



Does Greater Firm-Specific Return Variation Mean More or Less Informed Stock Pricing?

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ABSTRACT

Roll [1988] observes low R^2 statistics for common asset pricing models due to vigorous firm-specific return variation not associated with public information. He concludes that this implies “either private information or else occasional frenzy unrelated to concrete information” [p. 56]. We show that firms and industries with lower market model R^2 statistics exhibit higher association between current returns and future earnings, indicating more information about future earnings in current stock returns. This supports Roll’s first interpretation: higher firm-specific return variation as a fraction of total variation signals more information-laden stock prices and, therefore, more efficient stock markets.

1. Introduction

Stock markets perform a vital economic role by generating prices that serve as signals for resource allocation and investment decisions. This role has two parts: if stock prices are near their fundamental (full information) values, (1) capital is priced correctly in its different uses, and (2) this information provides corporate managers with meaningful feedback as stock

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prices change in response to their decisions. These two effects should lead to more economically efficient capital allocation, both between firms and within firms. Tobin [1982] defines the stock market as exhibiting *functional efficiency* if stock prices direct capital to its highest value uses; that is, the stock market is functionally efficient if it causes a microeconomically efficient resource allocation. A necessary condition for functional stock market efficiency is that share prices track firm fundamentals closely.

Information about fundamentals is capitalized into stock prices in two ways: through a general revaluation of stock values following the release of public information, such as unemployment statistics or quarterly earnings, and through the trading activity of risk arbitrageurs who gather and possess private information. Roll [1988], in explaining the low R^2 statistics of common asset pricing models, argues that the latter channel is especially important in the capitalization of firm-specific information. This is because he finds that firm-specific stock price movements are generally not associated with identifiable news release; therefore, he suggests, "The financial press misses a great deal of relevant information generated privately" [p. 564]. However, he acknowledges that two explanations of his finding are actually possible when he concludes by proposing that his findings seem "to imply the existence of either private information or else occasional frenzy unrelated to concrete information" [p. 566]. West [1988] makes a theoretical case that more firm-specific return volatility is associated with less information.

If Roll's [1988] former view that firm-specific price movements reflect the capitalization of private information into prices is correct, firm-specific price fluctuations are a sign of active trading by informed arbitrageurs and, thus, may signal that the stock price is tracking its fundamental value closely. In this view, the low R^2 statistics Roll observes for popular asset pricing models are a cause for celebration, for high firm-specific return variation reflects efficient markets. If Roll's latter view that firm-specific stock price movements reflect noise trading is correct, such movements might signal stock prices deviating from fundamental values.

In our opinion, the relative importance of the two preceding views is an empirical question. This study makes a first pass at using financial data to distinguish these two possible explanations. We examine the relation between firm-specific stock price variation and accounting measures of stock price informativeness. Operationally, we define firm-specific price variation as the portion of a firm's stock return variation unexplained by market and industry returns. We define price informativeness as how much information stock prices contain about future earnings, which we estimate from a regression of current stock returns against future earnings. Our measures of informativeness (association) are: (1) the aggregated coefficients on the future earnings, and (2) the marginal variation of current stock return explained by future earnings.

We find that firm-specific stock price variability is positively correlated with both of our measures of stock price informativeness. The positive relation is present in both simple correlations and in regression analyses that

control for factors that influence the informativeness measures and are correlated with firm-specific stock return variation. We subject our results to multiple robustness checks, including residuals diagnostic checks and perturbations in variable construction, in the data sample, and in the empirical specification of the regressions. All of this leads us to conclude that greater firm-specific price variation is associated with more informative stock prices and supports the first conjecture of Roll [1988] that firm-specific variation reflects arbitrageurs trading on private information.

Our findings are also consistent with recent work that links greater firm-specific return variation to better functioning stock markets. Morck, Yeung, and Yu [2000] find greater firm-specific price variation (less synchronicity of returns across firms) in economies where government better protects outside investors' private property rights. Their interpretation is that strong property rights promote informed arbitrage, leading to the impounding of more firm-specific information and thus less comovement in stock returns across firms. Using Morck, Yeung, and Yu's synchronicity measure, Wurgler [2000] shows that the efficiency of capital allocation across countries is negatively correlated with synchronicity in stock returns across domestically traded firms. Durnev, Morck, and Yeung [2000] find that U.S. industries and firms exhibiting larger firm-specific return variation use more external financing. Durnev, Morck, and Yeung [2003] show U.S. industries and firms exhibiting larger firm-specific return variation make more value-enhancing capital budgeting decisions.

The rest of the paper is organized as follows. Section 2 first reports our basic data sources and sample. It then discusses our measures of the focal variables: firm-specific stock return variability and stock price informativeness. The section also includes a discussion of our overall regression design and two empirical subspecifications: an industry-matched design and a cross-industry design. Section 3 discusses our industry-matched empirical design, our control variables, and our regression model. Section 4 presents the results and robustness issues. Section 5 describes our cross-industry empirical design and its results. Section 6 presents the regression relation between our informativeness measures and firm-specific return variability from 1983 to 1995. Section 7 concludes.

2. Data and Sample Selection, Variable Measures, and Basic Empirical Design

2.1 DATA AND SAMPLE SELECTION

Our empirical investigation relies on constructing variables from firm-level data on returns as well as accounting data. We obtain stock prices and returns from the Center for Research in Security Prices (CRSP) and firm-level accounting data from Standard & Poor's annual Compustat tapes. We begin with all companies listed in the WRDS CRSP/Compustat merged database for each year from 1983 to 1995. Our sample period stops in 1995

because in some of our variable constructions we need data up to 1998, the last year of data available to us when we started the research effort. We discard duplicate entries for preferred stock, class B stock, and the like by deleting entries whose CUSIP identifiers in CRSP append a number other than 10 or 11.

In our investigation, we must assign each firm to an industry. We identify a firm's industry each year by the primary Standard Industrial Classification (SIC) code of its largest business segment, ranked by sales, that year. Because accounting figures for firms in finance and banking (SIC 6000–6999) are not comparable with those of other firms, we exclude these firms. Because regulated utilities (SIC 4900–4999) are arguably subject to different investment constraints than unregulated firms, we drop firms of utilities industries, although keeping them in our sample does not change our primary findings qualitatively.

