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Market Reactions to Tangible and Intangible Information

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- Abstract -

Previous empirical studies suggest a negative relationship between prior 3-5 year fundamental performance and future returns: distressed firms outperform more profitable firms. In fact, we show here that after controlling for past stock returns firms with higher past fundamental returns actually *outperform* weaker firms. Our results are consistent with investors reacting appropriately to *tangible* information (defined as information which can be extracted from financial statements), but overreacting to *intangible* information. We explain these findings with a simple model based on the behavioral finding that investors are more overconfident about their ability to interpret intangible information. Finally, we reconcile our results with previous studies, and show that firms which grow through share-issuance activity experience low future returns, while firms that grow through increased profitability do not.

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1 Introduction

There is now substantial evidence that individual stock returns are predictable. This evidence can be divided into three categories. First, there is evidence that past returns can be used to forecast future returns. At horizons of 3 to 12 months, excess returns exhibit positive serial correlation or *momentum* (Jegadeesh and Titman 1993), while at longer horizons of 3 to 5 years, there is evidence of negative serial correlation or *reversal*, (see DeBondt and Thaler, (1985, 1987), and Chopra, Lakonishok, and Ritter (1992)).[1]

In the second category, *price-scaled variables* such as the earnings-to-price, dividend-to-price, cash flow-to-price, the book-to-market ratio, and market-capitalization itself forecast future returns.[2] The ratio that has been most studied in recent years is the book-to-market ratio. Studies find that stocks with high book-to-market ratios have historically generated much higher returns than stocks with low book-to-market ratios, and more importantly, that these returns cannot be easily explained with traditional asset pricing models.[3]

In the third and final category, there are a number of studies that examine the long term price reaction to specific information events. These information events can be categorized as either management decisions such as capital structure changes, dividend changes, and stock splits, or information about firm performance, such as earnings and sales figures.[4] There is considerable evidence that investors underreact to information conveyed by management decisions. For example, subsequent to a leverage increasing event, like a share repurchase or a dividend increase, benchmark-adjusted returns continue to be

[1]In addition, at very short horizons there is evidence of negative autocorrelation in individual stock returns (Jegadeesh (1990) and Lehmann (1990)).

[2]For evidence on e/p, see Basu (1983), Jaffe, Keim, and Westerfield (1989). For b/m, see Stattman (1980), Rosenberg, Reid, and Lanstein (1985), DeBondt and Thaler (1987), and Fama and French (1992). For c/p see Lakonishok, Shleifer, and Vishny (1994) and Chan, Hamao, and Lakonishok (1991) provide evidence on c/p and other price-scaled variables in the US and Japan, respectively.

[3]For example, Daniel and Titman (1997) show that stock returns can be better explained by the characteristics of the firm than by the sensitivity of returns to Fama and French (1993) factors (see also Davis, Fama, and French (2000) and Daniel, Titman, and Wei (2001).) Others have argued that the Sharpe-ratios of strategies based on the size, book-to-market, and momentum characteristics are much too high, especially given their apparently low correlation with important economic variables. A variant of the Hansen and Jagannathan (1991) argument shows that this is only possible in a rational asset pricing model when there is highly variable marginal utility across states (see MacKinlay (1995) and Brennan, Chordia, and Subrahmanyam (1998).)

[4]The appendix of Daniel, Hirshleifer, and Subrahmanyam (1998) reviews this evidence, and provides citations to the original works.

positive for the next 4 or 5 years.[5]

The existing evidence on the price reaction to information about firm performance depends on the horizon over which returns are measured. For example, there is substantial evidence of short-term underreaction to earnings surprises. Lakonishok, Shleifer, and Vishny (1994, LSV), however, provides evidence over longer horizons that suggests that stock prices overreact to sales and cash flow information as well as earnings.

The emphasis in this paper is on the long-term return patterns and how they relate to both the price scaled evidence (e.g., the book-to-market effect) and the extent to which investors either over or under-react to accounting information. As a number of the above cited researchers have noted, these return anomalies are likely to be closely related. For example, high book-to-market ratios, low returns and declining earnings can all be viewed as instruments for "distress," which for a variety reasons may be related to future returns. In particular, Fama and French (1993) suggest that the distressed nature of high book-to-market firms may lead their returns to covary with a (priced) distress factor, resulting in a high risk premium for a portfolio of these firms.[6] Indeed, Fama and French (1995) show that high book-to–market firms are generally those that have experienced poor long-term growth in earnings. In contrast, DeBondt and Thaler (1985, 1987) and Lakonishok, Shleifer, and Vishny (1994) suggest that investors overreact to distress resulting in high future returns for firms with deteriorating fundamentals. While these rational and behavioral hypotheses are very different, both rely on the idea that the high future returns are related to poor past operating performance. In other words, at least relative to the reaction in a risk-neutral world, both explanations assume that over long horizons, investors tend to overreact to information about fundamentals.

However, not all high book-to-market firms can be characterized as distressed. Some firms experience spectacular earnings and less than spectacular stock price performance, thereby realizing a higher proportional increase in their book values than in their market values. Such firms, which will become high(er) book-to-market firms, will therefore realize high future expected returns if investors underreact, not overreact, to the information conveyed by their past earnings.[7]

[5] See Loughran and Ritter (1997) (seasoned offerings), Ikenberry, Lakonishok, and Vermaelen (1995) (repurchases), Michaely, Thaler, and Womack (1995) (dividend initiations and omissions).

[6] Fama and French (1996) argue that the book-to-market effect subsumes the DeBondt and Thaler long term reversal effect.

[7] The evidence in Piotroski (2000), is consistent with the idea that the book-to-market is in fact generated by investors underreacting to the earnings of financially healthy firms. He finds that it is the

It is also the case that firms become high and low book-to-market firms for reasons that have nothing to do with the *tangible* accounting information examined by LSV, Fama and French and others. For example, the tangible information (e.g., sales, cash flows and earnings) pertaining to Internet firms in the late 1990s are all consistent with those firms being financially distressed. However, since the intangible information about their future growth opportunities was viewed very favorably, these firms had extremely low book-to-market ratios. To the extent that the subsequent low returns of Internet stocks can be characterized as resulting from previous overreaction, the culprit is overreaction to *intangible* information, and not the tangible accounting information that has been discussed in the above-cited literature.

To explore these alternatives in more detail we develop a simple model that explicitly distinguishes between what we are calling tangible and intangible information. To be more specific, we define tangible information as explicit performance measures, like sales, earnings and cash flows, which can be observed in the firms' accounting statements. Intangible information, in contrast, is that part of the stock's past return that cannot be linked directly to accounting numbers, but which presumably reflects changes in expectations about future cash flows.

In addition to helping us sort through the relation between various return anomalies, the distinction between tangible and intangible information is useful for distinguishing between various behavioral models. For example, Daniel, Hirshleifer, and Subrahmanyam (1998, DHS) makes a distinction between public and private information, which is likely to be related to our distinction between tangible and intangible information. Current earnings, for example, are publicly disclosed, while more ambiguous information about growth opportunities are at least partially collected (or interpreted) privately by investors. DHS argue that investors are overconfident about the precision of their private signals and therefore, in the long run, will overreact to intangible private information and underreact to tangible public information.

The distinction between tangible and intangible information is also motivated by existing psychological evidence that is consistent with the idea that individuals react differently to information that is difficult to interpret. Specifically, individuals tend to be more overconfident in settings where more judgment is required to evaluate information, and where

financially healthy high book-to-market stocks rather than the distressed high book-to-market stocks that account for the bulk of the value premium.

the feedback on the quality of this judgment is ambiguous in the short run (Einhorn (1980)).[8] If this is the case, then we might expect investors to put too little weight on tangible information relative to intangible information. We show that this interpretation is consistent with the empirical findings in this paper.

The distinction between tangible and intangible information may also relate to the model developed by Barberis, Shleifer, and Vishny (1998, BSV). This paper develops a behavioral model that motivates why investors may under- and over-react to *tangible* information such as earnings.[9]

Although our paper's focus is on behavioral explanations for why investors may overreact or underreact to tangible and intangible information, it should also be noted that changes in risk, associated with these information events, could potentially generate return patterns in fully rational markets that resemble overreaction and underreaction. For example, information that a firm's systematic risk has decreased will generate an initial positive return, and lower than average subsequent returns.

Our empirical analysis of these behavioral and risk-based hypotheses is based on a decomposition of the logarithm of a firm's current book-to-market ratio into three components: specifically, we show that the current book-to-market ratio is equal to the firm's log-book-to-market ratio, measured 5 years in the past, minus the log-return on an investment in the firm over the past 5 years, plus what we call the log *book return* over the past 5 years, which measures how much the book value of a shareholder's claim on the firm would have grown over the previous 5 years.[10] We define tangible information as that

[8]There are two papers that we know of that find evidence consistent with this hypothesis. Daniel and Titman (1999) find that the momentum effect is stronger among growth firms than among value firms, and interpret this as resulting from the fact that more of growth firms' value arises from growth options that must be evaluated subjectively. Also, the evidence in Chan, Lakonishok, and Sougiannis (1999) suggests that the book-to-market effect is far stronger among firms with high R&D expenditures. Daniel, Hirshleifer, and Subrahmanyam (2001) interpret this evidence as consistent with more of the value of high R&D firms coming from intangibles, about which investors are more overconfident. Also related is Klibanoff, Lamont, and Wizman (1999). who find evidence of overreaction to what they call "salient" information.

[9]The LSV results, which we will revisit in this paper, provide part of the motivation for the BSV model.

[10]In a related paper, Vuolteenaho (1999a) presents a similar book-to-market decomposition, though he interprets this decomposition as a forward looking relationship, while we interpret it in a backward looking manner: Specifically, based on the dividend-growth based decomposition of Campbell and Shiller (1988), he assumes that if a firm has a low current book-to-market ratio, it must have either high expected future book value growth, or low expected future market-value growth. In contrast, our decomposition expresses the path a firm took to get to its currently high- or low- book-to-market ratio, and looks at how expected future returns are related to this path.

component of the change in the firm's value (i.e., the firm's return) that is attributable to its growth in book value. Accordingly, we define the projection of past returns onto the book return as the tangible information, and the residual from this projection (the component of the firm's return that cannot be explained by fundamentals) as the return associated with intangible information.

By decomposing the book-to-market ratio in this way we isolate the effect of intangible information on stock returns and thereby generate much stronger evidence of return reversals than was found in the prior literature. Through this decomposition we illustrate that the tendency of fundamental to price ratios (book/market, earnings/price, sales/price, and cash flow/price) to forecast future returns arises mainly because these ratios capture the intangible component of past returns. Our evidence is therefore consistent with the view that investors overreact to intangible information.

In contrast to our finding on the reaction to intangible information, we find no evidence of a significant reversal of the returns associated with tangible information. This evidence, which is inconsistent with the previously mentioned findings in LSV, is somewhat puzzling since our book return measure is similar to the fundamental growth measures used by LSV. In addition, we get similar results when we estimate our regressions with decompositions based on other fundamental to price ratios, specifically earnings to price, cash flow to price, and sales to price.

Our analysis indicates that the difference between our results and the LSV results arises because of an important distinction between the performance measures we consider. The LSV tests examine a firm's *total* growth, while our measures essentially examine growth per share.[11] This distinction is important since total growth can result either from increases on a per-share basis, or from increases in the scale of operations. For example, a firm which issues equity but experiences a low return on investment will have a low per-share growth rate, but can have a high total growth rate. A firm that is highly profitable, but which uses these profits to pay dividends or repurchase shares, will have high per share growth, but can have negative total growth.

