.21	−1.41	0.02	0.11	0.18	0.53
Earnings	0.06	0.20	−1.62	0.03	0.10	0.16	0.47
ME	1,227.5	8,333.0	0.01	20.5	86.1	405.7	602,432.9
BE/ME	1.38	5.69	0.00	0.32	0.59	1.08	160.48
I/A	0.17	0.26	0.00	0.04	0.10	0.19	3.55

Panel B: Cross Correlations (Pearson)

	TotA	*DisA*	*NoaA*	Cash flows	Earnings	*ME*	*BE/ME*	*I/A*
TotA	1	0.71	0.31	−0.41	0.19	−0.06	−0.08	0.23
DisA		1	0.30	−0.33	0.09	−0.01	−0.02	0.20
NoaA			1	−0.10	0.11	0.01	−0.05	0.66
Cash flows				1	0.79	0.36	−0.06	−0.14
Earnings					1	0.35	−0.13	0.02
ME						1	−0.05	−0.03
BE/ME							1	−0.10
I/A								1

This table presents the summary statistics of total accruals, discretionary accruals, net operating assets, earnings, cash flows, market equity (*ME*), book-to-market equity (*BE/ME*), and investment-to-assets (*I/A*). Panel A reports the mean, standard deviation (Std); min, 25% percentile; median, 75% percentile; and max for these variables. Panel B reports their cross correlations. Total accruals, denoted *TotA*, are measured as the change in non-cash current assets (Compustat annual item 4 minus item 1), less the change in current liabilities (exclusive of short-term debt and taxes payable) (item 5 minus items 34 and 71), less depreciation expense (item 14), all divided by average total assets (the sum of item 6 and lagged item 6 divided by two). Discretionary accruals, denoted *DisA*, are measured as the residuals from the estimation of Dechow et al.'s modification of the original Jones [1991] model cross-sectionally for each SIC code and year combination. We measure net operating assets, denoted *NoaA*, as operating assets minus operating liabilities, both divided by lagged total assets. Operating assets are total assets minus cash and short-term investment (item 1), and operating liabilities are total assets less debt included in current liabilities (item 34), less long-term debt (item 9), less minority interests (item 38), less preferred stocks (item 130), less common equity (item 60). Cash flows are measured as the difference between earnings, defined as income before extraordinary items (item 18), and total accruals. Both earnings and cash flows are scaled by average total assets (item 6). *ME* (in millions of dollars) is the share price at the end of June in year *t* times the number of share outstanding. The book value (*BE*) is defined as the stockholders' equity (item 216), minus preferred stock, plus balance sheet deferred taxes and investment tax credit (item 35) if available, minus postretirement benefit asset (item 330) if available. If stockholders' equity value if missing, we use common equity (item 60) plus preferred stock par value (item 130). We measure preferred stock as preferred stock liquidating value (item 10) or preferred stock redemption value (item 56) or preferred stock par value (item 130) in that order of availability. If these variables are missing, we use book assets (item 6) minus liabilities (item 181). *BE/ME* is calculated by using the book value and market value at the end of the fiscal year. Investment-to-assets is defined as the annual change in gross property, plant, and equipment (item 7) plus the annual change in inventories (item 3) divided by the lagged book value of assets (item 6).

at the fiscal year end of year $t-1$ to the annual returns from the beginning to the end of calendar year $t-2$, which we call past returns, denoted r_{t-1}. Table 3 shows that, as *TotA* increases from decile 1 to 10, current returns increase from 11.7% to 25.6% per annum, and past returns increase from 3.8% to 37.1%. The return spreads of −33.3% and −13.9% are more than 3.5 standard errors from zero. Similar but somewhat weaker results can be observed across the *DisA* and *NoaA* deciles.

TABLE 3

The Lead-Lag Relations between Accruals and Stock Returns (January 1970–December 2007)

	Panel A: Total Accruals				**Panel B: Discretionary Accruals**				**Panel C: Net Operating assets**			
	$TotA_t$	r_{t-1}	r_t	r_{t+1}	$DisA_t$	r_{t-1}	r_t	r_{t+1}	$NoaA_t$	r_{t-1}	r_t	r_{t+1}
Low	−20.6	3.8	11.7	14.3	−22.9	15.9	24.1	12.7	21.7	15.9	23.5	15.1
2	−10.8	10.4	10.3	15.6	−9.7	11.2	13.9	15.6	44.4	14.3	13.4	15.3
3	−7.6	11.5	12.9	14.7	−5.7	13.7	13.6	15.8	55.3	12.0	12.9	15.7
4	−5.4	12.4	12.6	14.1	−3.2	13.2	14.8	15.1	62.7	11.5	10.6	13.5
5	−3.7	14.0	13.8	14.7	−1.3	12.0	12.8	15.9	68.6	12.5	13.7	14.3
6	−1.9	14.5	14.6	14.1	0.4	13.4	11.6	13.9	73.9	12.9	12.9	14.2
7	0.1	15.5	15.0	11.8	2.2	15.3	12.0	12.2	79.3	13.1	12.4	10.3
8	2.6	20.1	13.2	13.0	4.7	17.3	11.9	12.9	85.7	13.8	14.0	13.4
9	6.7	26.6	17.0	11.1	8.9	18.3	14.6	7.7	96.5	22.6	15.0	12.0
High	18.7	37.1	25.6	7.3	25.1	25.5	25.4	4.9	150.2	29.7	24.2	8.0
L−H	−39.3	−33.3	−13.9	7.1	−48.0	−9.6	−1.3	7.8	−128.5	−13.8	−0.8	7.1
$t_{\text{L}-\text{H}}$	−24.3	−10.7	−3.5	2.9	−10.5	−3.2	−0.3	4.0	−10.7	−5.0	−0.1	2.0

This table reports the portfolio average accruals, the returns from July of year t to June of year $t+1$ (r_{t+1}), the returns from January to December of year t (r_t), and the returns from January to December of year $t-1$ (r_{t-1}). Portfolio returns are value-weighted. We report the averages for 10 portfolios sorted on Sloan's [1996] total accruals (panel A), 10 portfolios sorted on Dechow, Sloan, and Sweeney's [1995] discretionary accruals (panel B), and 10 portfolios sorted on Hirshleifer et al.'s [2004] net operating assets (panel C). We form portfolios in June of year t based on the accrual measures at the fiscal year-end of $t-1$. The portfolio sorts are effective from July of year t to June of year $t+1$. See the caption of table 2 for the measurement of total accruals (*TotA*), discretionary accruals (*DisA*), and net operating assets (*NoaA*). All the table entries except for $t_{\text{L}-\text{H}}$ are in annualized percent.

4. *Empirical Results*

We organize our empirical investigation of the optimal investment explanation of the accrual anomaly around the four testable hypotheses developed in section 2.2. Section 4.1 uses factor regressions to quantify the impact of real investment on the magnitude of the accrual anomaly. Section 4.2 constructs ex ante discount rates as in Gebhardt, Lee, and Swaminathan [2001] and Fama and French [2002] and examines their cross-sectional variation across the accrual portfolios. Section 4.3 shows that the optimal investment hypothesis can account for the negative relation between accounting reliability and the magnitude of the accrual anomaly documented in Richardson et al. [2005]. Finally, section 4.4 shows that the expected returns to accruals-based trading strategies are time-varying.

4.1 FACTOR REGRESSIONS

The optimal investment hypothesis says that the accrual anomaly results from the negative relation between investment and the discount rate. Controlling for investment should, therefore, reduce the magnitude of the accrual anomaly. Our test design follows that of Lyandres, Sun, and Zhang [2008]. We regress low-minus-high accrual portfolio returns on the market factor and on the Fama–French [1993] three factors to measure abnormal returns as the regression intercepts (alphas). We then augment the standard factor models with an investment factor and quantify the explanatory

TABLE 4

Descriptive Statistics of the Investment Factor (January 1970–December 2007)

Summary Statistics				Cross Correlations (Pearson)					
					r_{INV}	*MKT*	*SMB*	*HML*	*WML*
Mean	0.57	α_{FF}	0.62	r_{INV}	1	−0.43	−0.24	0.33	0.28
t	6.0	t	7.1	*MKT*		1	0.27	−0.43	−0.09
		Adj.R^2	21%	*SMB*			1	−0.29	−0.01
α_{CAPM}	0.68	α_{CARH}	0.48	*HML*				1	−0.10
t	7.8	t	5.7	*WML*					1
Adj.R^2	18%	Adj.R^2	29%						

For the investment factor, we report the mean, the CAPM alpha (α_{CAPM}), the alpha from the Fama–French [1993] three-factor regressions (α_{FF}), the alpha from the Carhart [1997] four-factor regressions (α_{CARH}), their t-statistics (t), and adjusted R^2s (Adj.R^2). The t-statistics are adjusted for heteroscedasticity and autocorrelations. The mean and alphas are in percent. In June of each year t we sort all stocks on their June market equity into two groups using the 50–50 cutoff points and independently sort all stocks into three investment-to-assets groups using the 30–40–30 cutoff points. We form six portfolios by taking intersections of the two size and three investment-to-assets portfolios. Monthly returns on the six portfolios are calculated from July of year t to June of year $t+1$. The investment factor, denoted r_{INV}, is the difference, each month, between the simple average of the value-weighted returns on the two low investment-to-assets portfolios and the simple average of the value-weighted returns on the two high investment-to-assets portfolios. Investment-to-assets is the annual change in gross property, plant, and equipment (Compustat annual item 7) plus the annual change in inventories (item 3) divided by the lagged total assets (item 6). The returns for the market factor *MKT*, the size factor *SMB*, the value factor *HML*, and the momentum factor *WML* are obtained from Kenneth French's Web site.

power of investment as the percentage reduction in the magnitude of the alphas.

We construct the investment factor from a two-by-three sort on size and investment-to-assets, *I/A*. In June of each year t from 1970 to 2007, we sort all stocks into three *I/A* groups using 30–40–30% cutoff points, and independently sort all stocks into two groups using 50–50% cutoff points based on their June market equity. Taking the intersections of the two size and the three *I/A* groups forms six portfolios. Monthly returns on these portfolios are calculated from July of year t to June of $t+1$. The investment factor, denoted r_{INV}, is defined as the difference between the simple average of the value-weighted returns on the two low- *I/A* portfolios and the simple average of the value-weighted returns on the two high- *I/A* portfolios. From table 4, the average r_{INV} return is 0.57% per month ($t = 6$). Regressing r_{INV} on other common factors, such as the market factor *MKT*, the size factor *SMB*, the value factor *HML*, and the momentum factor *WML*, leaves significant positive alphas unexplained. (The data for the Fama–French factors and the momentum factor are from Kenneth French's Web site.) For example, the CAPM alpha of r_{INV} is 0.68% per month ($t = 7.8$), and the Fama–French alpha is 0.62% ($t = 7.1$).