We exclude firms that do not have a full year of uninterrupted returns (weekly) data because disruptions in trading can be due to initial public offerings (IPOs), delistings, or trading halts. IPOs are unusual information events, and we wish to explore the information content of stocks under normal operating circumstances. Similarly, trading halts generally correspond to unusual events such as takeover bids, bankruptcy filings, or legal irregularities.

2.2 FIRM-SPECIFIC STOCK RETURN VARIATION MEASURES

Firm-specific stock return variation is obtained from the regression:

$$r_{j,w,t} = \alpha_{j,t} + \beta_{j,t} r_{m,w,t} + \gamma_{j,t} r_{i_2,w,t} + \varepsilon_{j,w,t} \quad (1)$$

of firm j 's total returns $r_{j,w,t}$ on market return $r_{m,w,t}$ and a broad (two-digit SIC code) industry return $r_{i_2,w,t}$. Returns are measured across w weekly periods in each year t . We use weekly returns because CRSP daily returns data report a zero return when a stock is not traded on a given day. Although some small stocks may not trade for a day or more, they generally trade at least once every few days. Weekly returns are therefore less likely to be affected by such thin trading problems. Both the market return and broad industry return in (1) are value-weighted averages excluding the firm in question. This exclusion prevents any spurious correlations between firm returns and industry returns in industries that contain few firms. Thus,

$$r_{i_2,w,t} = \frac{\sum_{k \in i_2} W_{k,w,t} r_{k,w,t} - W_{j,w,t} r_{j,w,t}}{J_{i_2} - 1}, \quad (2)$$

where $W_{k,w,t}$ is the value weight of firm k in industry i_2 in week w and J_{i_2} is the number of firms in industry i_2 in the same week.

Regression (1) resembles standard asset pricing models. Note however that (1) contains an industry index as well as a market index. This is because we wish the residual $\varepsilon_{i,w,t}$ to be as analogous as possible to the abnormal returns typically used in event studies, which often use industry benchmarks.

Roll [1988] also excludes industry-related variation from his measure of firm-specific return variation.

We scale the variance of $\varepsilon_{j,w,t}$ by the total variance of the dependent variable in (1), obtaining

$$\Psi_{j,t} \equiv \frac{\sum_{w \in t} \varepsilon_{j,w,t}^2}{\sum_{w \in t} (r_{j,w,t} - \bar{r}_{j,t})^2}. \quad (3)$$

Given our sample, we estimate (3) for each firm in each year from 1983 to 1995. The resulting $\Psi_{j,t}$ are estimates of the firm-specific return variability for each firm j in each year t relative to total variability. We also obtain a weighted-average of $\Psi_{j,t}$ for a group of firms $\{j\}$ by summing the firms' numerators and denominators in (3) and forming the ratio. We generically refer to Ψ as *relative firm-specific stock return variation*.

Note that $\Psi_{j,t}$ is precisely $1 - R^2$ of (1), which is the variable Roll [1988] uses to distinguish firm-specific return variation from market-related and industry-related returns variation. Roll shows that arrival of private information contributes to a decline in R^2 . The value-weighted average across firms' R^2 of (1) is one of the synchronicity variables in Morck, Yeung, and Yu [2000]. The construction of $\Psi_{j,t}$ is equivalent to scaling firm-specific stock return variation by total variation. The scaling is desirable because some business activities are more subject to economy- and industrywide shocks than others, and firm-specific events in these industries may be correspondingly more intense though the intensity may intrinsically stem from environmental volatility.

Our premise is that a high value of $\Psi_{j,t}$ might indicate that a high-intensity stream of firm-specific information is being capitalized into a stock price by informed traders. Alternatively, a high value of $\Psi_{j,t}$ might indicate a noisy, or low-information, stock price. Consequently, our objective is to estimate the correlation between $\Psi_{j,t}$ and our earnings informativeness measures, discussed later, which should be higher when stock prices contain more information.¹

2.3 MEASURES OF STOCK PRICE INFORMATIVENESS

Our stock price informativeness measures (how much information about future earnings is capitalized into price) are based on Collins et al. [1994]. They assume revisions in expected dividends to be correlated with revisions

¹ An alternative to $\Psi_{j,t}$ is *absolute firm-specific stock return variation*, which is $\sum_{w \in t} \varepsilon_{j,w,t}^2$ divided by the number of observations in the summation. Notice that total variation can be decomposed into unexplained variation $\sum_{w \in t} \varepsilon_{j,w,t}^2$ and explained variation $(\sum_{w \in t} (r_{j,w,t} - \bar{r}_{j,t})^2 - \sum_{w \in t} \varepsilon_{j,w,t}^2)$. We refer to $(\sum_{w \in t} (r_{j,w,t} - \bar{r}_{j,t})^2 - \sum_{w \in t} \varepsilon_{j,w,t}^2)$ divided by the number of observations as *systematic variation*. We can adopt the absolute firm-specific stock return variation as alternative to the relative firm-specific stock return variation. Doing so, we need to ascertain that systematic variation is explicitly incorporated as a control variable. Such arrangement yields broadly consistent results; to conserve space we do not report them. These results are available on request.

in expected earnings.² This allows them to express current stock returns as a function of the current period's unexpected earnings and changes in expected future earnings. The ability of current stock returns in tracking future earnings is a measure of stock price informativeness. However, we note that our empirical measure is also affected by the timeliness (Collins et al. [1994], Basu [1997]) and forecastability (volatility) of earnings, which we need to control for in implementing our investigation.³

A key problem in estimating the relation between current stock returns and unexpected current earnings, as well as changes in expected future earnings, is that the latter are all unobservable. We follow Collins et al. [1994] and proxy for current unexpected earnings using current change in earnings, and for changes in expected future earnings using changes in reported future earnings. The function we estimate is thus a regression of current annual stock returns r_t on current and future annual earnings:

$$r_t = a + b_0 \Delta E_t + \sum_{\tau} b_{\tau} \Delta E_{t+\tau} + \sum_{\tau} c_{\tau} r_{t+\tau} + u_t, \quad (4)$$

where $\Delta E_{t+\tau}$ is the earnings per share change τ periods ahead, scaled by the price at the beginning of the current year.⁴ Collins et al. recommend including future stock returns $r_{t+\tau}$ as control variables.⁵ Based on Kothari and Sloan [1992] and Collins et al., we include three future years of earnings changes and returns in (4).⁶

Our first future earnings response measure is the *future earnings response coefficient*, the sum of the coefficients on future earnings, which we define as

$$FERC \equiv \sum_{\tau} b_{\tau}. \quad (5)$$

Our second future earnings response measure is *future earnings incremental explanatory power*, the increase in the R^2 of regression (4), associated with

² In choosing controls in our regression analyses, we address the possibility that the correlation between revision in dividends and in earnings varies among firms.