Our evidence suggests that the LSV findings results from stock prices underreacting to the implications of a change in the number of shares, consistent with previous evidence on share issues and repurchases, rather than because market prices overreact to information

[11] Dechow and Sloan (1997) also consider the distinction between the total growth of these measures and their growth per share. However, they do not examine why this distinction is important.

about changes in cash flows, earnings or sales. In other words, firms which grow through share-issuance activity experience low future returns, but firms that grow because of high profitability do not.

Finally, we examine the extent to which our evidence of intangible reversals can explain the observed relation between share issuances and repurchases and future stock returns. Recent work by Hovakimian, Opler, and Titman (2000) present evidence that is consistent with the observation that firms tend to issue shares when the intangible portion of their returns has been high and repurchase shares when the intangible portion of their returns are low. This suggests that part of the abnormal returns associated with issuances and repurchases is likely to be due to the reversal evidence described in this paper. However, our multiple regressions that include change in shares as well as the elements of our decomposition indicate that these reversals cannot fully explain the abnormal returns associated with share issuances and repurchases.

The rest of the paper is organized as follows. In Section 2 we present a simple model that illustrates our decomposition into tangible and intangible information, and the econometric implications of this decomposition. Section 3 motivates and describes our decomposition of the book-to-market ratio. Section 4 presents our basic empirical tests and results. Section 5 relates our results to those of LSV and other studies. Section 6 discusses how our results could potentially be explained with models in which risk-premia are negatively related to past intangible returns, and runs two brief empirical tests designed to assess this hypothesis. Section 7 concludes, discusses the implications of our results, and suggests future research.

2 Market Reactions to Different Types of Information

This section develops a simple model that provides some intuition and motivation for our empirical tests. The model describes three sources of stock price movements. These include accounting-based information about the firm's current profitability (*tangible* information); other information about the firm's future growth opportunities (*intangible* information); and pure noise. To keep it simple, there are three dates, 0, 1 and 2, a single risk-neutral investor, and a risk-free rate of zero.

Given these assumptions, price changes and returns would not be forecastable were all investors rational. However, in our model investors misinterpret new information and as a result make expectational errors. The model captures three kinds of errors:

1. *Over- or Underreaction to Tangible Information:* Investors may not correctly incorporate information contained in past accounting growth rates in forming their estimates of the future cash flows that will accrue to shareholders. In our empirical tests, we investigate whether investors over- or underreact to the information in earnings, cash flow, sales, or growth rates. Given the linear specification of our model Over- or Underreaction to past growth rates is equivalent to over- or underextrapolating these growth rates.

2. *Over- or Underreaction to Intangible Information:* Intangible information is news about future cashflows which is not reflected in current accounting-based growth numbers. Investors may over- or underreact to intangible information, perhaps because they over- or underestimate the precision of this information.

3. *Pure noise:* Overreaction means that investors move prices too much in response to information about future cash flows. Alternatively, we classify stock movements as *pure noise* if they are uncorrelated with future cash flows. One interpretation of this comes from microstructure theory: if investors overestimate the extent to which their counterparts are informed, they will overreact to purely liquidity motivated trades. Alternatively, noise trades can represent an extreme form of overconfidence, in which investors believe that they have valuable signals about future cash flows, but in reality their signals are unrelated to future cash flows.

2.1 The Model

The following provides the timing of the various information and cash flow realizations along with a brief description of the structure of the model. Also, a summary of the model variables are given in Table 1.

Book Values and Cash Flows:

1. At date 0, the firm is endowed with assets with value B_0, which we denote as the initial book value of the firm's assets. We assume that the assets do not physically

Table 1: **A Summary of the Model Variables**

	$t=0$	$t=1$	$t=2$
Cash Flows (θ_t):	–	$\tilde{\theta}_1 = \bar{\theta} + \tilde{\epsilon}_1$	$\tilde{\theta}_2 = \bar{\theta} + \rho\tilde{\epsilon}_1 + \tilde{\epsilon}_2$
Intangible Signal:	–	$\tilde{s}\ \ (=\tilde{\epsilon}_2 - \tilde{u})$	–
Price "Noise":	–	$\tilde{e}$	–
B_t	B_0	$B_0 + \tilde{\theta}_1\ \ (= B_0 + \bar{\theta} + \tilde{\epsilon}_1)$	$B_1 + \tilde{\theta}_2$
$E_t^R[\tilde{B}_2])$	$B_0 + 2\bar{\theta}$	$B_1 + \rho\tilde{\epsilon}_1 + \tilde{s} + \tilde{e}$	B_2
$M_t\ (= E_t^C[\tilde{B}_2])$	$B_0 + 2\bar{\theta}$	$B_1 + \rho^E\tilde{\epsilon}_1 + (1+\omega)\tilde{s} + \tilde{e}$	B_2
$(B–M)_t$	$-2\bar{\theta}$	$-\left(\bar{\theta} + \rho^E\tilde{\epsilon}_1 + (1+\omega)\tilde{s} + \tilde{e}\right)$	0
$r_{t-1,t}^B$	–	$\tilde{\theta}_1\ \ (= \bar{\theta} + \tilde{\epsilon}_1)$	$\tilde{\theta}_2\ (= \bar{\theta} + \rho\tilde{\epsilon}_1 + \tilde{\epsilon}_2)$
$r_{t-1,t}$	–	$(1+\rho^E)\tilde{\epsilon}_1 + (1+\omega)\tilde{s} + \tilde{e}$	$-\left[(\rho^E - \rho)\tilde{\epsilon}_1 + \omega\tilde{s} + \tilde{e}\right] + \tilde{u}$

Also:

- $\tilde{\epsilon}_2 = \tilde{s} + \tilde{u}$, where $\tilde{u} \perp \{\tilde{s}, \tilde{\epsilon}_1\}$
- $\bar{\theta} \sim \mathcal{N}\left(\theta_0, \sigma^2(\bar{\theta})\right)$
- $\tilde{\epsilon}_1 \sim \mathcal{N}(0, \sigma_1^2)$, $\tilde{\epsilon}_2 \sim \mathcal{N}(0, \sigma_2^2)$, $\tilde{s} \sim \mathcal{N}(0, \sigma_s^2)$, $\tilde{e} \sim \mathcal{N}(0, \sigma_e^2)$

depreciate over time. At times 1 and 2, the firm's cash flows are $\tilde{\theta}_1$ and $\tilde{\theta}_2$. Each period, the book value grows by the amount of the cash flow.

2. At date 2 the firm is assumed to be liquidated, and all proceeds are paid to shareholders. Since investors are risk-neutral and the risk-free rate is zero, the price is set equal to the expected book value at time 2.

Expectations of Future Cash Flows:

1. At $t = 0$ the expected cash flows at dates 1 and 2 are $E_0[\tilde{\theta}_1] = E_0[\tilde{\theta}_2] = \bar{\theta}$ respectively.[12]

2. The unexpected cash flow at time 1 is $\tilde{\epsilon}_1$, so the total realized time 1 cash flow is $\tilde{\theta}_1 = \bar{\theta}_1 + \tilde{\epsilon}_1$.

3. At $t = 1$, the conditional expected value of the time 2 cash flow is affected both by accounting and non-accounting based information. We assume a linear relation between the time 1 and time 2 accounting growth, specifically: $E^R[\tilde{\theta}_2|\tilde{\theta}_1] = \bar{\theta}_2 + \rho\tilde{\epsilon}_1$.

[12]This assumption makes makes $(B-M)_0$ a perfect proxy for $E_0[r_{0,1}^B]$. If this were not the case, the model results would be qualitatively the same, but algebraically more complicated.

ρ is thus a measure of the accounting growth persistence.[13] The R superscript denotes Rational – as we will see investors are not necessarily rational in our setting.

4. The investor also observes non-accounting based information. We summarize this information in the signal $\tilde{s} = E^R[\tilde{\theta}_2|\Omega_1] - E^R[\tilde{\theta}_2|\tilde{\theta}_1]$, where Ω_1 denotes the set of all information available to the investor at time 1. $\tilde{s}$ would be total effect of non-accounting based information on the price, were investors rational. Note that, by definition, s is orthogonal to accounting-based information – it can be thought of as summarizing the residual from the projection of Ω_1 onto θ_1.

Market Price Reactions to Information: If investors were fully rational, conditional expected price changes would equal zero, and the price at time 1 (P_1) would equal $E^R[B_2|\Omega_1]$. However, as discussed earlier, in this model there are three possible biases in the way investors set prices:

1. We model over/underreaction to tangible information by allowing investors to believe that the persistence in cash flow growth is greater than it really is (*i.e.*, they think it is ρ^E when it is really $\rho < \rho^E$). Investors then set prices according to this belief.

2. We model investor over/underreaction to intangible information by allowing the price response to the time 1 intangible information to be $(1+\omega)\tilde{s}$ rather than s. ω is thus the fractional overreaction to intangible information; if investors are rational, $\omega = 0$. Consistent with DHS, $\omega > 0$ could result from the investor overconfidence about their ability to interpret vague information, and $\omega < 0$ (underreaction to intangible information) could result from underconfidence.

3. In the model the time 1 price deviates from the expected payoff by $\tilde{e} \sim \mathcal{N}(0, \sigma_e^2)$, where $\tilde{e}$ is pure noise (*i.e.,* is orthogonal to θ_2, $\tilde{\epsilon}_1$ and $\tilde{s}$). One can interpret this "noise" term as an extreme form of overreaction where investors can receive a signal with zero precision, and act as though the signal is informative. However, there are also other interpretations.[14]

[13] In our empirical tests, the implicit specification will be different: there we assume a linear relation between the log-book return and future returns.

[14] For example, prices can fall if investors receive liquidity shocks that force them to sell.

As a result of these three biases, the time 1 price is not the expected payoff ($P_1 \neq E_t^R[\tilde{B}_2]$), so price changes (returns) are predictable using both past returns and tangible information. In the next subsection we consider what sort of predictability these three biases will result in, and ask how we can separate these effects.

2.2 Regression Estimates

This subsection considers regressions that we use to evaluate the importance of extrapolation bias, overreaction, and noise on stock returns. The regressions include both univariate and multivariate regressions of future price changes on past price changes, book value changes and book-to-market ratios. We carry out the related regressions in Section 4. The derivations of the mathematical results in this Section are given in Appendix A.

Return Reversal:

Consider first a univariate regression future price changes $r_{1,2}$ ($\equiv P_2 - P_1$) on past price changes $r_{0,1}$. This is equivalent to the long-horizon regression used by DeBondt and Thaler (1985). Based on our model assumptions, this coefficient is:

$$\beta = -\left(\frac{(\rho^E - \rho)(1+\rho^E)\sigma_1^2 + \omega(1+\omega)\sigma_s^2 + \sigma_e^2}{(1+\rho^E)^2\sigma_1^2 + (1+\omega)^2\sigma_s^2 + \sigma_e^2}\right) \tag{1}$$

If investors are fully rational ($\rho^E = \rho$, $\omega = 0$, and $\sigma_e^2 = 0$), β will be zero. However, a negative coefficient will result when investors over-extrapolate earnings ($\rho^E > \rho$), overreact to intangible information ($\omega > 0$), or incorporate noise into the price ($\sigma_e^2 > 0$), or any combination of the three.