We use one-way testing portfolios formed on different accrual measures. In June of each year t, we sort stocks into 10 deciles based on *TotA*, *DisA*, or *NoaA* over the fiscal year $t-1$. The value-weighted monthly returns of the subsequent portfolios are calculated from July of year t to June of year $t+1$. Because of the large number of testing portfolios, we only report the results for zero-cost low-minus-high portfolios to save space.

Table 5 reports that the investment factor explains more than 50% of the total accruals and discretionary accruals anomalies and more than 60% of the net operating assets anomaly. From panel A, the CAPM alpha of the low-minus-high *TotA* portfolio is 0.75% per month ($t = 3.4$). Adding r_{INV} into the factor regression reduces the alpha by 65.5% to an insignificant level of 0.26% ($t = 1$). Using the Fama–French three-factor model as the benchmark yields largely similar results. The Fama–French alpha of the zero-cost portfolio is 0.74% per month ($t = 3.5$), and adding r_{INV} into the regression reduces the alpha by 50% to 0.38% ($t = 1.6$). In both cases the zero-cost portfolios have loadings on r_{INV} around 0.70 and are more than 4.5 standard errors from zero.

The results for the *DisA* portfolios are similar. From panel B, the alpha of the zero-cost *DisA* portfolio is 0.65% per month ($t = 3.2$), and adding r_{INV} reduces the alpha by 60.7% to 0.25% ($t = 1.1$). The Fama–French alpha is 0.69% ($t = 3.4$), and r_{INV} reduces the alpha by 50.4% to 0.34% ($t = 1.5$). The r_{INV}-loadings in both regressions are around 0.63 and are more than five standard errors from zero. From panel C, investment is more effective in reducing the net operating assets anomaly. The CAPM alpha of the zero-cost *NoaA* portfolio is 0.81% per month ($t = 4$), and r_{INV} reduces the alpha by 82.4% to 0.14% per month ($t = 0.7$). The Fama–French alpha for the portfolio is 1.03% per month ($t = 4.8$), and r_{INV} reduces the alpha by 61.7% to 0.39%, albeit still significant ($t = 2$). The r_{INV}-loadings are around 1 and are more than eight standard errors from zero.

To understand the factor regressions, we study the investment (and earnings) behavior of extreme accrual deciles. To preview the results, the *I/A* spread between the extreme deciles dominates the *ROA* spread, suggesting that investment potentially plays a more important role than earnings in driving the accrual anomaly. We adopt the event study framework of Fama and French [1995], and examine the evolution of median *I/A* and *ROA* for extreme accrual deciles during seven years surrounding the portfolio formation. In June of each year t we assign stocks into 10 accrual deciles based on the accruals at the fiscal year end in year $t - 1$. The median *I/A* and *ROA* for the extreme deciles are calculated for $t + i$, $i = -3, \ldots 3$. We then average the median *I/A* (and the median *ROA*) of each decile for event-year $t + i$ across portfolio formation year t. We measure *ROA* as income before extraordinary items (Compustat annual item 18) divided by lagged total assets (item 6). The denominator is the same as in *I/A* to facilitate comparison in magnitude.

Table 6 shows that the high-*TotA* decile has higher *I/A* for one year before and one year after the portfolio formation. At the portfolio formation year, the high-*TotA* decile has an *I/A* of 26% per annum, whereas the low-*TotA* decile has an *I/A* of 9.9%. The difference is significant at the 1% level. The two extreme *DisA* deciles display a similar pattern: 23.7% versus 10.7% per annum. The pattern is more dramatic across the extreme *NoaA* deciles. At the portfolio formation, the high-*NoaA* decile has an *I/A* of 48%, whereas the low-*NoaA* decile has an *I/A* of 5%. Although a large portion of the spread

TABLE 5

Calendar-Time Factor Regressions of the Low-Minus-High Accrual Deciles, with and without the Investment Factor (January 1970–December 2007)

Panel A: Total Accruals						**Panel B: Discretionary Accruals**						**Panel C: Net Operating Assets**					
$\alpha_{\text{L−H}}$	β_{MKT}	β_{SMB}	β_{HML}	β_{INV}	$\lvert\Delta\alpha\rvert/\alpha$	$\alpha_{\text{L−H}}$	β_{MKT}	β_{SMB}	β_{HML}	β_{INV}	$\lvert\Delta\alpha\rvert/\alpha$	$\alpha_{\text{L−H}}$	β_{MKT}	β_{SMB}	β_{HML}	β_{INV}	$\lvert\Delta\alpha\rvert/\alpha$
0.75	−0.25					0.65	−0.15					0.81	−0.18				
(3.4)	(−4.6)					(3.2)	(−2.7)					(4.0)	(−3.2)				
0.26	−0.10			0.77	65.5	0.25	−0.03			0.63	60.7	0.14	0.01			0.98	82.4
(1.0)	(−1.8)			(4.9)		(1.1)	(−0.5)			(5.4)		(0.7)	(0.2)			(8.0)	
0.74	−0.14	−0.46	0.07			0.69	−0.14	−0.14	−0.06			1.03	−0.22	−0.25	−0.33		
(3.5)	(−2.5)	(−4.2)	(0.7)			(3.4)	(−2.4)	(−1.6)	(−0.6)			(4.8)	(−4.4)	(−2.9)	(−3.3)		
0.38	−0.04	−0.42	−0.01	0.68	50.0	0.34	−0.05	−0.11	−0.13	0.64	50.4	0.39	−0.07	−0.19	−0.43	1.04	61.7
(1.6)	(−0.8)	(−4.6)	(−0.2)	(4.7)		(1.5)	(−0.8)	(−1.5)	(−1.5)	(5.4)		(2.0)	(−1.4)	(−2.5)	(−4.8)	(8.5)	

The dependent variables in the factor regressions are value-weighted low-minus-high accrual decile returns. In June of each year t, we assign stocks into 10 deciles based on total accruals, discretionary accruals, and net operating assets. The accruals are over the fiscal year $t-1$. The monthly portfolio returns are calculated from July of year t to June of year $t+1$. We use the market factor (as in the CAPM) and the Fama and French [1993] three factors as explanatory variables in factor regressions. We then augment the CAPM and the Fama–French model with the investment factor, r_{INV}. See the caption of table 4 for the construction of r_{INV}. The t-statistics reported in parentheses are adjusted for heteroscedasticity and autocorrelations. $\alpha_{\text{L−H}}$ is the alpha for the low-minus-high accrual deciles. $\lvert\Delta\alpha\rvert/\alpha$ is the percentage reduction in alphas of investment-augmented regressions from the alphas without r_{INV}.

TABLE 6

The Event-Time Evolution of Median Investment-to-Assets (I/A) and Median Return-on-Assets (ROA) for the Low and High Accrual Portfolios during Three Years before and Three Years after the Portfolio Formation (January 1970–December 2007)

	Panel A: Total Accruals				**Panel B: Discretionary Accruals**				**Panel C: Net Operating Assets**			
	I/A		*ROA*		*I/A*		*ROA*		*I/A*		*ROA*	
Year	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
−3	13.6	12.2	5.5	7.0	11.3	12.2	5.7	6.8	6.5	14.3	0.3	6.5
−2	13.5	13.0	4.8	8.0	11.3	12.9	5.4	7.6	6.3	16.4	−1.4	7.1
−1	13.1	15.6	3.5	9.3	11.6	14.7	5.0	8.9	6.3	20.7	−2.0	7.8
0	9.9	26.0	−0.4	8.8	10.7	23.7	2.5	7.4	5.0	48.0	−3.5	6.5
1	11.7	12.8	3.6	6.6	10.6	11.9	4.7	5.5	6.5	15.3	−0.1	4.2
2	11.7	10.9	4.5	5.8	10.0	9.9	5.1	5.1	6.3	12.4	1.1	4.3
3	11.2	10.2	4.8	5.6	9.4	9.6	5.2	5.0	6.3	11.0	2.1	4.5

This table presents event–time evolution of investment-to-assets and return-on-assets for extreme accrual deciles formed in each June. We measure investment-to-assets as the sum of the annual change in gross property, plant, and equipment (Compustat annual item 7) and the annual change in inventories (item 3) divided by the lagged total assets (item 6). We measure return-on-assets as earnings (income before extraordinary items, item 18) divided by the lagged total assets (item 6). We consider three sets of portfolios sorted on Sloan's [1996] total accruals (panel A), Dechow, Sloan, and Sweeney's [1995] discretionary accruals (panel B), and Hirshleifer et al.'s [2004] net operating assets (panel C). See table 2 for detailed variable definitions. In June of each year t, we assign stocks into 10 accrual deciles based on the accruals at the fiscal year-end in year $t - 1$. The median investment-to-assets ratios (and the median return-on-assets ratios) for the two extreme accrual deciles are calculated for $t + i$, $i = -3, \ldots 3$. The median investment-to-assets ratios (and the median return-on-assets ratios) of each accrual portfolio for event-year $t + i$ are then averaged across portfolio formation years t.

converges within one year, the spread remains positive for all seven years surrounding the portfolio formation. Because the low-minus-high investment factor earns positive average returns, this investment pattern helps explain the accrual anomaly.

Table 6 also examines the evolution of *ROA* for extreme deciles. High investment can be induced by either low discount rates or high profitability, or both, and more profitable firms earn higher average returns than less profitable firms (e.g., Chen and Zhang [2009]). The *I/A* spread goes in the right direction to explain the accrual anomaly, but the *ROA* spread goes in the wrong direction. Panel A shows that the *ROA* spread across the extreme *TotA* deciles is 9.2% per annum, which is less than 60% of the *I/A* spread. The *ROA* spread across the extreme *DisA* deciles is even smaller at 4.9% per annum, about 38% of the *I/A* spread. Finally, the *ROA* spread across the extreme *NoaA* deciles is 10% per annum, only 23% of the *I/A* spread.

4.2 DISCOUNT RATE ESTIMATES

Our tests so far are based on ex-post realized returns. A common critique of this approach is that the realized returns are extremely imprecise and likely even biased.[4] To address this concern, we construct ex ante measures

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[4] A growing literature has studied alternative measures of expected returns in different contexts (e.g., Elton [1999], Claus and Thomas [2001], Gebhardt, Lee, and Swaminathan

of the discount rate and examine their cross-sectional relations with accruals. We present estimates from two approaches: the dividend discounting model as in Fama and French [2002] and the residual income model as in Gebhardt, Lee, and Swaminathan [2001].