³ The relation between current returns and future earnings is also used as an informativeness measure by Gelb and Zarowin [2002], Lundholm and Myers [2003], and Piotroski and Roulstone [2003].

⁴ If the deflator is beginning-of-period earnings, the independent variable is undefined when the denominator is negative or zero. To avoid having to delete firms with negative or zero earnings, we scale by beginning of year price P_{t-1} .

⁵ Collins et al. [1994] argue that using the actual future earnings introduces an error-in-variables problem in (4) because the theoretically correct regressor is the unobservable change in expected future earnings. This measurement error problem biases downward estimates of both the future earnings coefficients and the incremental explanatory power of the future earnings variables. To correct for this bias, they argue that future returns should be included as control variables and that the coefficient on $r_{t+\tau}$ is negative. We follow this standard practice in the accounting literature. However, dropping future returns from (4) does not affect our findings.

⁶ In related studies, Warfield and Wild [1992] also examine the relation between current returns and future earnings, and Kothari and Shanken [1992] analyze the relation between aggregate stock returns and future dividends. Lundholm and Myers [2000] derive a regression of returns on future earnings based on the residual income valuation model (Ohlson [1995]). Note that using earnings levels is econometrically equivalent to using changes.

including the terms $\sum_{\tau} b_{\tau} \Delta E_{t+\tau}$ (the incremental explanatory power of future earnings, given that current unexpected earnings are already in the model). Thus, we define⁷

$$FINC \equiv R^2_{r_t = a + b_0 \Delta E_t + \sum_{\tau} b_{\tau} \Delta E_{t+\tau} + \sum_{\tau} c_{\tau} r_{t+\tau} + u_t} - R^2_{a + b_0 \Delta E_t + u_t}. \quad (6)$$

The variables *FERC* and *FINC* are both informativeness measures that capture how well current stock prices predict future earnings. Yet, it is well known that the measures are affected by a variety of factors, including the timeliness of earnings (e.g., see Collins et al. [1994], Basu [1997]). Still, given adequate controls, higher values of either indicate that current returns capitalize more information about future earnings.

The stock returns in (4), r_t , are total annual stock returns, defined as capital gain plus dividend yield and are calculated from data reported in Compustat, following Collins et al. [1994].⁸ The change in earnings variables in (4), ΔE_t , are changes in earnings before interest, taxes, depreciation, and amortization (EBITDA) divided by the market value of common equity at the beginning of the firm's fiscal year, all from Compustat.⁹ Because interest, taxes, depreciation, and amortization are among the components of income most vulnerable to differences in accounting measurement, and because EBITDA is not sensitive to differences in capital structure, it is more appropriate for our purposes than net income.

Thus, we use two measures of informativeness, *FERC* and *FINC*, both of which should be higher when more information about future earnings is impounded into the stock price.

2.4 EMPIRICAL FRAMEWORK

Our empirical objective is to examine the relation between the informativeness measures (the earnings responses, *FERC* and *FINC*, as in equations (5) and (6), respectively) and *relative firm-specific stock return variation* ($\Psi_{j,t}$ as in equation (3)). Yet, *FERC* and *FINC* are affected by the intrinsic relation between returns and earnings, which includes timeliness, earnings volatility, and corporate governance that determines the relation between earnings and dividends and the like. Our approach is that, after controlling for the aforementioned, *FERC* and *FINC* reflect informativeness. Therefore, the regression relation between *FERC* and *FINC* and firm-specific return

⁷ Collins et al. [1994] recommend including future stock returns, r_{t+t} , as control variables only when future earnings changes, $\Delta E_{t+\tau}$, are included.

⁸ The fiscal year-end share price adjusted for stock splits and such, annual Compustat item 199/27, plus the dividends adjusted for stock splits and such during the year, item 26/27, all divided by the price at the end of the previous fiscal year, also adjusted for splits and the like, $199(-1)/27(-1)$. Compustat item 27 is an adjustment factor reflecting all stock splits and dividends that occurred during the fiscal year.

⁹ The reported earnings, Compustat item 13, minus the reported earnings the previous year, $13(-1)$, all divided by the previous year's fiscal year-end price times the previous year number of shares outstanding, $199(-1) \times 25(-1)$.

variation, given adequate controls, reveals the relation between informativeness and firm-specific return variation. A positive relation between informativeness and $\Psi_{j,t}$ suggests that greater $\Psi_{j,t}$ indicates more informed stock pricing, whereas a negative relation suggests the opposite.

Operationalizing this empirical plan depends on obtaining reliable estimates for *FERC*, *FINC*, and $\Psi_{j,t}$. We can readily obtain the estimates of $\Psi_{j,t}$, for either a firm or a group of firms on an industry level. Calculating *FERC* and *FINC* is more difficult. These difficulties drive our empirical design.

To calculate *FERC* and *FINC*, we use a cross-section of similar firms.¹⁰ The industry-level cross-sectional approach requires that firms pooled together for the estimation of their common informativeness measures be as homogeneous as possible. Although pooling firms in the same industry is a natural first step in this direction, there could still be factors (e.g., timeliness of accounting data in reflecting information on earnings) that affect both the informativeness measures' intrinsic values and their estimation precision. We use two methods to control for such factors. The first method matches pairs of high- and low- Ψ firms by industry and so focuses on *intraindustry* variation in earnings responses. Each pair of matched firms contains a high- $\Psi_{j,t}$ firm and a low- $\Psi_{j,t}$ firm that are similar in other critical dimensions. If the *FERC* and *FINC* estimates of the collected high- $\Psi_{j,t}$ firms differ significantly from those of the low- $\Psi_{j,t}$ firms, we can conclude that differences in $\Psi_{j,t}$ correlate with differences in *FERC* and *FINC*. We report results based on this method in the next two sections. The second method forms industry estimates and includes the additional factors as control variables in the regressions; therefore, it explains *cross-industry* variation in earnings responses with Ψ and controls.¹¹ The obtained results are reported in section 5.