Isolating the Extrapolation Effect:

The extrapolation effect can be directly estimated with the following univariate regression of $r_{1,2}$ on the lagged book return ($r_{0,1}^B \equiv B_1 - B_0$).

$$r_{1,2} = \alpha + \beta_B \, r_{0,1}^B + \epsilon$$

The estimated coefficient from this regression will equal,

$$\beta_B = -(\rho^E - \rho)\left(\frac{\sigma_1^2}{\sigma^2(\bar{\theta}) + \sigma_1^2}\right). \tag{2}$$

This will be negative if $\rho^E > \rho$ (when the investor over-extrapolates past earnings growth) and will be zero if investors properly assess tangible information (if $\rho^E = \rho$). Neither overreaction to growth (ω) nor noise (σ_e^2) affects β_B, so β_B isolates the extrapolation effect.

Intutively, this regression works because r^B is a proxy for the time 1 unexpected cash flow. However r^B is a noisy proxy because it is the sum of the expected and unexpected cash flows. We can better isolate the unexpected cash flows by controlling for the expected component of r^B. We can do this by including the lagged book-to-market ratio on the RHS of this regression:

$$r_{1,2} = \alpha + \beta_B r_{0,1}^B + \beta_{BM}(B-M)_0 + \epsilon$$

By controlling for the lagged book-to-market ratio, we control for the component of the book return that is expected and increase the absolute value of the coefficient of r^B. The coefficients from this multivariate regression are:

$$\begin{aligned} \beta_B &= -(\rho^E - \rho) \\ \beta_{BM} &= \beta_B/2 \end{aligned} \tag{3}$$

Thus, the regression on past book return isolates the extrapolation effect. We can isolate the overreaction and noise effects by using a multivariate regression of $r_{1,2}$ on past return, past book return and the lagged book-to-market ratio:

$$r_{1,2} = \alpha + \beta_{BM}(B - M)_0 + \beta_B r_{0,1}^B + \beta_R r_{0,1} + \tilde{\epsilon} \tag{4}$$

The coefficients in this regression are:

$$\beta_R = -\left(\frac{\sigma_e^2 + \omega(1+\omega)\sigma_s^2}{\sigma_e^2 + (1+\omega)^2\sigma_s^2}\right) \tag{5}$$

$$\beta_B = -\beta_R(1+\rho^E) - (\rho^E - \rho) \tag{6}$$

$$\beta_{BM} = \beta_B/2 \tag{7}$$

First, consider the "intangible reversal" coefficient, β_{IR}. From equation (5), this will be negative when there is either noise or overreaction. However, the magnitude of this coefficient is unaffected by extrapolation. Also:

1. If $\sigma_e^2 \gg \sigma_s^2$, $\beta_R \to -1$.
   This coefficient captures the intangible return reversal. If all of the return between $t = 0$ and $t = 1$ that is not related to the book returns is due to pure noise, then this return must completely reverse on average.

2. If $\sigma_e^2 > 0$, but $\omega = 0$, the $\beta_R \to -\sigma_e^2/(\sigma_e^2 + \sigma_s^2)$ implying that $-1 < \beta_3 < 0$.
   The past return will contain information about future growth, but will also contain noise. This will mean that there will be incomplete reversal.

3. If $\sigma_e^2 = 0$, but $\omega > 0$, then $\beta_R = -\omega/(1+\omega)$, again implying that $-1 < \beta_R < 0$.
   The intuition for this coefficient is straightforward: the time 1 price change is $(1 + \omega)\tilde{s}$, of which $-\omega s$ is reversed at time 2. This means that a fraction $\omega/(1+\omega)$ of this component of the price move is eventually reversed. Again with these parameters, there is incomplete reversal.

What results 2 and 3 suggest is that it is impossible to distinguish between the case of pure noise ($\sigma_e^2 > 0$, $\omega = 0$) and overreaction ($\omega > 0$, $\sigma_e^2 = 0$). This makes intuitive sense: the econometrician cannot directly observe s_g, but can only infer it through price movements. What this means is that, based on the analysis here, we will be unable to discriminate between overreaction and pure noise.[15] As we will discuss later, it is only possible to discriminate between these two alternatives by finding better proxies for the information about future cash flows, and analyzing whether the changes in mispricing are related to the arrival of this information.

The coefficient β_B is determined by two factors. First, consider the situation when investors rationally respond to tangible information. In this case, $\beta_B = \beta_{IR}(1+\rho^E)$. Here, r^B simply serves as a control for the $(1 + \rho^E)\tilde{\epsilon}_1$ term in the past return, which doesn't forecast future return if $\rho^E = \rho$. However, if investors believe earnings are more persistent than they are (if $\rho^E > \rho$), then β_2 must capture the effect of this extrapolation on $r_{1,2}$. That is what the $-(\rho^E - \rho)$ component of β_2 in equation (6) does.

Finally, in this regression the lagged book-to-market ratio $(B-M)_0$ just serves as a control for the $\bar{\theta}_1$ term in r^B. Since $(B-M)_0 = -2\bar{\theta}$, $\beta_{BM} = \beta_B/2$.

[15]Similarly, it is impossible to distinguish between overreaction and noise by looking at the relation between past return and book return and future book return..

2.2.1 Direct Intangible Return Estimation

An alternative way to generate the results above is to first isolate the intangible return by regressing $\tilde{r}_{0,1}$ on $r^B_{0,1}$ and $(B-M)_0$:

$$r_{0,1} = \gamma_0 + \gamma_{BM}(B-M)_0 + \gamma_B r^B_{0,1} + \tilde{v}$$

The residual from this regression will be the component of the past return that is orthogonal to the unexpected book return – we define this as the *intangible return* (though it captures both the return associated with intangibles and the noise term):

$$r_I^{(B)}(0,1) \equiv \tilde{v} = (1+\omega)\tilde{s} + \tilde{e}$$

The *(B)* superscript denotes that this return is orthogonalized with respect to the unexpected book-return. Then, if a modified version of the regression in equation (4) is run (the only change being the substitution of $r^I_{0,1}$ for $r_{0,1}$:

$$r_{1,2} = \alpha + \beta'_{BM}(B-M)_0 + \beta'_B r^B_{0,1} + \beta'_I r_I^{(B)}(0,1) + \tilde{\epsilon}$$

The regression coefficients are:

$$\begin{aligned}
\beta'_I &= -\left(\frac{\sigma_e^2 + \omega(1+\omega)\sigma_s^2}{\sigma_e^2 + (1+\omega)^2\sigma_s^2}\right) \\
\beta'_B &= -(\rho^E - \rho) \\
\beta'_{BM} &= \beta'_B/2
\end{aligned}$$

Notice that the coefficient β'_I is identical to that in equation (5), and β'_B and β'_{BM} are identical to those in equation (3). Thus, the coefficients in this regression tell us directly about the magnitude of the noise/intangible effect (β'_I) and the extrapolation effect (β'_B).

3 Decomposition of the Book-to-Market Ratio

Some authors have suggested that the underlying cause of the book-to-market effect and the long run reversal effect are essentially the same. However, as we mentioned in the introduction, there are some important differences between these two phenomena. In particular, the reversal effect appears to be much weaker and is concentrated mainly in small firms and in the extreme past winners and losers. In contrast, the book-to-market effect is stronger and more pronounced in larger firms. In addition, the reversal effect is present only in January while there is a book-to-market effect (albeit weaker) throughout the year.

This section presents a decomposition of the book-to-market effect that illustrates the relation between the book-to-market and reversal effects. We show that under certain conditions the book-to-market ratio will capture information about changes in the market value of the firm due to intangible information, while past return will capture tangible as well as intangible information. Thus, if there is overreaction to only intangible information, a firm's book-to-market ratio will do a better job forecasting its future returns than will its past returns.

The log of the firm's current book-to-market ratio can be expressed as its τ-period ago log book-to-market ratio, plus the log change in its book value, minus the log change in its market value:

$$bm_t \equiv log(B_t/M_t) = bm_{t-\tau} + \log\left(\frac{B_t}{B_{t-\tau}}\right) - \log\left(\frac{M_t}{M_{t-\tau}}\right) \tag{8}$$

where B_t is the book value per share at time t, and M_t is the market value per share at time t.

The last term on the right hand side of this equation, the log change in the share value, is not the same as the stock's past return. Depending on splits, *etc.*, the two can differ dramatically. The relation between the log returns and the market value changes are given by the expression:

$$r(t-\tau, t) \equiv \sum_{s=t-\tau+1}^{t} \log\left(\frac{M_s \cdot f_s + D_s}{M_{s-1}}\right)$$

Here f_s, a *price adjustment factor* from $s-1$ to s, adjusts for splits and rights issues.[16] D_s is the per-share cash distribution paid at time s, and M_s is the per share value at time s.

[16] We follow CRSP in this definition. Our f_s is equivalent to facpr + 1. See the *CRSP Data Definitions and Coding Schemes Guide, 1925-1998*, pages, 88, 89, and 158.

Rewriting gives:

$$\begin{aligned}
r(t-\tau,t) &\equiv \sum_{s=t-\tau+1}^{t} \log\left(\left(\frac{M_s}{M_{s-1}}\right)\cdot f_s \cdot \left(1+\frac{D_s}{M_s f_s}\right)\right) \\
&= \sum_{s=t-\tau+1}^{t} \log\left(\frac{M_s}{M_{s-1}}\right) + \underbrace{\log(f_s) + \log\left(1+\frac{D_s}{M_s f_s}\right)}_{\equiv n_s} \qquad (9) \\
&= \sum_{s=t-\tau+1}^{t} \log\left(\frac{M_s}{M_{s-1}}\right) + \sum_{s=t-\tau+1}^{t} n_s \\
&= \log\left(\frac{M_t}{M_{t-\tau}}\right) + n(t-\tau,t) \qquad (10)
\end{aligned}$$

$n(t-\tau,t)$ is a cumulative log adjustment factor. It is equal to the (log of the) number of shares one would have at time t, per-share held at time $t-\tau$, had one reinvested all cash distributions back into the stock.

Rewriting equation (8) then gives:

$$bm_t = bm_{t-\tau} + \underbrace{\log\left(\frac{B_t}{B_{t-\tau}}\right) + n(t-\tau,t)}_{\equiv r_B(t-\tau,t)} - r(t-\tau,t) \qquad (11)$$

The variable $r_B(t-\tau,t)$ can be interpreted as the *book return* between $t-\tau$ and t. The book return is defined as the log of the book value in dollars that one would hold at time t, per \$1 of book value held at time $t-\tau$, where dividends are assumed to be reinvested in shares at the firm's share price at the time they are issued. In this sense the book return is a measure, equivalent to the log stock return, of the return to investors, only where value is measured with book instead of with market value.

If we write the current book-to-market ratio in terms of the stock return and the book return we obtain:

$$bm_t = bm_{t-\tau} + r_B(t-\tau,t) - r(t-\tau,t) \qquad (12)$$

Hence, the current book-to-market ratio can be expressed as the past book-to-market ratio, plus the book return, minus the stock return.

The calculation of the book return is straightforward. CRSP supplies, for each trading period (here, a month), both prices at the beginning and end of the period, and an arithmetic return over the period. From equation (9), we have that:

$$n_s = r_s - \log\left(\frac{M_s}{M_{s-1}}\right)$$

which shows that from these quantities we can calculate the adjustment factor. Calculating the cumulative adjustment factor $n(t-\tau,t)$ then simply involves adding up the individual n_s's over the period from $t-\tau$ to t. The log book return is then calculated using the log of the ratio of the book values at $t-\tau$ and t and the adjustment factor, as shown in equation (11).[17]

We can also define the book return in terms of the change in total book value as opposed to the change in book value per share. We can rewrite the equation for r_B, as given in equation (11), as

$$r_B(t-\tau,t) = \log\left(\frac{B_t \cdot N_t}{B_{t-\tau}N_{t-\tau}}\right) + \underbrace{n(t-\tau,t) + \log\left(\frac{N_{t-\tau}}{N_t}\right)}_{\equiv n'(t-\tau,t)} \tag{13}$$

where N_t is the total number of shares outstanding at time t, and $B_t \cdot N_t$ is the firm's total book value at time t. The adjustment factor $n'(t-\tau,t)$ is now the percentage ownership in the firm one would have at time t, given a 1% ownership of the firm at time $t-\tau$, and again assuming full reinvestment of all cash flows. Corporate actions such as splits and stock dividends will leave n' unchanged, but equity issues, employee stock option plans, and other actions which trade ownership for cash or for services (in the case of stock option plans) make n' negative. Share repurchases, dividends and other actions which pay cash out of the firm make n' positive. This interpretation of n' will be important in relating our finding to those of LSV, as we do in Section 5.