4.2.1. Estimates from the Dividend Discounting Model. The basic idea is to use dividend growth rates to measure expected rates of capital gain in the dividend discounting model of Gordon [1962]. The discount rate (expected return) is estimated as the expected dividend-to-price ratio plus the expected rate of capital gain. If the dividend-to-price ratio is stationary, the compounded rate of dividend growth approaches the compounded rate of capital gain in a sufficiently long sample. As such, we can measure the ex ante discount rate as:

$$E[r_{t+1}] = E\left[\frac{D_{t+1}}{P_t}\right] + E[Ag_{t+1}], \tag{21}$$

in which D_{t+1}/P_t is the dividend-to-price ratio and Ag_{t+1} is the long-term dividend growth rate.

Following Blanchard [1993] and Chen, Petkova, and Zhang [2008], we implement the conditional version of equation (21), which says $E_t[r_{t+1}] = E_t[D_{t+1}/P_t] + E_t[Ag_{t+1}]$. The long-term dividend growth rate, Ag_{t+1}, is defined as the annuity of future dividend growth:

$$Ag_{t+1} = \left[\frac{\bar{r}-\bar{g}}{1+\bar{r}}\right]\sum_{i=0}^{\infty}\left[\frac{1+\bar{g}}{1+\bar{r}}\right]^i g_{t+i+1}, \tag{22}$$

in which $\bar{g}$ and $\bar{r}$ are the average real growth rate of dividends and the average real stock return, respectively, and g_{t+i+1} denotes the realized real growth rate of dividends from $t+i$ to $t+i+1$.

Let P_t = market value at time t of the securities allocated to the portfolio when it is formed at time t, $P_{t,t+1}$ = market value at time $t+1$ of the securities allocated to the portfolio at time t, $D_{t,t+1}$ = dividends paid between t and $t+1$ on the securities allocated to the portfolio at time t, $r_{t,t+1}$ = return (with dividends) observed at time $t+1$ on a portfolio formed at time t, and $r^X_{t,t+1}$ = return (without dividends) observed at time $t+1$ on a portfolio formed at time t. For each portfolio, we construct the real dividend-to-price ratio from the value-weighted realized stock returns with and without dividends and the Consumer Price Index (*CPI*) from the U.S. Bureau of Labor Statistics:

$$\frac{D_{t,t+1}}{P_t} = \left(r_{t,t+1} - r^X_{t,t+1}\right)\left(\frac{CPI_t}{CPI_{t+1}}\right). \tag{23}$$

[2001], Fama and French [2002], Lundblad [2005], Campello, Chen, and Zhang [2008], Chen, Petkova, and Zhang [2008], and Pastor, Sinha, and Swaminathan [2008]).

TABLE 7

The Averages of Realized Stock Returns, Expected Dividend-to-Price Ratio, Expected Long-Run Dividend Growth, and Ex-Ante Discount Rates for Quintiles Formed on Total Accruals, Discretionary Accruals, and Net Operating Assets (1970–2007)

	Panel A: Total Accruals				**Panel B: Discretionary Accruals**				**Panel C: Net Operating Assets**			
	r_{t+1}	E $[D/P]$	E $[Ag]$	E $[r]$	r_{t+1}	E $[D/P]$	E $[Ag]$	E $[r]$	r_{t+1}	E $[D/P]$	E $[Ag]$	E $[r]$
Low	14.1	2.7	5.4	8.1	13.3	2.0	4.5	6.5	14.7	2.6	6.5	9.1
2	13.7	3.2	2.8	6.1	14.7	2.6	4.1	6.8	13.5	3.0	3.5	6.5
3	13.2	2.7	3.5	6.2	14.1	3.3	4.3	7.5	13.2	2.9	3.0	5.9
4	10.8	2.3	2.4	4.7	11.3	2.8	2.5	5.4	11.1	2.6	3.2	5.8
High	8.2	1.4	0.8	2.2	5.3	2.0	0.7	2.7	9.1	2.0	1.7	3.7
L–H	5.9	1.3	4.6	5.9	8.0	0.1	3.8	3.8	5.7	0.6	4.8	5.4
$t_{\mathrm{L-H}}$	4.4	6.9	19.1	13.9	4.9	0.5	15.0	26.5	2.3	2.9	26.6	15.6

For the one-way sorted total accruals, discretionary accruals, and net operating assets quintiles, this table reports the annualized sample averages of the realized stock return in the future one year, r_{t+1}; the expected dividend-to-price ratio, E $[D/P]$; the expected long-run dividend growth, E $[Ag]$; and the ex ante discount rate, E $[r]$. All the series are adjusted for inflation. The t-statistics are adjusted for heteroscedasticity and autocorrelations. All entries except for the t-statistics are in annualized percent.

The portfolio real dividend growth rates are measured as:

$$\begin{aligned} g_{t+1} &= \left(\frac{D_{t,t+1}/P_t}{D_{t-1,t}/P_{t-1}}\right)\left(r^X_{t-1,t}+1\right)\left(\frac{CPI_{t-1}}{CPI_t}\right)-1 \\ &= \left(\frac{D_{t,t+1}/P_t}{D_{t-1,t}/P_{t-1}}\right)\left(\frac{P_{t-1,t}}{P_{t-1}}\right)-1. \end{aligned} \tag{24}$$

We construct Ag_{t+1} based on equation (22), in which we estimate $\bar{r}$ as the sample average of the realized real equity returns and $\bar{g}$ as the sample average of the real dividend growth rates. To implement Ag_{t+1} as an infinite sum of future real dividend growth rates, we use a finite sum of 100 years of future growth. We assume that future real dividend growth rates beyond 2007 equal the average dividend growth rate in the 1970–2007 period. Annual predictive regressions of Ag_{t+1} and D_{t+1}/P_t are then performed on a set of conditioning variables. The fitted values from these regressions provide the time series of $E_t[Ag_{t+1}]$ and $E_t[D_{t+1}/P_t]$, the sum of which provides the ex ante discount rate.[5]

Table 7 reports the discount rate estimates for the accrual quintiles. Following Chen, Petkova, and Zhang [2008], we use quintiles because some

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[5] We use the same conditioning variables as in Chen, Petkova, and Zhang [2008]: the dividend yield as the sum of dividends accruing to the CRSP value-weighted market portfolio over the previous 12 months divided by the contemporaneous level of the index, the default premium as the yield spread between Moody's Baa and Aaa corporate bonds from the monthly database of the Federal Reserve Bank of St. Louis, the term premium as the yield spread between long-term and one-year Treasury bonds from Ibbotson Associates, and the one-month Treasury bill rate from CRSP.

deciles generate excessively volatile dividend growth rates: Using (more aggregated) quintiles alleviates the influence of extreme outliers. The average realized returns of the low-minus-high *TotA*, *DisA*, and *NoaA* quintiles are 5.9%, 8%, and 5.7% per annum ($t = 4$, 4.9, and 2.3), respectively. More important, table 7 shows that high accrual firms have reliably lower discount rates than low accrual firms. The low-*TotA* quintile has a discount rate of 8.1% per annum, whereas the high-*TotA* quintile has a discount rate of 2.2%. The spread of 5.9% per annum is more than 10 standard errors from zero. (The *t*-statistics are adjusted for autocorrelations of up to 12 lags.) The discount rate spreads also are reliable across the *DisA* and *NoaA* quintiles: 3.8% and 5.4% per annum, respectively. The spreads mostly come from the expected long-term dividend growth rate. The difference in the long-term growth rate between the extreme *TotA* quintiles is 4.6% per annum, which is more than 75% of the discount rate spread. Similar results also hold for the *DisA* and *NoaA* quintiles.

4.2.2. Estimates from the Residual Income Model. We also estimate the cost of capital at the firm level using the approach of Gebhardt, Lee and Swaminathan [2001], who calculate the cost of (equity) capital as the internal rate of return that equates the present value of expected future cash flows from the Feltham and Ohlson [1995] residual income model to the current stock price. We closely follow Gebhardt et al.'s empirical procedure. (We only outline the basic procedure and refer the reader to their original paper for details.)

We compute the following finite horizon estimate of equity value for each firm:

$$P_t = B_t + \frac{FROE_{t+1} - r^e}{1 + r^e} B_t + \frac{FROE_{t+2} - r^e}{(1 + r^e)^2} B_{t+1} + TV, \tag{25}$$

in which r^e is the implied cost of equity. B_t is the book value from the most recent financial statement divided by the number of shares outstanding in the current month. $FROE_{t+i}$ is forecasted return on equity (*ROE*) for period $t + i$. For the first three years, we compute this variable as $FEPS_{t+i}/B_{t+i-1}$, in which $FEPS_{t+i}$ is the mean forecasted earnings per share (*EPS*) for year $t + i$ from Institutional Brokers' Estimate System (I/B/E/S). B_{t+i-1} is the book value per share for year $t + i - 1$. We use the mean analysts' one- and two-year-ahead earnings forecasts ($FEPS_{t+1}$ and $FEPS_{t+2}$) and the long-term growth rate estimate (*Ltg*) from I/B/E/S to compute the three-year-ahead earnings forecast as $FEPS_{t+3} = FEPS_{t+2}(1 + Ltg)$. Beyond the third year, we forecast *FROE* using a linear interpolation to the industry median *ROE*. We compute $B_{t+i} = B_{t+i-1} + FEPS_{t+i} - FDPS_{t+i}$, in which $FDPS_{t+i}$ is the forecasted dividend per share for year $t + i$, estimated using current dividend payment ratio (k = dividends for the most recent fiscal year divided by earnings over the same time period, $0 \leq k \leq 1$), that is, $FDPS_{t+i} = k \times FEPS_{t+i}$. We forecast earnings up to 12 future years and estimate a terminal

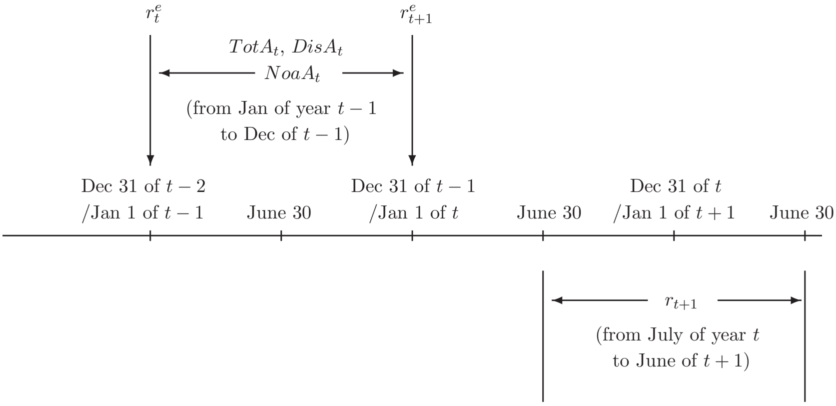

FIG. 1.—The timing of accruals and implied cost of capital.

value TV for cash flows beyond year 12 ($T = 12$) as follows:

$$TV = \sum_{i=3}^{T-1} \frac{FROE_{t+i} - r^e}{(1+r^e)^i} B_{t+i-1} + \frac{FROE_{t+T} - r^e}{r^e(1+r^e)^{T-1}} B_{t+T-1}. \qquad (26)$$

We estimate the implied cost of equity for each firm on each December 31 by substituting the forecasted future earnings, book values, and terminal values into equation (25) and solving for r^e from the resulting nonlinear equation. To study the relation between accruals and the implied cost of capital, we form five quintile portfolios based on a given accrual measure and calculate the value-weighted implied cost of capital across firms in each portfolio.