3. Industry-Matched-Pairs Methodology

As the first step in our matched-pair procedure, we select the two firms with the highest firm-specific return variation and the two firms with the lowest firm-specific return variation each year in each four-digit industry, i_4 . Thus, we maximize the difference in firm-specific stock return variation

¹⁰ We can pool many years of data for each firm to estimate its *FERC* and *FINC*. The approach is problematic because changes in the macroeconomic environment, industry conditions, the firm's business, institutional constraints, accounting rules, and financial regulations can all cause intertemporal shifts in our earnings response measures. The result could be unreliable and unstable estimates for *FERC* and *FINC*. The cross-sectional approach avoids this problem and has an additional advantage: because we can measure the firm-specific stock return variation for each firm annually, we can employ a year-by-year window to examine the evolution of the variables' relation over time. Still, the firm-by-firm approach produces results consistent with the reported results; they are available on request.

¹¹ Match pairing is appropriate to the extent that the matching criterion is an effective control for the omitted factors. Industry matching, for example, only controls for the omitted factors common to an industry. Including control variables is appropriate to the extent that we can construct adequate empirical proxies for the omitted factors. Because each method has its costs and benefits, we use both.

within each industry. We use two high- Ψ firms and two low- Ψ firms in each four-digit industry to mitigate any distortion of the metric due to outlier errors.

Our second step is to pool all the pairs of high- Ψ firms within each two-digit industry, i_2 . We call this subsample of firms H_{i_2} . We similarly pool all the pairs of low- Ψ firms within each two-digit industry, i_2 , and call the resulting subsample of firms L_{i_2} . Thus, if a two-digit industry i_2 has n_{i_2} four-digit industries, H_{i_2} and L_{i_2} each contains $2n_{i_2}$ firms.

We match firms by industry, because many of the determinants of $FERC$, $FINC$, and Ψ are industry specific and can thus be controlled for using this industry-matching procedure. Such determinants include both real business activities and accounting methods, which can determine both the magnitude and frequency of information arrival and the lag between the impact of an information event on stock returns and its recognition in earnings. To the extent that it controls for these industry factors, the matched-industry-pair design lets us reliably isolate the relation between stock price variability and informativeness.

3.1 DIFFERENTIAL EARNINGS RESPONSE AND RELATIVE FIRM-SPECIFIC STOCK RETURN VARIATION MEASURES

In each two-digit SIC industry i_2 , we use the $2n_{i_2}$ firms in H_{i_2} to estimate earnings response coefficients $FERC_{i_2,t}^H$ and $FINC_{i_2,t}^H$ for each year t . We then use the $2n_{i_2}$ firms in L_{i_2} to estimate earnings response measures $FERC_{i_2,t}^L$ and $FINC_{i_2,t}^L$. We take the difference in earnings response measures between firms with high and low firm-specific return variation in each two-digit industry as

$$\Delta FERC_{i_2,t} \equiv FERC_{i_2,t}^H - FERC_{i_2,t}^L \quad (7)$$

and

$$\Delta FINC_{i_2,t} \equiv FINC_{i_2,t}^H - FINC_{i_2,t}^L. \quad (8)$$

We refer to $\Delta FERC_{i_2,t}$ and $\Delta FINC_{i_2,t}$ as *differential future earnings response measures*.

We then construct weighted-average relative firm-specific stock return variation estimates for all the firms in H_{i_2} and L_{i_2} , respectively. These are:

$$\Psi_{i_2,t}^H \equiv \frac{\sum_{j \in H_{i_2}} \sum_{w \in t} \varepsilon_{j,w,t}^2}{\sum_{j \in H_{i_2}} \sum_{w \in t} (r_{j,w,t} - \bar{r}_{j,w,t})^2} \quad (9)$$

and

$$\Psi_{i_2,t}^L \equiv \frac{\sum_{j \in L_{i_2}} \sum_{w \in t} \varepsilon_{j,w,t}^2}{\sum_{j \in L_{i_2}} \sum_{w \in t} (r_{j,w,t} - \bar{r}_{j,w,t})^2}. \quad (10)$$

We denote the difference between the relative firm-specific return variation estimates for our high- and low- Ψ firms as:

$$\Delta \Psi_{i_2,t} \equiv \Psi_{i_2,t}^H - \Psi_{i_2,t}^L. \quad (11)$$

That is, for each two-digit industry i_2 , $\Delta\Psi_{i_2,t}$ is a weighted average of the highest two-firm Ψ estimates in each four-digit industry in i_2 minus a weighted average of the lowest two-firm Ψ estimates in each four-digit subindustry in i_2 . We refer to $\Delta\Psi_{i_2,t}$ as our *differential relative firm-specific return variation measure*.

We then test for a relation between our differential earnings response measures and differential relative firm-specific return variation measure, either between $\Delta FERC_{i_2,t}$ and $\Delta\Psi_{i_2,t}$ or between $\Delta FINC_{i_2,t}$ and $\Delta\Psi_{i_2,t}$. *Ceteris paribus*, a positive relation indicates that greater firm-specific stock price variability is associated with greater price informativeness, whereas a negative relation indicates the opposite.

3.2 CONTROL VARIABLES

Informativeness is defined as the total amount of information about future earnings that is capitalized into (or reflected in) the current period stock price and return. Firms with higher stock price informativeness (i.e., whose stock returns reflect more information about future earnings) have higher *FERC* and *FINC*. Hence, the simple correlations between $\Delta FERC_{i_2,t}$ and $\Delta\Psi_{i_2,t}$ or between $\Delta FINC_{i_2,t}$ and $\Delta\Psi_{i_2,t}$ are of interest.

However, our tests are best performed using multiple regressions. In addition to informativeness, empirical estimates of *FERC* and *FINC* are also affected by other factors, for example, earnings timeliness and earnings volatility. Although our industry-matching-pairs technique mitigates control problems, some effects may remain as exogenous determinants, even between firms in the same narrow industry. We must control for them explicitly.

We group such factors into three categories. The first category controls for problems in variable construction, that is, how precisely we can estimate *FERC* and *FINC*. The second category includes factors that have intrinsic effects on the informativeness content in *FERC* and *FINC*. The third category consists of controls for the effects of earnings timeliness on *FERC* and *FINC*. Timeliness refers to the speed with which information (that is impounded in price) is recognized in earnings. Firms with more timely earnings have a stronger relation between current returns and current earnings, and a weaker relation between current returns and future earnings. Although we can include timeliness in the second category, we separate it because of its importance. Details for the control variables are as follows.