In the next section, we examine the extent to which the three elements of a firm's book-to-market ratio individually predict future returns.

[17] An alternative method of calculating the book return is to simply plug the current and lagged book-to-market ratios and the past return $r(t-\tau,t)$ into equation (12). In our programs, we used both methods and checked for consistency.

4 Empirical Results

4.1 The Book-to-Market Decomposition: Empirical Results

This subsection reports Fama-MacBeth regressions of monthly returns on the three components of the book-to-market ratio, as given in equation (12). The regressions examine a time lag, τ of five years, over which we measure the book and market returns. This corresponds to the time horizons over which there is strong existing evidence of return reversals.

4.1.1 Data Construction

Our regression analysis in the next subsection examines various decompositions of each firm's log book-to-market ratio. Consistent with previous literature, we define a firm's log book-to-market ratio in year t (bm_t) as the log of the total book value of the firm at the end of the firms' fiscal year ending anywhere in year $t-1$ minus the log of the total market equity on the last trading day of calendar year $t-1$, as reported by CRSP. Book value is calculated using COMPUSTAT annual data. We follow Fama and French (1993), and set book value equal to total common equity, if available, plus balance sheet deferred taxes and investment tax credit. If total common equity is not available, we use shareholder's equity minus the value of preferred stock, where we use redemption value, liquidating value, or carrying value, in that order, as available. This definition is consistent with Fama and French (1993) and Daniel and Titman (1997).

The 12 cross-sectional regressions of monthly returns from July of year t through June of year $t+1$ all use the same bm_t as the right-hand-side variable. All other right-hand-side variables are also held constant. The minimum six-month lag between the end of the fiscal-year and the start of the FM regressions is to ensure that the book-equity used in the bm_t calculation is publicly available information.

bm_{t-5} is analogously defined as the log of the total book value of the firm at the end of the firms' fiscal year ending anywhere in year $t-6$, as reported by COMPUSTAT, minus the log of the total market equity on the last trading day of calendar year $t-6$, as reported by CRSP. It is simply bm_t lagged 5 years. $r(t-5,t)$ is the cumulative log return on the stock from the last trading day of calendar year $t-6$ to the last trading day of calendar year $t-1$. $r_B(t-5,t)$ is the log book return, over the same time period, constructed as discussed in Section 3. Finally, r_{mom} is the stock's 5-month cumulative log return from the last trading day of calendar year $t-1$, to the last trading day of May of year t. We do not include the return in June of year t because of concerns about bid-ask bounce.

To be included in *any* of our regressions for returns from July of year t to June of year $t+1$, we impose the requirement that a firm have a valid price on CRSP at the end of June of year t and as of December of year $t-1$. We also require that book value for the firm be available on COMPUSTAT for the firm's fiscal year ending in year t. For most of our empirical analysis here, where we utilize past five-year returns and book returns, we also require that the book value for the firm be available on COMPUSTAT for the firm's fiscal year ending in year $t-6$, that the firm have a valid price on CRSP at the end of December of year $t-6$, and that the return on the firm over the period from December of year $t-6$ to December of year $t-1$ be available. We also exclude all firms with prices that fall below five dollars per share as of the last trading day of June of year t. This is because of concerns about bid-ask bounce and nontrading among very low price stocks. Finally, we exclude all firms with negative book values in either year t or year $t-6$. This is again consistent with Fama and French (1993). and when we do our analysis with alternative fundamental measures in Section 4.3, we require that those measures (earnings, cash flow, or sales) be positive as well.[18]

4.1.2 Data Summary

Table 2 shows the average cross-sectional correlation coefficients between the variables we consider.[19] Some interesting patterns emerge here. First, bm at t and $t-5$ are highly correlated, which indicates that the book-to-market ratio is extremely persistent. Second, bm_{t-5} is highly correlated with r_B, which indicates that firms with high market values relative to their book values generally have high book returns per share in the future.[20]

[18] Needless to say, there are a lot of firms that are not included in our analysis because we need to measure book-to-market ratios in fiscal year $t-6$. Hence, our sample does not include firms that are younger than 5.5 years. However, since the returns we calculate are associated with implementable portfolio strategies, there are no biases associated with our selection criteria.

[19] The t-statistics presented below each correlation coefficient are the based on the time-series of cross-sectional correlation coefficients, as in the Fama-MacBeth regressions.

[20] This interpretation is slightly problematic, as we analyze only firms which exist in June of year $t+1$. Thus, selection bias could contribute to this result, in firms with a high bm_{t-5} may be more likely to disappear from the sample over the period from $t-5$ to t. However, the positive correlation is consistent with other finding, such as Fama and French (1995) and Vuolteenaho (1999b). In particular Vuolteenaho

Third, while the univariate correlation between bm_t and $r(t-5,t)$ is negative and strong, the correlation between bm_t and $r_B(t-5,t)$ is weak, indicating that, on average, high bm firms have suffered low past stock returns, rather than having experienced high book returns. However, a multivariate regression of bm_t on $r_B(t-5,t)$ and $r(t-5,t)$ generates strongly statistically significant positive and negative coefficients, respectively. Firms that have experienced past earnings growth that is not associated with increased stock returns generally have higher book-to-market ratios, as would be expected.

4.2 Fama-MacBeth Regression Results – Book-to-Market Decomposition

Table 3 presents the results from a set of regressions of stock returns on various decompositions of the log book-to-market ratio. Regression 1, a simple regression of returns on the log book-to-market ratio, shows that the book-to-market effect is strong in our sample, which is consistent with the existing literature. Regressions 2 through 9 decompose bm_t into its components as specified in equation (12): Regression 2 indicates that the book-to-market ratio measured five years prior to the formation date provides a reliable predictor of future returns. This evidence, which is consistent with Fama and French (1995), suggests that the book-to-market effect is very persistent. It is possible that bm_{t-5} captures past returns that occurred more than 5 years ago that are later reversed. Another possibility is that the lagged book-to-market ratio captures a persistent firm attribute that is related to returns (perhaps because it is associated with risk). For example, firms with intangible assets like patents and brand names are likely to have persistently low book-to-market ratios. We do not attempt to discriminate between these two hypotheses.[21]

The next set of univariate regressions allow us to gauge the extent to which investors over- or underreact to tangible and intangible information. Specifically, regression 3 shows that the book return, on its own, does not reliably forecast future returns, which is consistent with the observation that, over a five year period, investors react appropriately

uses a VAR to decompose a firm's stock return into two components: shocks to expected cash flows and shocks to expected returns (or discount rates). He finds that the typical firm's returns are mainly a result of news about cash flows, as opposed to future expected returns. He also finds that shocks to expected-returns and shocks to future cash flows are positively correlated, meaning that, *ex-ante* firms which are expected to have high future cash flow growth will also have high future expected returns.

[21] However, the evidence in Chan, Lakonishok, and Sougiannis (1999) suggests that high R&D firms *don't* earn consistently lower returns than firms with low or no R&D expenditures.

to information about accumulated earnings. However, consistent with existing evidence, we find, in regressions 4 and 5, evidence consistentn with long-term reversals and shorter term momentum, respectively.[22]

Regressions 6-9 are multiple regressions. The interesting regressions are 8 and 9, which include the lagged book-to-market ratio, the book return, and the past returns. In these regressions the coefficient on past returns become somewhat more negative and significant, the coefficient on book return becomes *positive* and significant, and the coefficient on the lagged book-to-market ratio becomes somewhat more positive. This is consistent with the model predictions as shown in equations (5)- (7), if there is overreaction to intangible information, but no overreaction to tangible information. This is consistent with the hypothesis that investors overreact to intangible information or noise, but react appropriately to tangible information.

4.3 Fama-MacBeth Regression Results - Alternative Growth Measures

The results presented in Table 3 suggests that there is evidence of overreaction to intangible information, but does not reveal significant overreaction to tangible information that is cross-sectionally correlated with book returns. To test the robustness of this hypothesis, we estimate similar regressions using other types of tangible information. Specifically, to be consistent with the earlier work of Lakonishok, Shleifer, and Vishny (1994), we examine sales, cash flows, and earnings. Our definitions of these variables follow LSV's; earnings are measured before extraordinary items, and cash flow is defined as earnings plus depreciation.

The results of these regressions are reported in Tables 4, 5, and 6. Regression (1), in each of these three Tables, show that the log sales-to-price ratio, cash flow-to-price ratio, and earnings-to-price ratio reliably forecast future returns, which is consistent with the

[22]We find a particularly strong long-term reversal effect, because we include a six month gap between the period over which $r(t-5,t)$ is calculated, and the returns we are forecasting. This is because the six-month momentum effect, which we eliminate with this experimental design, reduces the reversal effect as calculated in DeBondt and Thaler (1985) (see Asness (1995)). However, the momentum effect (regression 5) is weak here: we are using the same 5-month return to forecast all monthly returns from July of t to June to $t+1$. For the June returns in particular, this results in a twelve-month lag between the past return and the forecasted return. As previous research has demonstrated, this lag considerably weakens the momentum effect.

evidence cited in the Introduction.[23] Based on the t-statistics of these regressions, these variables forecast future returns about as well as the book-to-market ratio. However, in contrast to the lagged book-to-market ratio, none of the five-year lagged versions of these other ratios predict returns. Perhaps, this reflects the fact that these ratios are less persistent than the book-to-market ratio since these rations are less influenced by accounting conventions (*e.g.*, expensing R&D).

Each of these three ratios can be decomposed, as we did with the book-to-market ratio, using the method outlined in Section 3. Thus, we define the variables $r_S(t-\tau,t)$, $r_{CF}(t-\tau,t)$, and $r_{ERN}(t-\tau,t)$ analogously to $r_B(t-\tau,t)$ as defined in equation (11). Again, intuitively these can be thought of as the log of the growth in the sales, cash flows, and earnings for one split and dividend-adjusted (*i.e.*, dividends and other cash flows are reinvested) share purchased at time $t-\tau$. We continue to use the term *return* to emphasize that this is a measure of the growth over time per unit investment

The estimates of these Fama-MacBeth regressions, as reported in Tables 4-6, look quite similar to our earlier regressions of returns on various decompositions of the book-to-market ratio. Regression 3, in each of the Tables, reveals no significant univariate relation between $r_S(t-\tau,t)$, $r_{CF}(t-\tau,t)$, or $r_{ERN}(t-\tau,t)$ and future returns. However, in the multivariate regressions, the coefficients on the sales return, cash flow return, and earnings return are positive and strongly significant, and the coefficient on past return becomes more negative (though not significantly more negative).

It should also be noted that, for each of the three growth measures, while the five-year lagged fundamental-price ratios are insignificant in the univariate regressions, they are significant in the multivariate regressions. The significance in the multivariate regressions arise because the time $t-5$ ratios are negatively correlated with the $t-5 \to t$ fundamental return. Consistent with the model predictions in Section 2.2, the sign is positive in the multivariate regressions because the $t-5$ ratios act as a control for the *expected* component of the $t-5 \to t$ fundamental return. In other words, the regression results suggest that what matters in forecasting future returns is the *unexpected* fundamental return.