Figure 1 illustrates our timing of implied cost of capital. Following Fama and French [1993], we form portfolios on June 30 of each year t based on accruals over the fiscal year $t-1$ (known at the end of year $t-1$ or at the beginning of year t), denoted $TotA_t$, $DisA_t$, and $NoaA_t$. We match these accruals with ex post returns from July of year t to June of $t+1$, r_{t+1}. The six-month lag between January and June of year t is imposed to allow accounting information to be released to the markets. Our theory suggests that a firm adjusts its working capital investment in response to changes in the discount rate. Accruals are flow variables, meaning that after observing a low discount rate at the beginning of a year, a firm is likely to have high accruals over the course of the year. As such, we match $TotA_t$, $DisA_t$, and $NoaA_t$ with the discount rate estimated at the beginning of year $t-1$. We denote this discount rate r^e_t to emphasize its contemporaneous relation with $TotA_t$, $DisA_t$, and $NoaA_t$. Because the literature often compares ex post returns with ex ante discount rates measured at the beginning of the return window, we also report the discount rate measured at the beginning of year t, denoted

TABLE 8

The Average Implied Costs of Capital at Different Leads and Lags for Quintiles Formed on Total Accruals, Discretionary Accruals, and Net Operating Assets (1970–2007)

	Panel A: Total Accruals			Panel B: Discretionary Accruals			Panel C: Net Operating Assets		
	r^e_{t+1}	r^e_t	r^e_{t-1}	r^e_{t+1}	r^e_t	r^e_{t-1}	r^e_{t+1}	r^e_t	r^e_{t-1}
Low	9.35	9.76	9.91	9.15	9.48	9.63	9.37	9.66	9.80
2	9.41	9.66	9.81	9.28	9.44	9.51	9.60	9.74	9.85
3	9.36	9.53	9.58	9.35	9.45	9.54	9.49	9.64	9.66
4	9.24	9.23	9.36	9.34	9.44	9.60	9.43	9.50	9.61
High	9.13	9.11	9.25	9.32	9.41	9.59	9.00	9.12	9.28
L–H	0.22	0.65	0.66	−0.17	0.07	0.04	0.37	0.54	0.52
$t_{\mathrm{L-H}}$	1.47	4.33	4.59	−1.85	0.69	0.36	3.00	3.99	3.41

r^e is the annualized implied cost of capital. Figure 1 illustrates the timing convention. The t-statistics are adjusted for heteroscedasticity and autocorrelations. All entries except for the t-statistics are in annualized percent.

r^e_{t+1}, to compare with the ex post returns from July of year t to June of $t + 1$.[6]

Table 8 reports the detailed results. From panel A, firms with low total accruals at the beginning of year t have contemporaneously higher discount rates, r^e_t, than firms with high total accruals: 9.76% versus 9.11% per annum. The spread of 0.65% is more than four standard errors from zero. However, given the magnitude of the ex post return spread of 5.9% reported in table 7, the spread is too small. Low accrual firms also have higher one-year-ahead discount rates, r^e_{t+1}, than high accrual firms, but the spread is smaller, 0.22%, which is within 1.5 standard errors from zero. Low accrual firms have significantly higher one-year-lagged discount rates, r^e_{t-1}, than high accrual firms: 9.91% versus 9.25%, suggesting possible time lags in investment.

From panel B, the support for the optimal investment hypothesis for the discretionary accruals anomaly is weak. Moving from the low-*DisA* to the high-*DisA* quintile, we observe that the discount rate, r^e_t, is largely flat: The spread of 0.09% per annum is within one standard error from zero. Inconsistent with our hypothesis, the one-year-ahead discount rate, r^e_{t+1}, even increases by 0.17% per annum, which is marginally significant (t = 1.85). Panel C reports stronger evidence in support of our hypothesis for the net operating assets portfolios. Moving from the low-*NoaA* to the high-*NoaA* quintile, we see that r^e_t decreases by 0.54% per annum, which is almost four standard errors from zero. The one-year-ahead and the one-year-lagged discount rates also decrease by 0.37% and 0.52%, respectively, both of which are more than three standard errors from zero.

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[6] Gebhardt, Lee and Swaminathan [2001] match accruals measured at the beginning of year t with the discount rate estimated on June 30 of year $t + 1$, which is at the end of the ex post return window. However, the average realized returns over a holding period should be a proxy for the discount rate at the beginning (not the end) of the period.

4.3 DISENTANGLING THE ACCOUNTING RELIABILITY HYPOTHESIS FROM THE OPTIMAL INVESTMENT HYPOTHESIS

Richardson et al. [2005] rank each category of accruals according to accounting reliability, and show that less reliable accruals lead to lower earnings persistence and higher magnitude of the accrual anomaly. As we argue in section 2.2, the optimal investment hypothesis potentially can explain why the accrual anomaly is stronger for less reliable accruals. The logic is that less reliable accruals tend to be more correlated with investment and should have stronger predictive power for future returns than more reliable accruals.

Specific accrual items are measured as follows: Accruals consist of the change in non-cash working capital (ΔWC), the change in net noncurrent operating assets (ΔNCO), and the change in net financial assets (ΔFIN). $\Delta WC = WC_t - WC_{t-1}$, in which WC is current operating assets (COA) − current operating liabilities (COL), COA = current assets (Compustat annual item 4) − cash and short-term investments (item 1), and COL = current liabilities (item 5) − debt in current liabilities (item 34). $\Delta NCO = NCO_t - NCO_{t-1}$, in which NCO = noncurrent operating assets ($NCOA$) − noncurrent operating liabilities ($NCOL$), $NCOA$ = total assets (item 6) − current assets (item 4) − investments and advances (item 32), and $NCOL$ = total liabilities (item 181) − current liabilities (item 5) − long-term debt (item 9). $\Delta FIN = FIN_t - FIN_{t-1}$, in which FIN = financial assets ($FINA$) − financial liabilities ($FINL$), $FINA$ = short-term investments (STI, item 193) + long-term investments (LTI, item 32), and $FINL$= long-term debt (item 9) + debt in current liabilities (item 34) + preferred stock (item 130).

4.3.1. Descriptive Tests. For the most part, less reliable accruals are more correlated with investment than more reliable accruals. The first row of table 9 shows that ΔNCO has the highest Pearson correlation of 0.64 with I/A, followed by ΔWC with a correlation of 0.23, and then by ΔFIN with a correlation of −0.19. In the extended decomposition, ΔCOA and $\Delta NCOA$ have the highest correlations with I/A, 0.53 and 0.71, respectively, followed by ΔCOL, $\Delta NCOL$, and $\Delta FINL$ with 0.41, 0.21, and 0.48, respectively, and then by ΔSTI and ΔLTI with correlations very close to zero. All the correlations except those of ΔSTI and ΔLTI are significant at the 1% level. At the specific item level (not tabulated), changes in accounts receivable, other current assets, inventories, net property, plant, and equipment, intangibles, debt in current liabilities, accounts payable, other current liabilities, and long-term debt have relative high correlations with I/A: 0.33, 0.54, 0.14, 0.79, 0.23, 0.24, 0.41, 0.24, and 0.44, respectively, whereas the other line items have correlations with I/A close to zero.

We form portfolios in June of each year t based on ΔNCO, ΔWC, or ΔFIN over the fiscal year $t-1$, and calculate value-weighted portfolio returns from July of year t to June of $t+1$. From table 9, the low-minus-high ΔNCO decile earns an average return of 8.4% per annum ($t = 4$), and the low-minus-high ΔWC decile earns an average return of 7.7% ($t = 3.2$). In

TABLE 9

The Relations between Balance Sheet Categories of Accruals and Stock Returns (January 1970–December 2007)

	ΔWC	ΔNCO	ΔFIN	ΔCOA	ΔCOL	$\Delta NCOA$	$\Delta NCOL$	ΔSTI	ΔLTI	$\Delta FINL$
Corr(·, *I/A*)	0.23	0.64	−0.19	0.53	0.41	0.71	0.21	−0.00	0.03	0.48
Low	14.9	16.6	8.6	18.2	14.9	18.2	16.3	11.8	15.0	14.8
2	17.6	16.8	11.3	15.5	14.8	16.3	16.3	14.2	13.9	15.9
3	13.6	15.2	15.2	16.2	14.5	15.4	12.5	15.2	11.5	14.9
4	15.3	15.3	13.2	13.9	12.8	14.3	14.5	22.0	11.5	15.4
5	14.8	14.2	14.5	14.4	13.2	15.2	13.9	22.0	11.5	14.0
6	12.7	13.7	13.8	12.4	14.8	14.8	13.6	35.1	11.5	13.1
7	11.4	12.5	15.8	12.7	14.2	14.2	12.9	16.3	27.6	13.6
8	12.7	12.7	17.3	12.2	14.0	12.3	15.3	14.4	15.2	14.2
9	9.6	12.3	13.7	14.0	14.7	11.6	11.4	13.6	14.1	11.0
High	7.2	8.1	14.6	8.7	12.3	8.4	14.0	15.3	13.4	10.6
L–H	7.7	8.4	−6.0	9.5	2.6	9.7	2.3	−3.5	1.6	4.2
$t_{\text{L−H}}$	3.2	4.0	−2.6	3.5	1.5	3.9	0.9	−1.5	0.7	3.1

The row denoted Corr(?, I/A) reports the Pearson correlations between investment-to-assets, *I/A*, and balance sheet categories of accruals from Richardson et al.'s [2005] initial and extended accruals decompositions. We form decile portfolios at the end of June of each year t based on each accrual measure at the fiscal year end at $t - 1$. We calculate value-weighted portfolio returns from July of year t to June of $t + 1$, and the portfolios are rebalanced in June. We report the average returns for all the decile portfolios, the low-minus-high decile, and the t-statistics (adjusted for heteroscedasticity and autocorrelations); testing the average return of a given zero-cost strategy equals zero. All entries except for correlations and t-statistics are in annualized percent. See the caption of table 1 for the detailed definitions for various accrual categories.

contrast, the low-minus-high ΔFIN decile earns a negative average return of −6% per annum ($t = -2.6$). Sorting on ΔCOA, $\Delta NCOA$, and $\Delta FINL$ also produces low-minus-high portfolios that have significant average returns: 9.5%, 9.7%, and 4.2%, respectively, all of which are more than three standard errors from zero. Forming low-minus-high deciles on other categories in the extended accrual decomposition does not yield significant average returns.