3.2.1. Controlling for Problems in Variable Construction. We might be able to estimate $\Delta FERC$ and $\Delta FINC$ more accurately (i.e., with less measurement error) for some industry pools than for others. Differential measurement error in $\Delta FERC$ and $\Delta FINC$ can cause econometric problems. To prevent this, we include as controls (1) the number of firms in the industry pool, (2) the average diversification, and (3) average size of the firms in the pool.

The future earnings response variables can be more accurately estimated if a two-digit industry contains more four-digit industries because more firms are used in obtaining the estimates. This means the differential future

earnings response variables are also more accurately estimated. To control for such differences, we include the square root of the number of firms used in estimating the future earnings response variables as an additional explanatory variable. We refer to this as our *industry structure measure*, which we define as¹²

$$I_{i_2,t} \equiv \sqrt{2n_{i_2,t}}, \quad (12)$$

where n_{i_2} is the number of four-digit industries in the two-digit industry i_2 in year t .

Earnings responses might be related to firm size and firm diversification. Larger firms and more diversified firms are more complicated; therefore, they are harder to analyze. However, more analysts might follow them. We therefore control for the difference (between high- and low- Ψ firms in industry i_2) in average level of firm diversification and average firm size.

To measure firm-level diversification, we obtain the total number of distinct four-digit lines of business, $s_{j,t}$, each firm reports each year from the Compustat Industry Segment file.¹³ We then compute an asset-weighted average diversification index for the pool of the highest relative firm-specific return variation firms, H_{i_2} , in industry i_2 ,

$$D_{i_2,t}^H = \frac{\sum_{j \in H_{i_2}} A_{j,t} s_{j,t}}{\sum_{j \in H_{i_2}} A_{j,t}}, \quad (13)$$

where A_j is the total assets of firm j in year t . We construct an analogous index for the pool of the lowest relative firm-specific return variation firms, L_{i_2} , in industry i_2 ,

$$D_{i_2,t}^L = \frac{\sum_{j \in L_{i_2}} A_{j,t} s_{j,t}}{\sum_{j \in L_{i_2}} A_{j,t}}. \quad (14)$$

We then construct $\Delta D_{i_2,t}$, our *differential diversification measure* for each two-digit industry,

$$\Delta D_{i_2,t} \equiv D_{i_2,t}^H - D_{i_2,t}^L. \quad (15)$$

This measure is the average diversification level of the pool of high- Ψ firms in the four-digit industry minus the average diversification level of the pool of low- Ψ firms in that industry.

Earnings numbers might convey more information about large firms than about small firms. Freeman [1987], Collins, Kothari, and Rayburn [1987],

¹² We are also concerned that using more firms to construct the H_{i_2} and L_{i_2} subsamples in some industries than in others may affect our $\Delta FERC_{i_2,t}$, $\Delta FING_{i_2,t}$, and $\Delta \Psi_{i_2,t}$ measures. In a subsequent robustness check, we include the number of firms in the industry as an additional control variable.

¹³ The diversification data in Compustat start in 1983. Therefore, when we use the diversification variable, all our results are based on the sample of firms starting from 1983. If we forgo using the diversification variable, our sample can go back to at least 1975.

and Collins and Kothari [1989] find that the returns of larger firms impound earnings news on a more timely basis than the returns of smaller firms. Also, smaller firms are more likely to be growth firms whose earnings realizations are farther in the future than are those of larger (established) firms. This effect could induce a negative correlation between firm size and our earnings response measures *FERC* and *FINC*. Alternatively, small firms' earnings could be more variable and hence harder to forecast than large firms' earnings. This would induce a negative correlation between size and *FERC* and *FINC*.¹⁴

To measure the size of firm j in year t , we use its total assets, $A_{j,t}$, obtained from Compustat. We adjust these figures for inflation using the seasonally adjusted producer price index, π , for finished goods published by the U.S. Department of Labor, Bureau of Labor Statistics.¹⁵ We then gauge the average size of firms in the pool of highest firm-specific return variation firms, H_{i_2} , in industry i_2 as

$$S_{i_2,t}^H = \frac{\sum_{j \in H_{i_2}} \ln(\pi_t A_t)}{2n_{i_2,t}}, \quad (16)$$

where $n_{i_2,t}$ is the number of four-digit industries in the two-digit industry i_2 in year t and, hence, half the number of firms j in H_{i_2} in that year. We construct an analogous index for the pool of lowest firm-specific return variation firms, L_{i_2} , in industry i_2 ,

$$S_{i_2,t}^L = \frac{\sum_{j \in L_{i_2}} \ln(\pi_t A_t)}{2n_{i_2,t}}. \quad (17)$$

We then construct a *differential average firm size* measure for each two-digit industry,

$$\Delta S_{i_2,t} \equiv S_{i_2,t}^H - S_{i_2,t}^L. \quad (18)$$

This measure is the average size of firms in the pool of high- Ψ firms in the industry minus the average size of firms in the pool of low- Ψ firms in that industry. We refer to $\Delta S_{i_2,t}$ as our *differential firm size measure*.

To summarize, our controls for variations in the precision of our focal variables' construction are essentially the number of firms (in square root) used in estimating *FERC* and *FINC*, diversification, and firm size, all expressed as the differences between the pools of the high and low stock-specific return variation firms, that is, the high- Ψ and low- Ψ pools.

3.2.2. Controlling for Factors That Have an Intrinsic Effect on the Relation Between Returns and Earnings. Some variables may intrinsically affect the relation between current returns and future earnings. Prime candidates include

¹⁴ Durnev, Yeung, and Morck [2000] find that larger firms have smaller firm-specific variations.

¹⁵ This index is available at <http://www.stls.frb.org/fred/data/ppi/ppifgs>.

earnings volatility, beta volatility, the explanatory power of current earnings for future dividends, and institutional ownership.