[23]We follow convention in using the terminology "price" for these three ratios, and "market" for the book-to-market ratio. "Market" has the same meaning as "price."

4.4 Calculating the Intangible Return

As discussed in Section 2.2.1, an alternative way to estimate the model is to first orthoganalize the past return with respect to the lagged fundamental price ratio and the fundamental return. We do this by first performing cross-sectional regressions at each time, and defining the residual from this regression as the *intangible return*. So, for example, to calculate the book-value based intangible return, we run the regression:

$$r(t-5,5) = \gamma_0 + \gamma_{BM} bm_{t-5} + \gamma_B r_B(t-5,5) + \tilde{v}$$

cross-sectionally, and define the intangible return as the residual:

$$r_I^{(B)}0,1 \equiv \tilde{v}.$$

Table 7 shows the results of running the Fama-MacBeth regressions with both the intangible (orthoganalized) returns, and with the non-orthogonalized returns. We do this for each of the four accounting-growth measures. The second regression in each pair in the table illustrates what we concluded earlier: future returns appear completely unrelated to the tangible returns (as the coefficients on r_B, r_{CF}, r_{SLS}, and r_{ERN} are all insignificant), but are significantly related to the intangible return.

4.5 A Time Horizon Robustness Check

Our tests find no evidence of over- or underreaction to 5-year fundamental returns. However, it is possible that these effects exist, but that the the time horizon is less than 5 years.[24]

To examine this possibility, in Table 8 we perform the same regressions as in Tables 3-6, only now we break up the past fundamental returns into the components from from $t-5$ to $t-3$, and from $t-3$ to t. Since we are doing everything in logs, the sum of these two components is the return from $t-5$ to t.

For each of our four measures of fundamental growth, we see that neither of the two components of past fundamental returns are related to future returns at a statistically

[24]Or, for example, we know that there is post-earnings announcement drift a horizons of about a year. It is possible that there is long-horizon over-reaction, but this is masked by the post-earnings announcement drift in our 5-year tests.

significant level in the univariate regressions. Also, in multivariate regressions with past return, both components are significantly positive.

4.6 Seasonal Effects

The DeBondt and Thaler (1985) reversal effect appears distinctly weaker than the book-to-market. The book-to-market effect is stronger in January, but is still significant in the non-January months.[25] Also, the reversal effect tends to be concentrated among extreme winners and losers, while the book-to-market effect tends to be monotonic.

Our model suggests that the reversal effect is weaker because the firm's past return is a proxy for the sum of the tangible and intangible information that has arrived. If the market overreacts primarily to information about intangibles, then the lagged return will provide a noisy forecast of future returns, since it is the result of both tangible and intangible information. However, if we decompose the past return into tangible and intangible components, and use only the component of the past return not related to tangible measures, we should get a much better forecast of future returns. That is, the *intangible reversal* effect should be much stronger than the simple reversal effect.

We first explore the difference between the reversal and the intangible reversal effect in and out of January. Tables 9 and 10 present the primary regressions from Tables 3-6, only now we perform these regressions separately for January and non-January returns.

Regressions A and B in the two tables show the simple reversal effect and the momentum effect in and out of January. Consistent with other studies, we find that the reversal effect is very strong in January – the coefficient is about a factor of 25 larger than for the non-January regression – and is statistically insignificant outside of January. The momentum effect, in contrast, is strong outside of January, but insignificant in January (Jegadeesh and Titman 1993).

As discussed earlier, the bm effect is stronger in January – the coefficient on bm_t is a factor of 10 higher – but is still significant in the non-January months. The story is about the same for the other fundamental-price ratios.

One striking thing in Table 9 is that the coefficients in the univariate regressions on the fundamental returns (the regressions numbered (3)) are all significantly negative. This says that, in the month of January, there is evidence that firms whose fundamentals have

[25] Fama and French (1993) note this. Daniel and Titman (1997) present a table showing the returns of size and book-to-market sorted portfolios in January and non-January months.

grown tend to have low returns, and *vice-versa*. However, offsetting this is the fact that outside of January, the equivalent coefficients are all positive, and significant at a 5% level for two fundamental measures. As a result there is no significant evidence of over- or underreaction to fundamental growth across the year.

5 The Relation of our Results to the Findings of LSV

**Recall that LSV find a very strong relation between past tangible performance measures like sales, cash flows and earnings, and future returns. This starkly contrasts with our findings, which suggest that market prices react appropriately to these sources of information. This is puzzling, since our fundamental return measures are very similar to the growth measures used by LSV. In this Section, we show that the difference between our findings and those of LSV arises because the LSV tests examine changes in a firm's *total* growth while our growth measures essentially examine growth per share. This distinction is important since growth can result either from increases on a per share basis, or from increases in the scale of operations (*e.g.*, by acquiring another firm by issuing equity). Our evidence suggests that the LSV results are generated not because stock prices overreact to past growth, but rather because they underreact to the implications of a change in the number of shares, consistent with previous evidence on share issues and repurchases.

Table 11 provides Fama-MacBeth tests that verify that the LSV results continue to hold using our methodology and sample. Specifically, regression (2) shows that the coefficient on growth-in-sales in a univariate Fama-MacBeth regression is significantly negative, and regression (3) shows that, consistent with LSV's findings, in a multiple regression the coefficients on C/P and g_{SLS} are both highly significant, and in fact remain about the same as in the corresponding univariate regressions. This is what we would expect given that the average cross-sectional correlation between C/P and g_{SLS} is close to zero (-0.079, $t = -1.18$). Thus C/P and g_{SLS} have separate explanatory power for future returns.

However, regression (4) shows that if instead of using g_{sls} as an independent variable in the regression, we use r_{sls}, we get a coefficient that is quite different and is statistically insignificant.[26] This difference is striking and somewhat surprising since the average cross-

[26] This coefficient is slightly different than that in Table 4. The reason is that, to be included in the regressions in this Table, a firm was required to have positive cash flow in years t and $t-5$, in addition to the other data requirements imposed in Table 4.

sectional correlation between g_{sls} and r_{sls} is quite high $(0.764, t = 11.1)$. The difference is due to the fact that g_{sls} is defined as the log change in the *total* sales of the firm, while $r_{sls}(t-\tau,t)$ is adjusted for new issues, repurchases, *etc.*. Mathematically, the relation between the two measures is:

$$r_{sls}(t-\tau,t) = g_{sls}(t-\tau,t) + n'(t-\tau,t)$$

The difference between the two measures, $n'(t-\tau,t)$, as defined in equation (13), is equal to the change in the fractional ownership of a shareholder as a result of new issues, repurchases, *etc.*. As discussed in Section 3, n' will be negative if a firm has issued equity and positive if a firm repurchases shares or pays dividends.[27] Consistent with this, regressions in Table 11 illustrate that there is a strong positive relation between $n'(t-5,t)$ and future returns, and illustrate that, after controlling for n', growth in sales has no significant explanatory power for future returns.

Past research suggests that firms tend to issue (repurchase) shares when their stock prices increase (decrease) relative to their book returns.[28] Consistent with this past research, our regressions in Table 12 show that firms tend to issue (repurchase) shares following favorable (unfavorable) intangible information, that is when past returns have been high relative to past book returns. Hence, it is possible that the tendency of prices to overreact to intangible information is related to the tendency of prices to underreact to share repurchase and issuance decisions.[29] For example, it may be the case that the post announcement drift in stock prices following issuance and repurchase announcements reflect overreaction to intangible information rather than underreaction to the information signaled by the managers' issuance or repurchase choice.

To test this possibility we include $n'(t-5,t)$, our share issuance variable, in our return forecasting regressions. Consistent with earlier work, our regressions in Table 13 show that $n'(t-5,t)$ is positively related to future stock returns. In addition, $n'(t-5,t)$ continues to be significant after we control for book returns and market returns indicating

[27] This can be done with employee stock option plans, and any other actions which trade ownership for cash or for services (in the case of stock option plans).

[28] See, Hovakimian, Opler, and Titman (2000).

[29] However, an important issue here is that $n'(t-5,t)$ is not simply equal to the number of shares issued or repurchased. As discussed earlier, n' also reflects share creation associated with employee stock option plans, and other actions which trade ownership for cash or for services. On the other side n' also reflects dividends and other actions which pay cash out of the firm.

that the repurchase and issuance effects cannot be fully explained by the return reversals associated with information about intangibles.

6 Changes is Risk Measures and Intangible Returns

In our model and in the discussion of our empirical results, we assume the forecastable cross-sectional return variation we document arise from investors' biased expectations. In this section we consider the possibility that these return patterns can be driven by changes in risk rather than expectational errors.

Specifically, we find that average future returns are cross-sectionally negatively correlated with past intangible returns, but not with tangible returns. It is possible that the intangible returns are a good proxy for changes in risk, so that firms which have experienced positive intangible returns have become less risky, and *vice-versa*.

To understand how risk changes with realizations of favorable and unfavorable tangible and intangible information it is useful to consider a firm as a combination of assets in place and growth opportunities. As a general rule, growth opportunities, which provide options to fund projects with uncertain cash flows at a fixed costs, have higher betas than assets in place. In addition, in most cases the betas of both growth opportunities and assets in place decrease when favorable information is revealed. Basically, operating as well as financial leverage generally decreases when values increase. For example, in Berk, Green, and Naik (1999) the beta of a firm endowed with a growth opportunity decreases when favorable information is revealed because the cost of exercising the growth option is assumed to be fixed.

Since the beta of both the firm's assets in place and its growth opportunity should decrease with favorable news (and high realized returns) it seems plausible that the average firm could become less risky (and have lower expected returns) following the revelation of both favorable tangible and intangible information. This is consistent with our evidence that future returns and past intangible returns are negatively correlated, though not consistent with our evidence that the correlation of past tangible returns and future returns is zero.

However, it should also be noted that if the value of a firm's growth opportunities increase in value relative to the asset in places, then the firm's beta should increase. Again, both components of value may become less risky, but if the mix towards the more risky growth opportunity increases, the beta of the entire firm will increase. Hence, if we interpret a revelation of favorable intangible information, holding tangible information constant, as implying an increase in the relative value of a firm's growth opportunities, then we might expect the favorable intangible information to be associated with an increase in risk, and hence an increase in expected returns.

The above discussions suggest that theory provides very little guidance as to what the relationship between tangible and intangible returns and risk might be. One can plausibly argue that high intangible returns, holding the level of tangible returns constant, might either increase or decrease risk.

Empirically, we attempt to measure risk using two proxies: the firms' market betas and their own return variance. We find that our evidence on betas is inconsistent with the risk story: we find that beta *increases* with the intangible returns. In contrast we find that the firms' own return variance decreases with the intangible return.

Table 14 presents the results of a set of Fama-MacBeth regressions in which the dependent variable is the change in the firms' beta with respect to the CRSP value weighted index. The pre-beta here is the beta calculated using the 24 months of returns preceding the five year period over which we measure the tangible and intangible returns. The post-beta is the beta calculated using the 24 monthly returns immediately following the formation date. We define the change in beta as the difference between the post-beta and the pre-beta.

Table 14 shows that, for all accounting growth measures, the relation between the intangible return and the change in beta is positive. In contrast, the coefficients relating the tangible growth measures and changes in beta are not significantly different from zero.