We also form deciles on the specific line items in the extended accrual decomposition. Because of the large number of items, we only summarize the key results without tabulating the details. The low-minus-high decile formed on change in accounts receivable earns an average return of 7.9% per annum ($t = 3.8$), consistent with Hribar [2002]. The low-minus-high decile on change in inventories earns an average return of 7.1% per annum ($t = 2.6$), consistent with Thomas and Zhang [2002]. Significant average low-minus-high decile returns also can be obtained by forming portfolios on changes in other current assets (3.7% per annum, $t = 2.3$), net *PP&E* (6.8%, $t = 2.6$), intangibles (4.5%, $t = 3$), debt in current liabilities (3.4%, $t = 2.4$), and change in long-term debt (3.6%, $t = 2.1$). All these variables have significant correlations with investment-to-assets.

The evidence that $\Delta FINL$, changes in other current assets, changes in debt in current liabilities, and changes in long-term debt predict returns in the cross section is intriguing. While our assessment of covariation with investment largely goes in the opposite direction from Richardson et al.'s

[2005] assessment of accounting reliability, the two types of assessment go in the same direction for the aforementioned variables. While Richardson et al. rank their accounting reliability to be high, we also rank their correlations with investment to be high. As such, the cross-sectional predictability of these variables provides a unique opportunity to disentangle the accounting reliability hypothesis from the optimal investment hypothesis. Because of their high reliability, the former hypothesis predicts that these variables should not forecast future returns. However, the latter hypothesis says that these variables should forecast future returns because they covary with investment. The evidence lends support to the optimal investment hypothesis.

4.3.2. Factor Regressions. If accrual reliability reflects the correlation of a given accrual component with *I/A*, controlling for investment should substantially attenuate the explanatory power of the accrual component for future returns. The evidence in table 10 is largely consistent this prediction.

We adopt the same simple test design as in table 5. We use the low-minus-high deciles formed on different accrual components as testing portfolios in factor regressions, and perform the market regressions with and without the investment factor, r_{INV}. We only tabulate the results from adding the investment factor into the CAPM to save space: Using the Fama-French model as the baseline regression yields largely similar results (not reported). Table 10 shows that adding the investment factor is effective in reducing the alphas for the low-minus-high deciles formed on ΔNCO and ΔWC, and to a lesser extent, on ΔFIN. For example, the alpha of the zero-cost ΔNCO portfolio is 0.88% per month ($t = 5.9$). Adding r_{INV} reduces this alpha by 51% to 0.43%, albeit still significant. The alpha of the zero-cost ΔWC portfolio is 0.90% ($t = 4.3$), and r_{INV} reduces the alpha by 60% to 0.36% ($t = 1.6$). The investment factor lowers the magnitude of the low-minus-high ΔFIN alpha by 45% from 0.49% to 0.27%, although it only lowers the low-minus-high $\Delta FINL$ alpha by 11% from 0.45% to 0.40%. Finally, the investment factor reduces the alphas of zero-cost deciles formed on ΔCOA and $\Delta NCOA$ by 69% and 37%, respectively.

In untabulated results, we also find that adding r_{INV} reduces the low-minus-high alpha formed on accounts receivable from 0.59% per month ($t = 2.73$) to 0.16% ($t = 0.74$); the low-minus-high inventories alpha from 0.64% ($t = 3.42$) to zero; the low-minus-high alpha formed on other current assets from 0.38% ($t = 2.15$) to 0.18% ($t = 1.07$); the low-minus-high alpha formed on change in property, plant, and equipment from 0.42% ($t = 2.45$) to −0.11% ($t = -0.66$); the low-minus-high intangibles alpha from 0.42% ($t = 2.67$) to 0.22% ($t = 1.36$); the low-minus-high accounts payable alpha from 0.63% ($t = 3.22$) to 0.22% ($t = 1.05$); and the low-minus-high alpha formed on change in long-term debt from 0.43% ($t = 3.39$) to 0.26% ($t = 1.83$). It is clear that investment is effective in summarizing the predictive power of all these variables for cross-sectional returns.

TABLE 10

Calendar-Time Factor Regressions of the Low-Minus-High Deciles Formed on the Accrual Categories in Richardson et al.'s [2005] Initial and Extended Decompositions, with and without the Investment Factor (January 1970–December 2007)

$\alpha_{\text{L-H}}$	β_{MKT}	β_{INV}	$\|\Delta\alpha\|/\alpha$	$\alpha_{\text{L-H}}$	β_{MKT}	β_{INV}	$\|\Delta\alpha\|/\alpha$	$\alpha_{\text{L-H}}$	β_{MKT}	β_{INV}	$\|\Delta\alpha\|/\alpha$
	Panel A: Δ*NCO*				**Panel B: Δ*WC***				**Panel C: Δ*FIN***		
0.88	−0.18			0.90	−0.16			−0.49	−0.05		
(5.9)	(−4.5)			(4.3)	(−3.2)			(−2.1)	(−0.8)		
0.43	−0.03	0.75	51.4	0.36	−0.00	0.82	60.4	−0.27	−0.12	−0.35	45.3
(3.0)	(−0.8)	(8.6)		(1.6)	(−0.1)	(6.5)		(−1.0)	(−1.7)	(−1.8)	
	Panel D: Δ*COA*				**Panel E: Δ*COL***						
1.04	−0.49			0.36	−0.26						
(4.6)	(−7.2)			(1.8)	(−4.3)						
0.32	−0.28	1.10	69.2	−0.02	−0.15	0.58					
(1.5)	(−4.1)	(7.4)		(−0.1)	(−2.4)	(4.4)					
	Panel F: Δ*NCOA*				**Panel G: Δ*NCOL***						
0.82	−0.13			0.15	0.08						
(4.6)	(−2.4)			(1.0)	(1.8)						
0.52	−0.04	0.46	36.6	−0.02	0.13	0.26					
(3.0)	(−0.7)	(3.7)		(−0.1)	(3.0)	(2.8)					
	Panel H: Δ*STI*				**Panel I: Δ*LTI***				**Panel J: Δ*FINL***		
−0.01	−0.07			0.19	−0.08			0.45	−0.06		
(−0.1)	(−1.6)			(1.3)	(−2.1)			(3.2)	(−1.6)		
−0.23	−0.01	0.33		0.12	−0.06	0.11		0.40	−0.05	0.08	11.1
(−1.1)	(−0.2)	(2.2)		(0.8)	(−1.3)	(1.1)		(2.6)	(−1.2)	(0.9)	

The dependent variables in the factor regressions are value-weighted low-minus-high accrual decile returns. In June of each year t, we assign stocks into 10 deciles based on ΔNCO, ΔWC, ΔFIN, and ΔCOA, ΔCOL, $\Delta NCOA$, $\Delta NCOL$, ΔSTI, ΔLTI, and $\Delta FINL$ in panels A to J, respectively. The accruals are measured at the fiscal year end of year $t-1$, and the monthly value-weighted portfolio returns are calculated from July of year t to June of year $t+1$. We run the market regression with and without the investment factor, r_{INV}. Table 4 describes the construction of r_{INV}. The t-statistics reported in parentheses are adjusted for heteroscedasticity and autocorrelations. $\alpha_{\text{L-H}}$ is the alpha for the low-minus-high deciles. $|\Delta\alpha|/\alpha$ is the percentage reduction in alphas from augmenting the factor regressions with r_{INV}. See the caption of table 1 for the detailed definitions for various accrual categories.

TABLE 11

The Averages of Realized Stock Returns, Expected Dividend-to-Price Ratio, Expected Long-Run Dividend Growth, and Ex Ante Discount Rates for Quintiles Formed on the Accrual Categories in Richardson et al.'s [2005] Initial and Extended Decompositions (1970–2007)

		E	E	E		E	E	E		E	E	E
	r_{t+1}	$[D/P]$	$[Ag]$	$[r]$	r_{t+1}	$[D/P]$	$[Ag]$	$[r]$	r_{t+1}	$[D/P]$	$[Ag]$	$[r]$
	Panel A: ΔNCO				**Panel B: ΔWC**				**Panel C: ΔFIN**			
Low	15.7	2.9	5.2	8.1	15.9	2.4	6.0	8.4	9.9	2.2	3.1	5.3
2	14.4	3.0	4.4	7.4	13.6	3.1	4.5	7.7	11.3	2.8	3.1	5.9
3	13.0	2.9	4.0	6.9	12.7	2.9	2.4	5.3	13.0	3.0	3.1	6.1
4	11.8	2.6	3.0	5.6	11.0	2.4	2.9	5.3	14.1	2.7	4.7	7.4
High	9.6	1.9	2.8	4.6	7.3	1.4	2.3	3.8	12.5	2.0	2.4	4.4
L−H	6.0	1.0	2.5	3.5	8.6	0.9	3.7	4.6	−2.6	0.2	0.7	0.9
$t_{\text{L−H}}$	2.8	11.8	5.5	7.2	4.7	6.4	21.7	16.2	−1.2	1.7	3.6	3.4
	Panel D: ΔCOA				**Panel E: ΔCOL**							
Low	16.0	3.2	5.9	9.0	14.3	2.9	4.2	7.1				
2	15.1	3.4	4.5	7.9	13.1	3.3	3.3	6.6				
3	13.0	2.7	2.5	5.1	13.4	3.0	4.2	7.1				
4	12.8	2.3	3.3	5.6	14.7	2.4	4.3	6.7				
High	12.3	1.5	1.4	2.9	13.8	1.8	3.7	5.6				
L−H	3.7	1.7	4.5	6.2	0.5	1.1	0.5	1.5				
$t_{\text{L−H}}$	1.8	7.9	12.2	11.6	0.2	8.1	1.1	3.2				
	Panel F: $\Delta NCOA$				**Panel G: $\Delta NCOL$**							
Low	14.2	2.9	3.3	6.2	17.1	2.8	5.4	8.2				
2	14.1	2.9	5.1	8.0	13.2	2.1	4.5	6.6				
3	14.8	2.9	3.6	6.6	13.4	2.4	3.6	6.0				
4	12.8	2.7	3.5	6.2	14.3	2.7	3.1	5.8				
High	10.6	1.9	2.0	4.0	12.5	3.0	2.3	5.3				
L−H	3.6	1.0	1.2	2.2	4.6	−0.2	3.1	3.0				
$t_{\text{L−H}}$	2.5	8.0	8.2	10.4	2.4	−1.4	3.0	3.1				
	Panel H: ΔSTI				**Panel I: ΔLTI**				**Panel J: $\Delta FINL$**			
Low	13.7	2.8	3.0	5.8	13.6	2.8	2.6	5.4	15.8	2.4	5.0	7.3
2	14.9	3.2	4.2	7.4	11.6	2.7	0.7	3.3	15.6	2.9	4.4	7.3
3	14.9	3.2	4.2	7.4	11.6	2.7	0.7	3.3	12.0	2.8	5.0	7.7
4	13.8	3.0	3.0	6.0	10.3	4.0	0.3	4.3	14.2	2.9	3.7	6.7
High	14.6	2.4	6.0	8.4	14.1	2.9	3.3	6.2	10.8	2.1	1.4	3.5
L−H	−0.9	0.4	−3.0	−2.6	−0.6	−0.1	−0.7	−0.8	5.0	0.2	3.6	3.8
$t_{\text{L−H}}$	−0.4	4.1	−6.4	−6.8	−0.4	−1.5	−2.8	−4.2	2.9	3.6	17.8	19.8