Earnings that are more volatile may be intrinsically harder to forecast. Thus, firms with more variable earnings should, *ceteris paribus*, exhibit a weaker relation between current stock returns and future earnings (i.e., lower *FERC* and *FINC*). To control for this, we first calculate the past earnings standard deviation of each firm over the previous five years, $stdev(\Delta EPS_t / P_{t-1})$. We then average the $stdev(\Delta EPS_t / P_{t-1})$ for each of the high- and low- Ψ pools in each i_2 industry, and we denote these averages VE^H and VE^L , respectively. The difference, $\Delta VE = VE^H - VE^L$, is our *differential earnings volatility measure*.

The level of systematic risk in a firm's business activities can change, and this could change the predictability of its future earnings. To capture this effect, we introduce the difference in the average volatility of market model beta as a control.

To compute the variance of beta, we first estimate beta for each firm in each month using the capital asset pricing model and daily returns data. The daily Treasury bill (T-bill) rate, calculated from the 30-day T-bill rate, is used as the risk-free rate.¹⁶ For each firm we then compute the standard deviation of beta using the 12 estimated betas. Then, for each year we compute the average standard deviation across firms in the highest and lowest Ψ firm pools of each two-digit industry.

Investors value dividends, not earnings. We interpret earnings as signals of expected future dividends. However, high current earnings need not translate into high future dividends if agency problems separate shareholders from managers. We include two variables to control for this.¹⁷

The first is the R^2 from a regression of current earnings changes on current and future dividend changes:

$$\Delta E_t = a + b_0 \Delta DIV_t + \sum_{\tau} b_{\tau} \Delta DIV_{t+\tau} + \varepsilon_t,$$

where τ is from 1 to 3. We refer to this as *future dividends explanatory power*, denoted FD^H (FD^L) for the high (low) relative firm-specific return variability firms, and ΔFD is the *differential future dividends explanatory power*, $FD^H - FD^L$.¹⁸

The second variable is *institutional ownership*, which we interpret as indicative of shareholder monitoring and therefore reduced agency problems. We refer to institutional ownership of the high (low) return variability firms

¹⁶ Daily T-bill return is the simple rate that, over the number of calendar days in the month, compounds to the one-month T-bill rate from Ibbotson and Associates Inc.

¹⁷ It is questionable whether these controls should be incorporated. Poor corporate governance that allows management to disrespect shareholders' rights can lead to less informed risk arbitrages and thus less informed stock prices. To be conservative, we nevertheless incorporate these controls. Our results are not affected if these controls are excluded.

¹⁸ If a firm neither pays dividends nor repurchases stock, we set ΔDIV to zero. As a robustness check, we suppress observations with zero dividends and find qualitatively similar results.

as INS^H (INS^L), and ΔINS is the *differential institutional ownership*, $INS^H - INS^L$.¹⁹

To summarize, the controls for factors other than informativeness that affect *FERC* and *FINC* are: earnings variability, beta variability, future dividends explanatory power, and institutional ownership.

3.2.3. Controlling for the Effects of Earnings Timeliness on *FERC* and *FINC*.

Firms with less timely earnings have a weaker association between returns and current earnings but a stronger relation between returns and future earnings, and thus they may have higher future earnings response measures, all else equal. Although our industry-matching-pairs technique may mitigate these problems, some timeliness effects may remain. To control for this, we include the (industry value weighted) average current stock return and research and development (R&D) expenditures divided by total assets.

Given the myriad accounting methods, estimates, and choices (many of which are not disclosed) that affect a firm's reported earnings, it is virtually impossible to control for timeliness directly. However, Basu [1997] shows that the sign of the current annual stock return can be used as a proxy for whether the firm is releasing good news or bad news, and that the generally accepted accounting principle (GAAP) of conservatism implies that bad news is impounded into earnings in a more timely fashion than good news. Basu also shows that the earnings of bad news firms are more variable and therefore less predictable. His results imply that the sign of a firm's current annual stock return can be used as a proxy for the timeliness (and predictability) of its earnings. His results also imply that because the recognition of good news in earnings is delayed (and the earnings of good news firms are more predictable), good news firms should have a stronger relation between current returns and future earnings than bad news firms.²⁰

To see whether our industry-matching technique controls for differences in earnings timeliness, we compared the past stock returns distributions of our high and low firm-specific return variation subsamples of firms. The null hypothesis that the two distributions have identical means cannot be rejected at the 10% level (t -statistic = -1.45 , probability level = 0.15), and the null hypothesis that the two distributions are identical cannot be rejected at the 10% level by a Kolmogorov-Smirnov test (D -statistic = 0.088 , probability level = 0.25). The statistically similar returns distribution of the high and low firm-specific return variation firms suggests that our matched-pair technique controls adequately for earnings timeliness.

¹⁹ Firms' institutional ownership is reported on a quarterly basis. Therefore, we first transform it to annual numbers by averaging quarterly data and then compute industry level institutional ownership by weighting firm ownership with total assets. If the institutional ownership data are missing, we set it to zero. The institutional ownership data are from the CDA/Investnet database and they start in 1980.

²⁰ In a corporate governance context, Bushman et al. [2000] also base their timeliness metrics on good versus bad news. The use of financial accounting information in this context is reviewed in Bushman and Smith [2001].

Nevertheless, as a further check, we include the difference in the value-weighted average past stock return (r^H and r^L for the high and low return variability firms in each two-digit industry, respectively) as an additional control variable.

Timeliness should also be affected by growth. Growing firms are presumably investing in projects that will generate earnings in the future, whereas mature firms are maintaining a steady pattern of earnings. Thus, a growing firm might exhibit a stronger relation between current returns and future earnings, all else equal, than would a mature firm.

We therefore include a measure of firm growth opportunities, the industry-weighted average R&D over total assets ($R\&D^H$ and $R\&D^L$ for the high and low return variability firms in each two-digit industry, respectively) as an additional control variable.²¹ Again, the actual control is the difference in the scaled $R\&D^H$ and $R\&D^L$ variable between the high- and low- Ψ groups.

To summarize, our controls for timeliness are industry-weighted averages of current stock returns and R&D expenditures divided by total assets.

3.3 REGRESSION FRAMEWORK

Our regressions are thus of the form either:

$$\Delta FERC_{i_2,t} = \alpha + \beta \Delta \Psi_{i_2,t} + \sum_k \gamma_k Z_k + e_{i_2,t} \quad (19)$$

or

$$\Delta FINC_{i_2,t} = \alpha + \beta \Delta \Psi_{i_2,t} + \sum_k \gamma_k Z_k + e_{i_2,t}, \quad (20)$$

estimated across two-digit industries, indexed by i_2 for year t , where Z_k is a vector of the control variables discussed earlier. Table 1 lists the variables used in our main results along with their definitions.