The last row of this Table presents a regression with two new measures, the total tangible and the total intangible return. To construct these measures we run a set of yearly cross-sectional regressions of the past 5-year return on all four of the fundamental-return and the four lagged fundamental-to-price ratios. We define the total intangible return ($r_I^{(Tot)}(t-5,t)$) as the residual from this regressions and the total intangible return ($r_T^{(Tot)}(t-5,t)$) as the fitted component of this regression. Thus, $r_I^{(Tot)}(t-5,t)$ ($r_T^{(Tot)}(t-5,t)$) can be thought of as the part of the past return that can be explained by *none* (*any*) of the four fundamental-return measures.

The results of this regression are also consistent with the hypothesis that changes in β are related to intangible returns, but not tangible returns.

Table 15 presents the results of Fama-MacBeth regressions in which the dependent variable is the change in the firms' return standard deviation. These tables show that, in almost all cases, the coefficient relating the change in the firms' return standard deviation to the intangible return in negative. The sets of BV, SLS and CF regressions suggest a strong negative relation between both tangible and intangible returns and the change in a firm's residual risk. However, in the final earnings regression, the coefficient on $r_I^{(ERN)}(t-5,t)$ is insignificant, suggesting that it is the component of past returns that can be explained by the earnings return that is responsible for the relation between past returns and the change in standard deviation. The last regression in Table 15 provides additional support for this: we see that the total tangible return, as defined above, is strongly negatively correlated with changes in standard deviation, but there is no statistically significant relation between the total intangible return and the change in standard deviation.

7 Conclusions

There is substantial evidence from the psychology literature that individuals are overconfident about their abilities. This overconfidence may lead investors to overestimate the quality of information signals they generate about security values, which may in turn generate mispricing. The psychology literature also suggests that the degree to which individuals are overconfident depends on the situation. In particular, individuals tend to be more overconfident about their ability to evaluate information that is relatively vague.

The *Oxford English Dictionary* defines a tangible property or form as "That can be laid hold of or grasped by the mind, or dealt with as a fact." and intangible "... That cannot be grasped mentally." Our premise is that investors will tend to be more overconfident about the tangible information than about intangible information, and hence will tend to overreact more to information about intangibles. If our hypothesis is correct, we should expect to observe less evidence of overreaction to tangible information.

To test whether there is a greater tendency to overreact to information about less tangible assets we decompose the past return of a firm into components arising from information about tangible and intangible assets. Specifically, we posit that the unexpected book return per share should be a good proxy for information about tangibles, and that the residual from the projection of stock returns on book returns should proxy for the returns associated with information about intangibles. Our evidence suggests that there is significant long-run overreaction to information about intangibles. However, we find no discernible evidence of overreaction to information about tangibles.

Our results should be contrasted to the results in Lakonishok, Shleifer, and Vishny (1994), who find evidence of overreaction to past growth rates of the same (tangible) accounting variables that we examine. The difference between the LSV variables and our variables is that we measure accounting performance on a per share basis and they do not. In other words, the typical LSV growth firm experienced substantial growth in the number of its outstanding shares relative to the tangible growth firms identified in this study. As we show, the LSV evidence of underperformance of growth firms is driven by the tendency of these firms to perform poorly (well) following share issuances (repurchases) rather than because of overreaction to tangible information. Indeed, given the evidence that firms tend to issue (repurchase) shares following increases (decreases) in the returns of intangible assets, one might conclude that the LSV evidence supports the idea that investors overreact to only intangible information.

Finally, we should note that our notion of overreacting to intangible information is consistent with firms reacting to pure noise. In particular, the reversals we observe could be due to price changes that could be self-generated. For example, it is plausible that small movements in stock prices, generated by relatively minor liquidity events, can snowball into major price moves if the original price move attracts the interest of momentum investors and analysts who develop "stories" to explain the price move (see, *e.g.*, De Long, Shleifer, Summers, and Waldmann (1990)).[30] Such a scenario can be viewed as overreaction, if one classifies reacting to nothing as overreacting.

Although reacting to noise can be viewed as consistent with our model of overreacting to intangible information, it may have nothing to do with overconfidence or any of the

[30]This is also potentially consistent with the observations of De Long, Shleifer, Summers, and Waldmann (1990) on Soros' trading strategies. Relative to positive feedback trading strategies and the conglomerate boom, they state that:

> The truly informed investment strategy in this case, says Soros, was not to sell short in anticipation of the eventual collapse of conglomerate shares (for that would not happen until 1970) but instead to buy in anticipation of further buying by uninformed investors. The initial price rise in conglomerate stocks, caused in part by purchases by speculators like Soros, stimulated the appetites of uninformed investors *since it created a trend of increasing prices and allowed conglomerates to report earnings increases through acquisitions.* [my italics]

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other behavioral theories that have been discussed in the literature. For this reason it would be quite interesting to document whether there are in fact types of information that investors do tend to overreact to. What we have shown is that, over long time horizons, investors do not tend to under or overreact to any fundamental information. To our knowledge, this is consistent with other results in the literature which, at least so far, have uncovered no evidence of overreaction to fundamental information. Interestingly, we can show that there is overreaction/noise in the return data – returns reverse – but price movements which can be linked to fundamentals do not reverse. Thus, it would be interesting to attempt to link the price movements which do reverse to other types of information sources.

Another avenue for future research would be to replicate our tests in different economies with different accounting standards and rules relating to disclosure and insider trading. With weaker accounting standards, what we are calling tangible information may be viewed as less tangible and more open to judgment and interpretation. In addition, in environments with less disclosure, investors must rely more on intangible information, (e.g., rumors). Hence, one might expect evidence of long-term return reversals to systematically differ across countries.

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A Appendix – Derivation of Section 2.2 Equations

Derivation of Equation (1):

The univariate regression coefficient in equation (1) is equal to:

$$\beta = \frac{cov(r_{1,2}, r_{0,1})}{var(r_{0,1})}.$$

From the equations for $r_{0,1}$ and $r_{1,2}$ in Table 1, and given that that ϵ_1, $\tilde{s}$, $\tilde{e}$, and $\tilde{u}$ are mutually uncorrelated, and that $\epsilon_1 \sim \mathcal{N}(0, \sigma^1)$, $s \sim \mathcal{N}(0, \sigma_s^2)$, $e \sim \mathcal{N}(0, \sigma_e^2)$ this is equal to:

$$\beta = \frac{cov(r_{1,2}, r_{0,1})}{var(r_{0,1})} = \frac{-(\rho^E - \rho)(1+\rho^E)\sigma_1^2 - \omega(1+\omega)\sigma_s^2 - \sigma_e^2}{(1+\rho^E)^2\sigma_1^2 + (1+\omega)^2\sigma_s^2 + \sigma_e^2}$$

Derivation of Equation (2):

From the equations for $r_{1,2}$ and $r_{1,2}^B$ given in Table 1, and given the assumption that $\tilde{\epsilon}_1$ and $\bar{\theta}_1$ are uncorrelated, the regression coefficient is equal to:

$$\beta_B = \frac{cov(r_{1,2}, r_{0,1}^B)}{var(r_{0,1}^B)} = \frac{-(\rho^E - \rho)\sigma_1^2}{\sigma^2(\bar{\theta}) + \sigma_1^2} = -(\rho^E - \rho)\left(\frac{\sigma_1^2}{\sigma^2(\bar{\theta}) + \sigma_1^2}\right).$$

Derivation of Equation (3):

Define: $X = \begin{bmatrix} r_{0,1}^B \\ (B-M)_0 \end{bmatrix}$, then using the equations for $r_{0,1}^B$ and $(B-M)_0$ in Table 1, we have that:

$$var(X) = \begin{bmatrix} \sigma^2(\bar{\theta}) + \sigma_1^2 & -2\sigma^2(\bar{\theta}) \\ -2\sigma^2(\bar{\theta}) & 4\sigma^2(\bar{\theta}) \end{bmatrix}$$

and

$$var(X)^{-1} = \frac{1}{\sigma_1^2}\begin{bmatrix} 1 & 1/2 \\ 1/2 & \left(1 + \sigma_1^2/\sigma^2(\bar{\theta})\right)/4 \end{bmatrix}$$

From the equations for $r_{0,1}^B$, $r_{1,2}$ and $(B-M)_0$ in Table 1, we have that

$$cov(X, r_{1,2}) = \begin{bmatrix} -(\rho^E - \rho)\sigma_1^2 \\ 0 \end{bmatrix},$$

so the vector of regression coefficients is:

$$\begin{bmatrix} \beta_B \\ \beta_{BM} \end{bmatrix} = var(X)^{-1} \cdot cov(X, r_{1,2}) = \begin{bmatrix} -(\rho^E - \rho) \\ -(\rho^E - \rho)/2 \end{bmatrix}$$

Derivation of Equations (5)-(7):

First, note that $cov(B{-}M_0, r^B_{0,1}) = -2\sigma^2(\bar{\theta})$, and $cov(B{-}M_0, r_{0,1}) = cov(B{-}M_0, r_{1,2}) = 0$. Therefore, in this regression, as in the regression discussed immediately above, $B - M_0$ will serve as a perfect control for the component of $r^B_{0,1}$ that is uncorrelated with $r_{1,2}$ and $r_{0,1}$ (*i.e.*, for $\bar{\theta}$).

This means that $\beta_{BM} = \beta_B/2$. It also means that the coefficients β_{IR} and β_B are identical to what they would be in the regression:

$$r_{1,2} = \alpha + \beta_B \underbrace{\left(r^B_{0,1} + (1/2)(B{-}M)_0\right)}_{=\tilde{\epsilon}_1} + \beta_{IR} r_{0,1} + \epsilon$$

Now, define:

$$X = \begin{bmatrix} r^B_{0,1} - (1/2)(B{-}M)_0 \\ r_{1,2} \end{bmatrix}.$$

Then:

$$var(X) = \begin{bmatrix} \sigma_1^2 & (1{+}\rho^E)\sigma_1^2 \\ (1{+}\rho^E)\sigma_1^2 & (1{+}\rho^E)^2\sigma_1^2{+}(1{+}\omega)^2\sigma_s^2{+}\sigma_e^2 \end{bmatrix}$$

$$cov(X, r_{1,2}) = \begin{bmatrix} -(\rho^E - \rho)\sigma_1^2 \\ -(1{+}\rho^E)(\rho^E - \rho)\sigma_1^2 - (1{+}\omega)\omega\sigma_s^2 - \sigma_e^2 \end{bmatrix}$$

The inverse of the covariance matrix is:

$$var(X)^{-1} = \frac{1}{\sigma_1^2((1{+}\omega)^2\sigma_s^2{+}\sigma_e^2)} \begin{bmatrix} (1{+}\rho^E)^2\sigma_1^2{+}(1{+}\omega)^2\sigma_s^2{+}\sigma_e^2 & -(1{+}\rho^E)\sigma_1^2 \\ -(1{+}\rho^E)\sigma_1^2 & \sigma_1^2 \end{bmatrix}.$$

Finally, to get the regression coefficients:

$$\begin{aligned} \begin{bmatrix} \beta_B \\ \beta_{IR} \end{bmatrix} &= var(X)^{-1} \cdot cov(X, r_{1,2}) \\ &= \frac{1}{(1{+}\omega)^2\sigma_s^2{+}\sigma_e^2} \begin{bmatrix} (1{+}\rho^E)\left(\omega(1{+}\omega)\sigma_s^2{+}\sigma_e^2\right) - (\rho^E - \rho)((1{+}\omega)^2\sigma_s^2{+}\sigma_e^2) \\ -\omega(1{+}\omega)\sigma_s^2 - \sigma_e^2 \end{bmatrix}, \end{aligned}$$

so

$$\begin{aligned} \beta_{IR} &= -\left(\frac{\sigma_e^2 + \omega(1+\omega)\sigma_s^2}{\sigma_e^2 + (1+\omega)^2\sigma_s^2}\right) \\ \beta_B &= -\beta_{IR}(1{+}\rho^E) - (\rho^E - \rho). \end{aligned}$$