We report the annualized averages of the realized future one-year returns, r_{t+1}, the expected dividend-to-price ratio, $E[D/P]$, the expected long-run dividend growth, $E[Ag]$, and the ex ante discount rate, $E[r]$. All the series are adjusted for inflation. The t-statistics are adjusted for heteroscedasticity and autocorrelations. Except for the t-statistics, all the table entries are in annualized percent. See the caption of table 1 for the detailed definitions for various accrual categories.

4.3.3. Discount Rate Estimates. If the optimal investment hypothesis drives the negative relation between accrual reliability and the magnitude of the accrual effect, less reliable accruals should covary more with the ex ante discount rates than more reliable accruals. Tables 11 and 12 are largely consistent with this prediction.

Table 11 reports discount rate estimates from the dividend discounting model for one-way quintiles formed on accrual categories. The test design is the same as in table 7. The low-minus-high portfolios formed on the less

TABLE 12

The Average Implied Costs of Capital at Different Leads and Lags for Quintiles Formed on the Accrual Categories in Richardson et al.'s [2005] Initial and Extended Decompositions (1970–2007)

	r^e_{t+1}	r^e_t	r^e_{t-1}	r^e_{t+1}	r^e_t	r^e_{t-1}	r^e_{t+1}	r^e_t	r^e_{t-1}
	Panel A: Δ*NCO*			**Panel B: Δ*WC***			**Panel C: Δ*FIN***		
Low	9.79	10.06	10.17	9.16	9.52	9.74	9.21	9.37	9.35
2	9.54	9.88	9.98	9.25	9.42	9.52	9.65	9.67	9.76
3	9.35	9.48	9.59	9.20	9.24	9.33	9.45	9.56	9.74
4	9.20	9.27	9.44	9.20	9.17	9.33	9.56	9.67	9.92
High	8.83	8.92	9.02	9.26	9.20	9.35	9.03	9.34	9.60
L−H	0.96	1.14	1.15	−0.09	0.32	0.39	0.18	0.03	−0.24
$t_{\text{L−H}}$	5.66	6.45	9.35	−0.67	2.44	2.51	2.42	0.22	−1.84
	Panel D: Δ*COA*			**Panel E: Δ*COL***					
Low	10.46	10.53	10.60	10.57	10.63	10.70			
2	10.44	10.50	10.54	10.55	10.63	10.72			
3	10.37	10.38	10.50	10.46	10.50	10.58			
4	10.43	10.41	10.47	10.34	10.38	10.47			
High	10.33	10.30	10.38	10.31	10.35	10.46			
L−H	0.13	0.23	0.22	0.26	0.28	0.24			
$t_{\text{L−H}}$	0.59	1.07	1.06	1.01	1.16	1.04			
	Panel F: Δ*NCOA*			**Panel G: Δ*NCOL***					
Low	10.76	10.87	10.94	10.58	10.66	10.73			
2	10.71	10.78	10.82	10.62	10.69	10.73			
3	10.64	10.62	10.66	10.67	10.76	10.84			
4	10.38	10.36	10.37	10.66	10.66	10.69			
High	9.90	9.85	9.92	10.43	10.46	10.54			
L−H	0.86	1.01	1.02	0.15	0.21	0.19			
$t_{\text{L−H}}$	5.65	5.77	5.55	1.36	1.64	1.46			
	Panel H: Δ*STI*			**Panel I: Δ*LTI***			**Panel J: Δ*FINL***		
Low	11.52	11.55	11.66	12.02	11.93	11.93	10.60	10.73	10.77
2	11.76	11.66	11.60	11.68	11.71	11.76	10.93	10.99	11.00
3	11.27	11.41	11.45	11.99	12.03	12.09	11.17	11.16	11.17
4	10.74	10.78	10.95	11.27	11.27	11.24	11.10	11.07	11.08
High	9.55	9.60	9.68	10.55	10.55	10.58	10.42	10.33	10.37
L−H	1.97	1.95	1.98	1.47	1.38	1.35	0.18	0.41	0.41
$t_{\text{L−H}}$	6.00	6.24	6.82	5.53	5.97	6.33	1.30	2.84	2.92

r^e is the annualized implied costs of capital. Figure 1 illustrates the timing convention. The t-statistics are adjusted for heteroscedasticity and autocorrelations. All entries except for the t-statistics are in annualized percent. See the caption of table 1 for the detailed definitions for various accrual categories.

reliable Δ*WC* and Δ*NCO* earn positive average ex post returns that are more than 2.5 standard errors from zero. In contrast, the average return of the zero-cost portfolio formed on the more reliable Δ*FIN* is insignificantly negative. More important, the ex post profitability of the Δ*NCO* and Δ*WC* is at least partially expected ex ante. The low-Δ*NCO* quintile has a high discount rate of 8.1% per annum, whereas the high-Δ*NCO* quintile has a low discount rate of 4.6%: The spread of 3.5% per annum ($t = 7.2$) accounts for about 60% of the average return spread. The discount rate spread of 4.6% across the extreme Δ*WC* quintiles accounts for more than 50% of the average return spread. In contrast, the spread across the extreme quintiles of the more reliable Δ*FIN* is only 0.9%, albeit significant.

The results from the extended accrual decomposition are more mixed. The discount rate spread between low and high ΔCOA quintiles is 6.2% per annum that is more than 10 standard errors from zero. At the other extreme, the discount rate spread between extreme ΔLTI quintiles is a small −0.8% per annum. The evidence lends support to the optimal investment hypothesis because ΔCOA is highly correlated with investment but ΔLTI is not. However, $\Delta NCOA$ is even more correlated with investment than ΔCOA, but the discount rate spread across the $\Delta NCOA$ quintiles is only 2.2% per annum, albeit significant. Further, the low-minus-high ΔSTI quintile has an insignificant average ex post return of −0.9% per annum, but a significant ex ante return of −2.6%.

Table 12 reports the discount rate estimates from the residual income model. The test design is the same as in table 8. We find some evidence that less reliable accruals covary more with ex ante discount rates than more reliable accruals. The low-minus-high ΔNCO portfolio has a significant contemporaneous discount rate of 1.14% per annum, which is more than six standard errors from zero. The results for the one-year-ahead and one-year-lagged discount rates are largely similar. The low-minus-high ΔWC portfolio has a significant discount rate of 0.32% per annum ($t = 2.44$). The one-year-lagged discount rate remains significant at 0.39% per annum ($t = 2.51$), but the one-year-ahead discount rate is close to zero. In contrast, the discount rate spread across the extreme quintiles formed on the more reliable ΔFIN is close to zero.

The results from the extended decomposition again are more mixed. The spread in contemporaneous discount rate between extreme $\Delta NCOA$ quintiles is 1.01% per annum, which is more than 5.5 standard errors from zero. This evidence is consistent with the optimal investment hypothesis because $\Delta NCOA$ is highly correlated with investment. However, the discount rate spread between the extreme quintiles formed on ΔCOA (also closely correlated with investment) is only 0.23%, which is within 1.1 standard errors from zero. Further, the discount rate of the low-minus-high quintile formed on ΔSTI (weakly correlated with investment) is relatively large: 1.95% per annum, which is more than six standard errors from zero. However, table 11 shows that this discount rate estimate from the dividend discounting model is significantly negative: −2.6% per annum. The fact that the two methods yield different estimates makes the interpretation of the results somewhat difficult.

4.4 TIME-VARYING EXPECTED RETURNS TO ACCRUALS-BASED TRADING STRATEGIES

We also study the time series predictability of returns to accruals-based trading strategies. This part is motivated by the observation that the accrual anomaly seems to have deteriorated over the years since Sloan's [1996] discovery (e.g., Green, Hand, and Soliman [2009]). Figure 2 reports the annual returns of low-minus-high deciles formed on various accruals from 1990 to 2007. The average return of the *TotA* strategy is 12.4% per annum

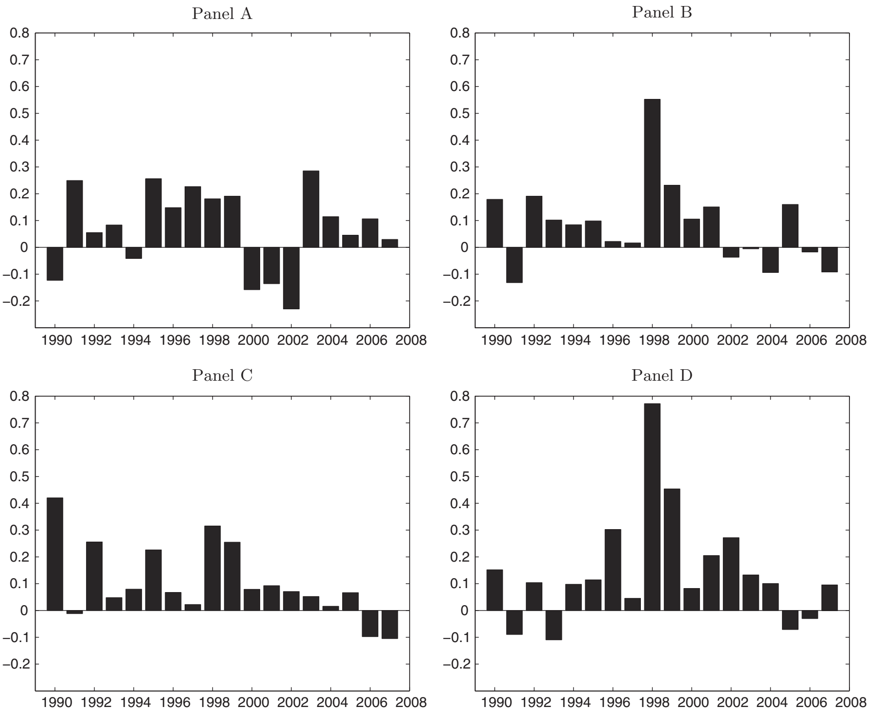

FIG. 2.—Annual value-weighted CRSP market excess returns and returns to low-minus-high deciles formed on total accruals (*TotA*), discretionary accruals (*DisA*), and net operating assets (*NoaA*) (1990–2007). Panel A: market excess returns. Panel B: low-minus-high *TotA*. Panel C: low-minus-high *DisA*. Panel D: low-minus-high *NoaA*.

during the first half of the sample from 1990 to 1998, but is only 4.5% from 1999 to 2007. The average return of the zero-cost *DisA* decile is 15.8% in the first half but is 4.8% in the second half. The *NoaA* strategy's average return does not vary much across the two subsamples. However, its annual return has largely been decreasing since 1998.