We perform year-by-year regressions as well as a panel regression using a time-random effects model. The virtue of year-by-year regressions is that they automatically account for time-varying factors likely to affect earnings, such as changes in macroeconomic volatility, the institutional environment, accounting disclosure rules, and industry-specific real business factors (e.g., the length of investment-return cycles). Also, year-by-year regressions allow us to estimate the relation between earnings response measures and stock return volatility annually, rather than over a long window. This is important because both the quality of earnings numbers and the intensity of informed trading may change over time. Annual industry-level estimates of these variables are therefore of more use in this context than a cross-section of firm-level time series averages.

²¹ When we scale R&D by sales, the results do not change. We also used two other proxies for growth opportunities: industry-weighted market-to-book ratios and past assets growth. We obtained similar results.

TABLE 1
Definitions of Main Variables

Variable		Definition
Panel A: Future earnings response measures		
Future earnings explanatory power increase of high- Ψ firms	$FINC^H$	Increase in the coefficient of determination of the regression: $r_t = a + b_0 \Delta E_t + \sum_{\tau} b_{\tau} \Delta E_{t+\tau} + \sum_{\tau} d_{\tau} r_{t+\tau} + u_t$ ($\tau = 1, 2, 3$) relative to the base regression $r_t = a + b_0 \Delta E_t + \eta_t$ of high- Ψ firms, where r is annual return and E is earnings per share (operating income before depreciation over common shares outstanding). Each regression is performed on the cross-section of four-digit industry high- Ψ firms for each two-digit industry. Change in earnings per share, ΔE_t , is scaled by previous year price, P_{t-1} .
Future earnings explanatory power increase of low- Ψ firms	$FINC^L$	Same as $FINC^H$ using the sample of low- Ψ four-digit industry firms.
Differential explanatory power increase	$\Delta FINC$	Difference between future earnings explanatory power increases of high- and low- Ψ four-digit industry firms, $FINC^H - FINC^L$.
Future earnings return coefficient of high- Ψ firms	$FERC^H$	Sum of the coefficients on future changes in earnings $\sum_{\tau} b_{\tau}$ ($\tau = 1, 2, 3$) of high- Ψ four-digit industry firms in the regression: $r_t = a + b_0 \Delta E_t + \sum_{\tau} b_{\tau} \Delta E_{t+\tau} + \sum_{\tau} d_{\tau} r_{t+\tau} + u_t$ ($\tau = 1, 2, 3$), where r is annual return and E is earnings per share (operating income before depreciation over common shares outstanding). Each regression is performed on the cross-section of four-digit industry high- Ψ firms for each two-digit industry. Change in earnings per share, ΔE_t , is scaled by previous year price, P_{t-1} .
Future earnings return coefficient of low- Ψ firms	$FERC^L$	Same as $FERC^H$ using the sample of low- Ψ four-digit industry firms.
Differential future earnings return coefficient	$\Delta FERC$	Difference between future earnings return coefficients of high- and low- Ψ four-digit industry firms, $FERC^H - FERC^L$.
Panel B: Relative firm-specific return variation measures		
Relative firm-specific return variation of high- Ψ firms	Ψ^H	Two-digit industry aggregate of firm-specific relative to systematic return variation of high- Ψ firms. It is calculated as the ratio of residual sum of squares to total sum of squares (residual plus explained sum of squares) from the regressions of firm return on market and two-digit industry value-weighted indexes (constructed excluding own return) performed on weekly data using firms in four-digit industry. High- Ψ firms are identified from the individual regressions described earlier.
Relative firm-specific return variation of low- Ψ firms	Ψ^L	Same as Ψ^H using the sample of low- Ψ four-digit industry firms.
Differential relative firm-specific return variation	$\Delta \Psi$	The difference between Ψ of high- and low- Ψ four-digit industry firms, $\Psi^H - \Psi^L$.

TABLE 1 — *Continued*

Variable		Definition
Panel C: Control variables		
Industry structure	I	Square root of the aggregate number of firms in a two-digit industry used to construct future earnings response and return variation measures.
Size of high- Ψ firms	S^H	Log of average of inflation adjusted total assets in two-digit industry using the sample of high- Ψ four-digit industry firms.
Size of low- Ψ firms	S^L	Same as S^H using the sample of low- Ψ four-digit industry firms.
Differential firm size	ΔS	Difference between the logs of average total assets of high- and low- Ψ four-digit industry firms, $S^H - S^L$.
Diversification of high- Ψ firms	D^H	Average number of four-digit industries a firm operates in the sample of high- Ψ four-digit industry firms.
Diversification of low- Ψ firms	D^L	Same as D^H using the sample of low- Ψ four-digit industry firms.
Differential diversification	ΔD	The difference between diversification measures of high- and low- Ψ four-digit industry firms, $D^H - D^L$.
Past earnings volatility of high- Ψ firms	VE^H	Two-digit average standard deviation of past changes in earnings, ΔE_t , using the sample of high- Ψ four-digit industry firms, where E is earnings per share (operating income before depreciation over common shares outstanding). Firm-level volatility is constructed using five years of lagged data. Change in earnings, ΔE_t , is scaled by previous year price, P_{t-1} .
Past earnings volatility of low- Ψ firms	VE^L	Same as VE^H using the sample of low- Ψ four-digit industry Ψ firms.
Differential past earnings volatility	ΔVE	The difference between past earnings volatilities of high- and low- Ψ four-digit industry firms, $VE^H - VE^L$.
Volatility of beta of high- Ψ firms	$V\beta^H$	Two-digit industry standard deviation of beta constructed using the sample of high- Ψ four-digit industry firms. Volatility of beta is calculated as a simple average of the variances of monthly firms' betas belonging to a corresponding four-digit industry. Beta is defined from the regression: $(r_t - r_{f,t}) = \alpha + \beta(r_t - r_{m,t}) + k_t$ using daily data; r_t is a firm's daily return; $r_{f,t}$ is daily T-bill rate, where T-bill return is the simple daily rate that, over the number of calendar days in the month, compounds to the one-month T-bill rate from Ibbotson and Associates Inc.; and r_m is the value-weighted market return.
Volatility of beta of low- Ψ firms	$V\beta^L$	Same as $V\beta^H$ using the sample of low- Ψ four-digit industry firms.
Differential volatility of beta	$\Delta V\beta$	The difference between volatilities of beta of high- and low- Ψ four-digit industry firms, $V\beta^H - V\beta^L$.
Institutional ownership of high- Ψ firms	INS^H	Two-digit industry total assets-weighted institutional ownership constructed using the sample of high- Ψ four-digit industry firms. Annual institutional ownership is calculated as the simple average of quarterly ownership data.