Table 2: **Average Correlation Coefficients of Book-to-Market and Past Return Measures**

Values in Percent, t-statistics in parentheses

	bm_t	bm_{t-5}	$r_B(t-5,t)$	$r(t-5,t)$	r_{mom}
bm_t	100.0	61.6	-4.5	-39.5	11.9
		(6.92)	(-0.28)	(-3.09)	(0.93)
bm_{t-5}		100.0	-38.9	18.4	3.1
			(-4.27)	(1.43)	(0.27)
$r_B(t-5,t)$			100.0	39.4	-9.6
				(5.02)	(-1.16)
$r(t-5,t)$				100.0	-16.9
					(-1.03)
r_{mom}					100.0

Table 3: **Fama-MacBeth Regressions of Monthly Returns on Book-to-Market and Past Return Measures**

1968:07-1999:12, All Months, t-statistics in parentheses

	Const	bm_t	bm_{t-5}	$r_B(t-5,t)$	$r(t-5,t)$	r_{mom}
1	0.0121	0.0026				
	(4.75)	(3.69)				
2	0.0119		0.0011			
	(4.59)		(2.10)			
3	0.0122			-0.0009		
	(4.60)			(-1.39)		
4	0.0126				-0.0022	
	(5.03)				(-2.74)	
5	0.0109					0.0072
	(4.54)					(2.67)
6	0.0118		0.0010	-0.0004		
	(4.44)		(1.77)	(-0.53)		
7	0.0129		0.0014		-0.0025	
	(5.25)		(2.67)		(-2.95)	
8	0.0121		0.0022	0.0022	-0.0033	
	(4.84)		(3.24)	(2.95)	(-3.43)	
9	0.0113		0.0021	0.0021	-0.0032	0.0054
	(4.90)		(3.17)	(2.87)	(-3.36)	(2.05)

Table 4: **Fama-MacBeth regressions of Monthly returns on sales growth and past returns measures**

1968:07-1999:12, All Months, t-statistics in parentheses

	Const	sp_t	sp_{t-5}	$r_S(t-5,t)$	$r(t-5,t)$	r_{mom}
1	0.0228	0.0018				
	(4.99)	(3.69)				
2	0.0159		0.0007			
	(3.66)		(1.66)			
3	0.0118			0.0001		
	(4.33)			(0.28)		
4	0.0127				-0.0024	
	(5.03)				(-3.02)	
5	0.0110					0.0066
	(4.52)					(2.47)
6	0.0163		0.0008	0.0007		
	(3.75)		(1.93)	(1.26)		
7	0.0182		0.0009		-0.0024	
	(4.31)		(2.14)		(-3.05)	
8	0.0202		0.0014	0.0025	-0.0032	
	(4.71)		(3.09)	(4.58)	(-3.79)	
9	0.0194		0.0013	0.0024	-0.0031	0.0048
	(4.92)		(3.17)	(4.44)	(-3.66)	(1.87)

Table 5: **Fama-MacBeth regressions of Monthly returns on cash flow growth and past returns measures**

1968:07-1999:12, All Months, t-statistics in parentheses

	Const	cfp_t	cfp_{t-5}	$r_{CF}(t-5,t)$	$r(t-5,t)$	r_{mom}
1	0.0389	0.0031				
	(6.78)	(4.68)				
2	0.0174		0.0006			
	(3.58)		(1.21)			
3	0.0121			-0.0002		
	(4.60)			(-0.33)		
4	0.0131				-0.0025	
	(5.30)				(-3.08)	
5	0.0112					0.0068
	(4.69)					(2.51)
6	0.0175		0.0007	-0.0000		
	(3.56)		(1.23)	(-0.06)		
7	0.0235		0.0012		-0.0027	
	(4.69)		(2.20)		(-3.23)	
8	0.0329		0.0023	0.0031	-0.0046	
	(6.06)		(3.81)	(5.02)	(-4.52)	
9	0.0311		0.0022	0.0030	-0.0045	0.0050
	(5.79)		(3.63)	(5.00)	(-4.44)	(1.87)

Table 6: **Fama-MacBeth regressions of Monthly returns on earnings growth and past returns measures**
1968:07-1999:12, All Months, t-statistics in parentheses

	Const	ep_t	ep_{t-5}	$r_{ERN}(t-5,t)$	$r(t-5,t)$	r_{mom}
1	0.0355	0.0025				
	(5.67)	(3.60)				
2	0.0162		0.0005			
	(3.09)		(0.85)			
3	0.0123			-0.0004		
	(4.79)			(-0.95)		
4	0.0133				-0.0026	
	(5.49)				(-3.21)	
5	0.0112					0.0075
	(4.77)					(2.75)
6	0.0157		0.0004	-0.0003		
	(2.89)		(0.72)	(-0.75)		
7	0.0227		0.0010		-0.0027	
	(4.15)		(1.74)		(-3.22)	
8	0.0330		0.0022	0.0023	-0.0045	
	(5.10)		(2.99)	(3.99)	(-4.13)	
9	0.0308		0.0020	0.0023	-0.0044	0.0058
	(4.71)		(2.78)	(3.90)	(-3.99)	(2.15)

Table 7: **Fama-MacBeth Regressions with Intangible Returns**

1968:07-1999:12, t-statistics in parentheses

Const	bm_{t-5}	$r_B(t-5,t)$	$r_I^{(B)}(t-5,5)$	$r(t-5,t)$
0.0126				-0.0023
(5.07)				(-2.76)
0.0118			-0.0033	
(4.49)			(-3.45)	
0.0121	0.0022	0.0022		-0.0033
(4.85)	(3.23)	(2.93)		(-3.45)
0.0118	0.0010	-0.0004	-0.0033	
(4.43)	(1.74)	(-0.54)	(-3.45)	
Const	sp_{t-5}	$r_{SLS}(t-5,t)$	$r_I^{(SLS)}(t-5,5)$	$r(t-5,t)$
0.0203	0.0014	0.0025		-0.0032
(4.71)	(3.09)	(4.56)		(-3.80)
0.0163	0.0008	0.0006	-0.0032	
(3.75)	(1.92)	(1.23)	(-3.80)	
Const	cp_{t-5}	$r_{CF}(t-5,t)$	$r_I^{(CF)}(t-5,5)$	$r(t-5,t)$
0.0328	0.0023	0.0031		-0.0046
(6.03)	(3.78)	(4.99)		(-4.50)
0.0175	0.0007	-0.0000	-0.0046	
(3.54)	(1.22)	(-0.04)	(-4.50)	
Const	ep_{t-5}	$r_{ERN}(t-5,t)$	$r_I^{(ERN)}(t-5,5)$	$r(t-5,t)$
0.0327	0.0021	0.0023		-0.0045
(5.07)	(2.96)	(3.98)		(-4.13)
0.0154	0.0004	-0.0003	-0.0045	
(2.84)	(0.66)	(-0.72)	(-4.13)	

Table 8: **Fama-MacBeth Regressions of Returns on Lagged Growth Measures**

1968:07-1999:12, t-statistics in parentheses

	Const	bm_{t-5}	$r_B(t-5,t-3)$	$r_B(t-3,t)$	$r(t-5,t)$
1	0.0121		-0.0010		
	(4.64)		(-1.34)		
2	0.0121			-0.0009	
	(4.58)			(-1.10)	
3	0.0121	0.0020	0.0016	0.0028	-0.0033
	(4.86)	(2.97)	(1.82)	(2.74)	(-3.40)

	Const	cfp_{t-5}	$r_{cf}(t-5,t-3)$	$r_{cf}(t-3,t)$	$r(t-5,t)$
1	0.0120		0.0001		
	(4.67)		(0.22)		
2	0.0123			-0.0006	
	(4.77)			(-1.05)	
3	0.0331	0.0024	0.0036	0.0028	-0.0047
	(5.99)	(3.80)	(4.96)	(4.27)	(-4.56)

	Const	ep_{t-5}	$r_{ern}(t-5,t-3)$	$r_{ern}(t-3,t)$	$r(t-5,t)$
1	0.0122		-0.0005		
	(4.87)		(-1.12)		
2	0.0123			-0.0005	
	(4.87)			(-1.04)	
3	0.0329	0.0022	0.0028	0.0021	-0.0045
	(4.83)	(2.86)	(3.85)	(3.55)	(-4.02)

	Const	sp_{t-5}	$r_{sls}(t-5,t-3)$	$r_{sls}(t-3,t)$	$r(t-5,t)$
1	0.0115		0.0010		
	(4.33)		(1.32)		
2	0.0122			-0.0006	
	(4.53)			(-0.93)	
3	0.0202	0.0013	0.0029	0.0020	-0.0032
	(4.72)	(3.05)	(3.99)	(2.93)	(-3.76)

Table 9: **Fama-MacBeth Regressions of Returns on Fundamental-Price Ratios, Lagged Returns and Lagged Growth Measures**

1968:07-1999:12, **January Only**, *t-statistics in parentheses*

	Const	bm_t	bm_{t-5}	$r_B(t-5,t)$	$r(t-5,t)$	r_{mom}
A	0.0444				-0.0187	
	(4.23)				(-4.16)	
B	0.0344					0.0016
	(3.10)					(0.13)
1	0.0417	0.0154				
	(3.67)	(3.94)				
2	0.0422		0.0039			
	(3.52)		(1.90)			
3	0.0477			-0.0117		
	(3.86)			(-3.92)		
4	0.0448		0.0093	0.0079	-0.0229	
	(4.48)		(3.09)	(2.15)	(-4.27)	
	Const	sm_t	sm_{t-5}	$r_S(t-5,t)$	$r(t-5,t)$	r_{mom}
1	0.1147	0.0118				
	(4.37)	(4.19)				
2	0.0794		0.0057			
	(3.61)		(2.97)			
3	0.0486			-0.0098		
	(3.84)			(-3.51)		
4	0.0935		0.0076	0.0059	-0.0225	
	(4.79)		(3.77)	(2.09)	(-4.62)	
	Const	cfm_t	cfm_{t-5}	$r_{CF}(t-5,t)$	$r(t-5,t)$	r_{mom}
1	0.1397	0.0116				
	(4.00)	(3.39)				
2	0.0501		0.0012			
	(2.60)		(0.55)			
3	0.0468			-0.0116		
	(3.68)			(-4.32)		
4	0.1029		0.0067	0.0040	-0.0230	
	(4.51)		(2.75)	(1.38)	(-4.14)	
	Const	$ernm_t$	$ernm_{t-5}$	$r_{ERN}(t-5,t)$	$r(t-5,t)$	r_{mom}
1	0.1272	0.0098				
	(3.27)	(2.62)				
2	0.0484		0.0012			
	(2.40)		(0.53)			
3	0.0423			-0.0084		
	(3.37)			(-4.21)		
4	0.1122		0.0076	0.0054	-0.0234	
	(4.08)		(2.62)	(2.03)	(-3.95)	

Table 10: **Fama-MacBeth Regressions of Returns on Fundamental-Price Ratios, Lagged Returns and Lagged Growth Measures**