To test the time-varying risk hypothesis (Hypothesis 4 in section 2.2), we follow the finance literature on predicting stock market excess returns (e.g., Fama and French [1989], Hodrick [1992], and Bollerslev, Tauchen, and Zhou [2009]). We perform predictive regressions of the monthly (overlapping) observations of a given strategy's returns that go from the beginning of month t to the beginning of month $t + \tau$ on an explanatory variable at the beginning of month t. τ is the predictive horizon that ranges from one month ($\tau = 1$) to 24 months ($\tau = 24$). Bollerslev et al. show that the variance risk premium, defined as the difference between implied and realized variance of S&P 500 index, can explain a significant fraction of the variation of market excess returns.[7] The magnitude of the predictability is particularly strong at quarterly horizon, in which variance risk premium dominates other popular conditioning variables in predicting stock market returns. The major advantage of using this variable to predict returns is its low first-order autocorrelation, which is only 0.50 in the 1990–2007 sample. The sample starts from 1990 because of data restrictions (the variance risk premium data are from Hao Zhou's Web site). In contrast, many popular predictors, such as the default premium, have autocorrelations above 0.98, raising the possibility of spurious regressions and biased estimates (e.g., Stambaugh [1999] and Ferson, Sarkissian, and Simin [2003]).

Panel A of table 13 replicates Bollerslev, Tauchen, and Zhou's [2009] central result that variance risk premium predicts market excess returns with a maximum adjusted R^2 of 6.37% in the quarterly horizon. The slopes are all positive and mostly significant, suggesting that variance premium is positively correlated with the (countercyclical) expected market risk premium and that the variance premium is also countercyclical. More important, the table presents strong evidence that variance premium predicts returns to accruals-based trading strategies. At the quarterly horizon, variance premium predicts the low-minus-high *TotA*, *DisA*, and *NoaA* returns with adjusted R^2s of 3.47%, 2.37%, and 8.79%, and the t-statistics of the slopes are 2.74, 1.99, and 3.53, respectively. The t-statistics are adjusted for overlapping observations using the robust Hodrick [1992] standard errors. Using the Newey and West [1987] standard errors to account for autocorrelations yields largely similar results. In fact, the slopes are universally positive and mostly significant across various horizons.

While the evidence with variance risk premium is informative, it is based on a relatively short sample that starts in 1990. The remaining panels of table 13 report predictive regressions using a more traditional set of conditioning variables in the 1970–2007 sample. We use three additional conditioning variables. Fama and Schwert [1977] and Fama [1981] document that the relative Treasury bill rate predicts returns. We measure the relative bill rate as the one-month Treasury bill rate from the Federal Reserve Board minus its 12-month moving average. Keim and Stambaugh [1986] and Fama and French [1989] document the forecasting power of the term premium and the default premium for market excess returns. The term premium is the difference between the 10-year Treasury bond yield and the one-year Treasury bill yield from the Federal Reserve Board. The default premium is the difference between the Baa-rated corporate bond yield and the Aaa-rated corporate bond yield from the Federal Reserve Board.

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[7] Specifically, variance risk premium is the difference between the implied variance and realized variance, in which the implied variance is the end-of-month observation of *VIX*-squared and the realized variance is the sum of squared five-minute log returns of the S&P 500 index over the month. (*VIX* is the Chicago Board Options Exchange's implied volatility index computed using a wide range of S&P 500 index options.) Both variance measures are of monthly basis in percentage-squared and are available at the end of observation month.

TABLE 13

Predictive Regressions of CRSP Market Excess Returns and Returns to Low-Minus-High Accruals-Based Trading Strategies

τ	1	3	6	9	12	15	18	24	1	3	6	9	12	15	18	24
Panel A: Predictive Regressions with Variance Risk Premium (January 1990–December 2007)																
	Market excess returns								Low-minus-high *TotA*							
Slope	0.03	0.12	0.16	0.16	0.16	0.20	0.18	0.10	0.06	0.11	0.12	0.18	0.23	0.33	0.35	0.42
t_{HD}	1.45	2.87	2.12	1.45	1.10	1.14	0.86	0.39	4.23	2.74	1.62	1.65	1.58	1.80	1.62	1.45
t_{NW}	1.87	4.04	3.32	2.18	1.90	2.06	1.57	0.79	2.51	2.85	1.77	2.22	2.00	2.20	2.25	2.21
Adj.R^2	0.92	6.37	6.00	3.50	2.20	2.80	1.60	−0.10	3.42	3.47	1.90	3.40	3.80	6.10	5.50	6.20
	Low-minus-high *DisA*								Low-minus-high *NoaA*							
Slope	0.04	0.08	0.13	0.16	0.21	0.26	0.27	0.31	0.08	0.16	0.32	0.36	0.53	0.64	0.66	0.79
t_{HD}	2.81	1.99	1.63	1.47	1.52	1.51	1.32	1.13	5.12	3.53	3.30	2.49	2.81	2.76	2.33	2.15
t_{NW}	2.46	2.23	1.87	2.49	2.94	2.61	2.52	3.00	4.64	5.17	3.99	3.36	3.50	2.75	2.85	2.60
Adj.R^2	1.86	2.37	3.30	4.20	6.80	8.10	7.60	7.70	6.27	8.79	1.36	8.70	11.50	10.80	8.30	7.10
Panel B: Predictive Regressions with the Term Premium (January 1970–December 2007)																
	Market excess returns								Low-minus-high *TotA*							
Slope	0.25	0.70	1.07	1.73	2.16	2.43	2.78	3.31	−0.17	−0.39	−0.06	0.23	0.59	1.04	1.68	2.65
t_{HD}	3.03	2.89	2.28	2.52	2.42	2.24	2.18	2.02	−1.99	−1.58	−0.13	0.32	0.63	0.90	1.23	1.51
t_{NW}	1.79	1.89	1.83	2.16	2.36	2.54	2.94	3.48	−1.08	−1.01	−0.12	0.33	0.76	1.16	1.73	2.53
Adj.R^2	0.49	1.50	1.80	3.30	3.90	3.90	4.20	4.80	0.07	0.22	−0.20	−0.20	0.00	0.40	1.10	2.30
	Low-minus-high *DisA*								Low-minus-high *NoaA*							
Slope	0.14	0.33	1.04	1.54	1.83	1.94	2.09	2.13	0.09	0.14	0.17	−0.09	−0.65	−1.21	−1.80	−2.61
t_{HD}	1.89	1.57	2.57	2.61	2.36	2.02	1.83	1.42	1.13	0.58	0.36	−0.14	−0.75	−1.16	−1.49	−1.73
t_{NW}	1.06	1.10	2.28	2.42	2.35	2.11	2.06	2.00	0.66	0.39	0.28	−0.11	−0.57	−0.89	−1.14	−1.47
Adj.R^2	0.02	0.21	1.90	2.70	2.90	2.60	2.50	1.90	−0.13	−0.15	−0.20	−0.20	0.00	0.30	0.60	0.80

(*Continued*)

TABLE 13—*Continued*

τ	1	3	6	9	12	15	18	24	1	3	6	9	12	15	18	24
Panel C: Predictive Regressions with Relative Interest Rate (January 1970–December 2007)																
	Market excess returns								Low-minus-high *TotA*							
Slope	−2.90	−10.39	−14.08	−22.69	−28.86	−29.44	−25.11	−13.57	4.37	9.59	3.52	2.72	1.45	−2.11	−13.52	−42.57
t_{HD}	−1.13	−1.79	−1.41	−1.63	−1.61	−1.45	−1.09	−0.50	1.73	1.31	0.29	0.17	0.07	−0.10	−0.59	−1.70
t_{NW}	−1.17	−1.88	−1.61	−2.01	−2.18	−1.98	−1.70	−0.91	1.61	1.58	0.41	0.28	0.14	−0.18	−1.11	−3.07
Adj.R^2	0.17	1.37	1.20	2.30	2.90	2.40	1.40	0.10	0.60	0.87	−0.10	−0.20	−0.20	−0.20	0.20	2.60
	Low-minus-high *DisA*								Low-minus-high *NoaA*							
Slope	−1.02	−0.98	−11.18	−17.61	−20.35	−24.29	−32.88	−49.34	−2.75	−6.70	−11.78	−16.74	−19.04	−16.39	−19.14	−33.67
t_{HD}	−0.47	−0.16	−1.03	−1.23	−1.17	−1.27	−1.67	−2.25	−1.06	−0.99	−1.00	−1.09	−0.98	−0.71	−0.79	−1.35
t_{NW}	−0.42	−0.18	−1.37	−1.75	−1.82	−1.89	−2.52	−3.31	−1.13	−1.37	−1.47	−1.53	−1.30	−0.93	−0.89	−1.25
Adj.R^2	−0.17	−0.21	0.80	1.40	1.40	1.70	2.70	4.70	0.12	0.45	0.70	0.70	0.50	0.20	0.20	0.50
Panel D: Predictive Regressions with the Default Premium (January 1970–December 2007)																
	Market excess returns								Low-minus-high *TotA*							
Slope	1.04	2.52	4.34	4.58	4.86	4.18	3.18	−0.57	−1.17	−2.98	−4.57	−4.88	−4.78	−4.14	−3.80	−2.21
t_{HD}	5.33	4.40	3.90	2.78	2.24	1.56	1.00	−0.14	−5.96	−5.08	−4.01	−2.91	−2.22	−1.57	−1.21	−0.53
t_{NW}	1.80	1.65	1.81	1.52	1.40	1.11	0.82	−0.15	−1.87	−1.85	−1.99	−1.87	−1.57	−1.18	−0.95	−0.47
Adj.R^2	0.71	1.50	2.30	1.70	1.40	0.70	0.20	−0.20	0.86	1.73	2.10	1.70	1.10	0.60	0.30	−0.10
	Low-minus-high *DisA*								Low-minus-high *NoaA*							
Slope	−0.48	−0.92	−2.10	−1.44	−0.35	0.43	0.71	2.12	−0.34	−1.08	−2.10	−2.30	−1.75	−1.68	−0.97	−1.08
t_{HD}	−2.81	−1.83	−2.12	−0.98	−0.18	0.18	0.25	0.56	−1.79	−1.87	−1.86	−1.38	−0.80	−0.63	−0.31	−0.26
t_{NW}	−0.96	−0.72	−1.08	−0.66	−0.15	0.16	0.24	0.63	−0.55	−0.71	−0.85	−0.67	−0.38	−0.30	−0.14	−0.12
Adj.R^2	0.00	0.04	0.40	0.00	−0.20	−0.20	−0.20	−0.10	−0.12	0.10	0.30	0.10	−0.10	−0.20	−0.20	−0.20