1968:07-1999:12, **February-December Only**, *t-statistics in parentheses*

	Const	bm_t	bm_{t-5}	$r_B(t-5,t)$	$r(t-5,t)$	r_{mom}
A	0.0097				-0.0007	
	(3.88)				(-0.99)	
B	0.0088					0.0077
	(3.68)					(2.81)
1	0.0095	0.0015				
	(3.72)	(2.25)				
2	0.0091		0.0008			
	(3.57)		(1.55)			
3	0.0091			0.0001		
	(3.47)			(0.16)		
4	0.0092		0.0015	0.0017	-0.0015	
	(3.64)		(2.28)	(2.29)	(-1.76)	
	Const	sp_t	sp_{t-5}	$r_{SLS}(t-5,t)$	$r(t-5,t)$	r_{mom}
1	0.0146	0.0009				
	(3.53)	(2.05)				
2	0.0102		0.0002			
	(2.44)		(0.57)			
3	0.0085			0.0010		
	(3.18)			(2.06)		
4	0.0137		0.0008	0.0022	-0.0015	
	(3.28)		(1.86)	(4.09)	(-2.00)	
	Const	cp_t	cp_{t-5}	$r_{cf}(t-5,t)$	$r(t-5,t)$	r_{mom}
1	0.0299	0.0023				
	(5.77)	(3.65)				
2	0.0145		0.0006			
	(2.90)		(1.09)			
3	0.0090			0.0009		
	(3.50)			(1.98)		
4	0.0267		0.0019	0.0030	-0.0030	
	(4.90)		(3.09)	(4.85)	(-3.13)	
	Const	ep_t	ep_{t-5}	$r_{ern}(t-5,t)$	$r(t-5,t)$	r_{mom}
1	0.0274	0.0019				
	(4.80)	(2.76)				
2	0.0134		0.0004			
	(2.47)		(0.72)			
3	0.0096			0.0003		
	(3.82)			(0.96)		
4	0.0259		0.0017	0.0021	-0.0029	
	(3.99)		(2.27)	(3.49)	(-2.77)	

Table 11: **Fama-MacBeth regressions of Monthly Returns on C/P and Past Sales Growth Measures**

1968:07-1999:12, All Months, t-statistics in parentheses

	Const	cfp_t	$g_{sls}(t-5,t)$	$r_{sls}(t-5,t)$	$n'(t-5,t)$	$r(t-5,t)$
1	0.0388	0.0030				
	(6.76)	(4.66)				
2	0.0133		-0.0022			
	(5.48)		(-3.05)			
3	0.0386	0.0029	-0.0019			
	(6.71)	(4.56)	(-2.73)			
3	0.0123			-0.0003		
	(4.63)			(-0.56)		
4	0.0118				0.0049	
	(4.47)				(3.49)	
5	0.0131					-0.0025
	(5.30)					(-3.07)
7	0.0388	0.0030		-0.0005		
	(6.57)	(4.57)		(-0.94)		
8	0.0331	0.0024		0.0005		-0.0020
	(6.82)	(4.27)		(1.08)		(-2.62)
9	0.0345	0.0025	-0.0010		0.0032	
	(5.89)	(4.08)	(-1.65)		(2.38)	
10	0.0345	0.0025		-0.0010	0.0042	
	(5.89)	(4.08)		(-1.65)	(2.98)	
11	0.0344	0.0024	-0.0012			-0.0016
	(7.14)	(4.44)	(-1.77)			(-2.11)
12	0.0297	0.0020	0.0000		0.0040	-0.0018
	(6.16)	(3.87)	(-0.04)		(3.33)	(-2.53)
13	0.0297	0.0020		0.0000	0.0040	-0.0018
	(6.16)	(3.87)		(-0.04)	(3.13)	(-2.53)

Correlations of Right-Hand Side Variables

	cfp_t	$r_{sls}(t-5,t)$	$g_{sls}(t-5,t)$	$n'(t-5,t)$	$r(t-5,t)$
cfp_t	100.0	6.3	-7.9	-21.0	-23.0
$r_{sls}(t-5,t)$	6.3	100.0	76.4	-27.9	31.1
$g_{sls}(t-5,t)$	-7.9	76.4	100.0	39.2	30.9
$n'(t-5,t)$	-21.0	-27.9	39.2	100.0	2.0
$r(t-5,t)$	-23.0	31.1	30.9	2.0	100.0

Table 12: **Relation of Share Growth and Past Return Measures**
This table presents the results of a set of Fama-MacBeth regressions of adjusted share growth from t to $t+1$ on (1)$gsha_{t-4,t}$, the adjusted share growth from $t-4$ years to t, (2) bm_{t-4}, the log book-to-market ratio at $t-4$ years; (3)$r_B(t-4,t)$ the log-book return from $t-4$ to t; (4) $r(t-4,t)$, the log-stock return from $t-4$ to t. t-statistics are in parenthesis.

	Const	$gsha_{t-4,t}$	bm_{t-4}	$r_B(t-4,t)$	$r(t-4,t)$
1	-0.0052	0.0588			
	(-1.52)	(4.52)			
2	-0.0080		-0.0052		
	(-2.05)		(-3.12)		
3	-0.0045			-0.0067	
	(-1.22)			(-3.98)	
4	-0.0112				0.0095
	(-2.76)				(2.65)
5	-0.0067	0.0570	-0.0037		
	(-1.78)	(4.31)	(-2.09)		
6	-0.0039	0.0587		-0.0058	
	(-1.12)	(4.61)		(-4.52)	
7	-0.0104	0.0554			0.0095
	(-2.46)	(4.26)			(2.98)
8	-0.0051	0.0570	-0.0029	-0.0053	
	(-1.32)	(4.39)	(-1.62)	(-4.08)	
9	-0.0130	0.0531	-0.0054		0.0109
	(-2.87)	(4.01)	(-2.99)		(3.37)
10	-0.0117	0.0529	-0.0045	-0.0067	0.0124
	(-2.54)	(4.11)	(-2.50)	(-4.45)	(3.65)

Table 13: **Fama-MacBeth regressions of Monthly returns on Book-to-Market, Past Return, and Issuance Measures**

1968:07-1999:12, All Months, t-statistics in parentheses

	Const	bm_t	bm_{t-5}	$r_B(t-5,t)$	$r(t-5,t)$	$n`(t-5,t)$
1	0.0116					0.0052
	(4.36)					(3.53)
2	0.0118	0.0021				0.0040
	(4.52)	(3.07)				(2.86)
3	0.0117		0.0009			0.0048
	(4.42)		(1.86)			(3.32)
4	0.0123			-0.0013		0.0054
	(4.61)			(-2.08)		(3.66)
5	0.0122				-0.0021	0.0051
	(4.80)				(-2.74)	(3.85)
6	0.0119		0.0007	-0.0009		0.0050
	(4.47)		(1.29)	(-1.43)		(3.53)
7	0.0125		0.0012		-0.0023	0.0046
	(4.97)		(2.40)		(-2.92)	(3.60)
8	0.0121		0.0022	0.0022	-0.0033	
	(4.84)		(3.24)	(2.95)	(-3.43)	
9	0.0120		0.0017	0.0014	-0.0028	0.0041
	(4.73)		(2.69)	(1.90)	(-3.04)	(3.32)

Table 14: **Fama-MacBeth Regressions of Change in Betas on Tangible and Intangible Return Measures**

Annual 1967-1998 t-statistics in parentheses

Const	bvp_t	bvp_{t-5}	$r_{BV}(t-5,t)$	$r(t-5,5)$	$r_I^{(B)}(t-5,t)$
-0.0913	-0.0396				
(-4.26)	(-2.41)				
-0.0742			-0.0312		
(-3.02)			(-1.85)		
-0.1358				0.0756	
(-5.61)				(2.92)	
-0.0751		0.0249	-0.0200		0.1066
(-3.26)		(1.12)	(-1.03)		(4.11)
Const	$slsp_t$	$slsp_{t-5}$	$r_{SLS}(t-5,t)$	$r(t-5,5)$	$r_I^{(SLS)}(t-5,t)$
-0.1951	-0.0184				
(-2.28)	(-1.50)				
-0.1016			0.0195		
(-3.75)			(1.28)		
-0.1321				0.0809	
(-5.21)				(3.23)	
-0.0740		0.0048	0.0183		0.0824
(-0.73)		(0.32)	(1.04)		(3.21)
Const	cfp_t	cfp_{t-5}	$r_{CF}(t-5,t)$	$r(t-5,5)$	$r_I^{(CF)}(t-5,t)$
-0.3939	-0.0361				
(-2.53)	(-2.10)				
-0.0909			0.0024		
(-4.03)			(0.22)		
-0.1380				0.0861	
(-5.59)				(3.55)	
0.1993		0.0342	0.0128		0.1146
(1.04)		(1.59)	(0.95)		(4.33)
Const	$ernp_t$	$ernp_{t-5}$	$r_{ERN}(t-5,t)$	$r(t-5,5)$	$r_I^{(ERN)}(t-5,t)$
-0.3835	-0.0332				
(-2.15)	(-1.77)				
-0.0870			-0.0046		
(-4.04)			(-0.45)		
-0.1412				0.0861	
(-5.60)				(3.52)	
0.3705		0.0506	0.0087		0.1198
(1.81)		(2.31)	(0.65)		(4.46)
Const				$r_T^{(Tot)}(t-5,t)$	$r_I^{(Tot)}(t-5,t)$
-0.1283				0.0378	0.1305
(-5.23)				(1.24)	(4.92)

Table 15: **Fama-MacBeth Regressions of Change in Return Standard Deviation on Tangible and Intangible Return Measures**

Annual 1967-1998 t-statistics in parentheses

Const	bvp_t	bvp_{t-5}	$r_{BV}(t-5,t)$	$r(t-5,5)$	$r_I^{(BV)}(t-5,t)$
-0.2577	0.3798				
(-0.66)	(4.37)				
0.0694			-0.7169		
(0.17)			(-7.36)		
0.2291				-0.8411	
(0.63)				(-6.79)	
0.1375		-0.1586	-0.8251		-0.8408
(0.35)		(-1.58)	(-7.92)		(-6.40)
Const	$slsp_t$	$slsp_{t-5}$	$r_{SLS}(t-5,t)$	$r(t-5,5)$	$r_I^{(SLS)}(t-5,t)$
1.2807	0.2481				
(2.36)	(4.32)				
-0.3250			0.0020		
(-0.73)			(0.02)		
0.2319				-0.8204	
(0.63)				(-6.77)	
-0.9699		-0.1135	-0.0918		-0.9679
(-1.47)		(-1.96)	(-0.82)		(-6.98)
Const	cfp_t	cfp_{t-5}	$r_{CF}(t-5,t)$	$r(t-5,5)$	$r_I^{(CF)}(t-5,t)$
-0.2080	0.0026				
(-0.30)	(0.03)				
0.1663			-0.6882		
(0.42)			(-10.01)		
0.2000				-0.6218	
(0.55)				(-5.64)	
-0.7588		-0.1083	-0.7318		-0.4042
(-0.84)		(-1.16)	(-9.83)		(-2.91)
Const	$ernp_t$	$ernp_{t-5}$	$r_{ERN}(t-5,t)$	$r(t-5,5)$	$r_I^{(ERN)}(t-5,t)$
-1.7815	-0.1679				
(-2.43)	(-2.00)				
0.0690			-0.5148		
(0.18)			(-9.05)		
0.1401				-0.4834	
(0.38)				(-4.44)	
0.0465		-0.0035	-0.5269		-0.2226
(0.05)		(-0.04)	(-8.33)		(-1.55)
Const				$r_T^{(Tot)}(t-5,t)$	$r_I^{(Tot)}(t-5,t)$
0.3386				-0.9226	-0.0490
(0.89)				(-6.68)	(-0.37)