We report predictive regressions of monthly (overlapping) observations of a portfolio's returns from month t to month $t + \tau$ on a given predictor at the beginning of month t. τ ranges from 1 month to 24 months. The t-statistics testing zero slopes are adjusted using both the robust Hodrick [1992] standard errors for overlapping observations (t_{HD}) and the Newey and West [1987] standard errors for autocorrelations (t_{NW}). The adjusted R^2s are in percent.

Panel B of table 13 shows that the term premium predicts market excess returns with a positive slope, especially at longer horizons (12 months and beyond). High values of the term premium also forecast higher returns of the low-minus-high *DisA* decile. The slopes at the six-month horizon and onwards are, for the most part, significantly positive. However, the slopes from forecasting the low-minus-high *TotA* decile returns are mostly positive and insignificant, and the slopes from forecasting the low-minus-high *NoaA* decile returns are mostly negative and insignificant. From panel C, the relative bill rate forecasts market excess returns with a negative slope. Nominal interest rates are procyclical: High values of the relative bill rate indicate good times when market excess returns are on average lower going forward, and low values of the relative bill rate indicate bad times when market excess returns are on average higher going forward. More important, the relative bill rate predicts the low-minus-high *DisA* decile returns: The slopes are universally negative and are at least marginally significant at long horizons. The slopes from forecasting the low-minus-high *NoaA* returns also are universally negative but are all within 1.4 standard errors from zero. The slopes from forecasting the low-minus-high *TotA* returns have mixed signs and are mostly insignificant.

While the evidence from predictive regressions so far is largely consistent with the time-varying risk hypothesis, panel D documents some evidence that is not. The default premium forecasts market excess returns with a positive slope, especially in short horizons up to 12 months, suggesting that the default premium is countercyclical. However, the default premium also forecasts returns to accruals-based strategies with a negative slope. In the case of the *TotA* and *DisA* portfolios, the slopes are often significant in short horizons. The evidence says that high values of the default premium (that indicate bad times) forecast lower average returns to accruals-based trading strategies going forward, and that low values of the default premium (that indicate good times) forecast higher average returns to accruals-based trading strategies going forward.

On balance, however, the overall evidence suggests that the expected returns to accruals-based trading strategies are time-varying (and countercyclical), suggesting that the deterioration of the accrual effect in recent years might be temporary and likely to mean-revert in the near future. We caution that definitively distinguishing the time-varying risk hypothesis from the learning hypothesis of Green, Hand, and Soliman [2009] requires a much longer sample, if it is at all possible. Estimating expected returns is notoriously difficult (e.g., Merton [1980]), and capturing their time-variation is even harder. The learning story predicts that the magnitude of the accrual anomaly should monotonically decrease since Sloan's [1996] discovery. This story does not predict the recurring nature of the expected returns to accruals-based trading strategies: It is hard to imagine investors forgetting in bad times what they have learned previously. While both stories are plausible, time will tell which story provides a more accurate description of the reality.

5. *Other Empirical Evidence on the Accrual Anomaly*

The accrual anomaly literature has documented evidence of earnings announcement returns and the behavior of sell-side analysts, auditors, bondholders, short-sellers, and other capital markets participants, evidence that is supportive of Sloan's [1996] earnings fixation hypothesis. It is interesting to see whether such evidence is consistent with the optimal investment hypothesis.

5.1 EARNINGS ANNOUNCEMENT RETURNS

Sloan [1996] shows that predictable stock returns related to accruals are concentrated around subsequent earnings announcements, suggesting investors are systematically surprised. This evidence is a hurdle for any risk-based story. Indeed, traditional consumption-based asset pricing theories link risk to expected returns, and have little to say about patterns of subsequent realized returns.

In contrast, investment-based asset pricing predicts the concentration of ex post realizations of returns around earnings announcements. The reason is simple. As first noted by Cochrane [1991], q-theory predicts that under constant returns to scale, the stock return from t to $t + 1$ is equal to the investment return, which is the ratio of marginal benefits of investment in period $t + 1$ divided by marginal costs of investment in period t. This equivalence holds ex ante *and* ex post, period by period and state by state. In the simplest static model in section 2.1, the stock return is identical to the return on assets (see equations (2) and (3)). It is, therefore, only natural for the expected return to be realized around earnings announcements when earnings news is released to the markets.

The literature has provided other related reasons why predictable stock returns are concentrated around subsequent earnings announcements. Earnings announcements likely convey more new information to the markets than other periods. Ball and Kothari [1991] and Shin [2003, 2006], for example, argue that disclosures resolve uncertainty, but the increased information flow also raises risk during the disclosure period. If earnings information is correlated across firms, risk would increase, and investors should expect higher returns to compensate for the higher risk around earnings announcements. Alternatively, information about earnings or cash flow volatility is more likely to be revealed via earnings announcements. If expected returns are related to fundamental volatility, it is not surprising for predictable stock returns to concentrate around earnings announcements.

5.2 ANALYST FORECAST ERRORS

Bradshaw, Richardson, and Sloan [2001] show that sell-side analysts' earnings forecasts do not incorporate the predictable future earnings declines of firms with high accruals. While the evidence is consistent with investors ignoring information contained in high accruals, the evidence does not necessarily refute the optimal investment hypothesis because of analysts' conflicts of interest problems. Sell-side analysts often work for securities firms that invest in the companies for which analysts make investment recommendations. Also, securities firms often compensate analysts for short-term performance of the companies that they follow, providing analysts with incentives to issue overly optimistic forecasts. Because of the conflicts of interest, analysts' forecasts have historically been optimistically biased, giving rise to negative forecast errors on average. These forecast errors are likely to be larger for firms with high accruals: These firms invest more, need more external financing, and are more actively traded. As such, analysts have stronger incentives to issue optimistic forecasts to generate trading commissions and investment banking business.

5.3 AUDITOR OPINIONS

Bradshaw, Richardson, and Sloan [2001] also show that high accrual firms are less likely to have unclean audit opinions and auditor changes, suggesting that auditors do not alert investors to the increased frequency of future earnings declines and to generally accepted accounting principles (GAAP) violations associated with high accruals. However, if accruals are negatively correlated with risk (and expected returns), high accrual firms with lower risk should be less likely to have modified auditor opinions, such as going concern in the audit report. In contrast, low accrual firms with higher risk should be more likely to have such modified opinions. In both cases, firms report accruals faithfully. This alternative explanation is potentially consistent with the optimal investment hypothesis. Also, auditors are not immune to conflicts of interest problems. Business firms hire and compensate their auditors, thereby influencing the relationships with the auditors and likely compromising their independence. As an example, Arthur Anderson was accused of applying lax standards in auditing Enron because of conflicts of interest over the high consulting fees from Enron (e.g., Healy and Palepu [2003]).

5.4 THE CORPORATE BOND MARKET

Bhojraj and Swaminathan [2009] document that corporate bonds of firms with high accruals underperform corporate bonds of firms with low accruals by 0.93% per annum, and suggest that corporate bond investors cannot distinguish between low and high earnings quality in the same way as equity investors. However, they acknowledge that: "It is puzzling as to why corporate bond investors who have strong incentives to focus on cash flows and who tend to be large, sophisticated institutional investors, are confused by differences in earnings quality. Perhaps the information in accruals has to do with more than just earnings quality and is related to over-optimism about the value created by current capital expenditures" (pp. 35–36).

However, as first noted by Merton [1974], bond and equity are different contingent claims written on the same productive assets, and should share similar sources of risk. As such, the optimal investment hypothesis also predicts the discount rate variation across corporate bonds issued by firms with extreme accruals. An advantage of this explanation is that does not assume systematic, cognitive failures on the part of large, sophisticated institutional investors.

5.5 SHORT SELLERS

Using a sample of U.S. traded firms from 1990 to 1998, Richardson [2003] finds no evidence that short sellers trade on the basis of information contained in accruals. While the evidence is consistent with the notion that the market does not impound earnings quality information, it does not refute the optimal investment hypothesis. If the average returns of low-minus-high accrual portfolios are compensation for risk, short sellers should have no incentives to short high accruals stocks. Also, high accrual stocks tend to be smaller and less liquid, and taking short positions can be costly.

6. *Summary*

Interpreting accruals as working capital investment, we hypothesize that firms optimally adjust their investment in response to discount rate changes. This hypothesis can be motivated from the q-theory of investment. When the discount rate falls, more projects become profitable and accruals increase, but future returns should decrease on average because the lower discount rate means lower expected returns going forward. When the discount rate rises, fewer projects become profitable and accruals decrease, but future returns should increase on average because the higher discount rate means higher expected returns going forward. Most, if not all, existing explanations for the accrual anomaly assume some form of investor irrationality. In contrast, our explanation retains the assumption of rational expectations in the original sense of Muth [1961] and Lucas [1972].

We report four main results. First, adding an investment factor into standard factor regressions substantially reduces the magnitude of the accrual anomaly, often to insignificant levels. Second, accruals covary negatively with the discount rate estimates from the dividend discounting model as in Fama and French [2002], and for the most part, with the estimates from the residual income model as in Gebhardt, Lee, and Swaminathan [2001]. Third, less reliable accruals are more correlated with investment than more reliable accruals, meaning that the optimal investment hypothesis can explain the negative relation between accounting reliability and the accrual effect. Finally, expected returns to accruals-based strategies are time-varying (countercyclical), meaning that the deterioration of the accrual effect in recent years might be temporary and likely to mean-revert in the near future. In all, we conclude that real investment is an important driving force of the accrual anomaly.

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