TABLE 1 — *Continued*

Variable		Definition
Institutional ownership of low- Ψ firms	INS^L	Same as INS^L using the sample low- Ψ four-digit industry firms.
Differential institutional ownership	ΔINS	The difference between institutional ownership measures of high- and low- Ψ four-digit industry firms, $INS^H - INS^L$.
Research and development expenses of high- Ψ firms	$R\&D^H$	Two-digit industry total assets-weighted ratio of $R\&D$ to total assets constructed using the sample of high- Ψ four-digit industry firms.
Research and development expenses of low- Ψ firms	$R\&D^L$	Same as $R\&D^H$ using the sample of low- Ψ four-digit industry firms.
Differential research and development expenses	$\Delta R\&D$	The difference between research and development measures of high- and low- Ψ four-digit industry firms, $R\&D^H - R\&D^L$.
Past industry return of high- Ψ firms	r^H	Two-digit industry value-weighted return in $t - 1$ using the sample of high- Ψ four-digit industry firms.
Past industry return of low- Ψ firms	r^L	Same as r^H using the sample of low- Ψ four-digit industry firms.
Differential past industry return	Δr	Differential past industry return of high- and low- Ψ four-digit industry firms, $r^H - r^L$.
Future dividends explanatory power of high- Ψ firms	FD^H	The coefficient of determination of the regression: $\Delta E_t = a + b_0 \Delta DIV_t + \sum_{\tau} b_{\tau} \Delta DIV_{t+\tau} + \varepsilon_t$ ($\tau = 1, 2, 3$) of high- Ψ four-digit industry firms, where E is earnings per share (operating income before depreciation over common shares outstanding) and DIV is dividends per share plus the value of stock repurchase over common shares outstanding. Each regression is performed on the cross-section of high- Ψ four-digit industry firms for each two-digit industry.
Future dividends explanatory power of low- Ψ firms	FD^L	Same as FD^H using the sample of low- Ψ four-digit industry firms.
Differential future dividends explanatory power	ΔFD	The difference between future dividends explanatory power measures of high- Ψ and low- Ψ four-digit industry firms, $FD^H - FD^L$.

4. Empirical Findings from the Industry-Matched Pairs Study

4.1 UNIVARIATE STATISTICS

Table 2 shows simple univariate statistics for the variables described previously for 1995, the most recent year in our sample. The mean of the differential future earnings response measures, $\Delta FERC$ and $\Delta FINC$, are both positive. Also, the fraction of positive $\Delta FERC$ is 43/47 and of $\Delta FINC$ is 39/47; both are statistically significantly different from being random. Because the differences are calculated as the figure for the high relative firm-specific return variability group minus the figure for the low relative firm-specific

TABLE 2

Univariate Statistics of Main Variables: All Variables Constructed Using Industry Match-Pairing Approach, 1995 Data

Variable	Mean	Std. Dev.	Minimum	Maximum
Panel A: Future earnings response measures				
$FINC^H$	0.259	0.212	0.044	0.818
$FINC^L$	0.249	0.232	0.051	0.545
$\Delta FINC$	0.100	0.137	-0.149	0.577
$FERC^H$	0.567	0.700	-2.333	2.117
$FERC^L$	-0.175	0.638	-1.716	0.988
$\Delta FERC$	0.742	0.660	-1.843	3.294
Panel B: Relative firm-specific return variation measures				
Ψ^H	0.923	0.033	0.790	0.981
Ψ^L	0.610	0.056	0.333	0.945
$\Delta \Psi$	0.313	0.053	0.203	0.383
Panel C: Control variables				
I	5.547	5.473	2.828	11.045
S^H	4.028	0.556	3.265	5.984
S^L	4.986	0.590	3.727	6.412
ΔS	-0.958	0.579	-2.055	0.219
D^H	2.372	1.134	1.044	6.521
D^L	3.189	1.190	1.357	6.424
ΔD	-0.817	1.234	-4.117	1.098
VE^H	0.240	0.125	0.066	0.639
VE^L	0.215	0.149	0.068	1.021
ΔVE	0.025	0.106	-0.396	0.279
$V\beta^H$	1.979	0.437	1.135	3.510
$V\beta^L$	1.819	0.737	0.926	5.588
$\Delta V\beta$	0.161	0.915	-4.452	1.717
INS^H	0.237	0.130	0.035	0.543
INS^L	0.304	0.136	0.037	0.604
ΔINS	-0.067	0.130	-0.370	0.259

return variability group, these positive differences mean that the future earnings response measures for high relative firm-specific stock return variability firms are almost always higher than those for low variability firms in the same industry. This suggests that high relative firm-specific return variation is associated with greater information being impounded into stock prices.

4.2 SIMPLE CORRELATIONS

Table 3 presents correlations of the differences in our key variables between industry-matched pairs of firms grouped by high and low relative firm-specific return variability, estimated across our sample of two-digit industries for 1995. The key feature in the table is the positive and significant correlation between differential stock return variability ($\Delta \Psi$) and the differential future earnings explanatory power increase measure ($\Delta FINC$).

TABLE 2 — *Continued*

Variable	Mean	Std. Dev.	Minimum	Maximum
$R\&D^H$	1.844×10^{-4}	1.842×10^{-4}	1.150×10^{-4}	7.824×10^{-4}
$R\&D^L$	4.270×10^{-5}	5.480×10^{-5}	1.150×10^{-6}	3.016×10^{-4}
$\Delta R\&D$	1.417×10^{-4}	1.671×10^{-4}	-1.020×10^{-5}	7.487×10^{-4}
r^H	0.085	0.210	-0.243	0.862
r^L	0.090	0.186	-0.213	0.939
Δr	-0.004	0.180	-0.422	0.579
FD^H	0.191	0.219	0.001	0.902
FD^L	0.130	0.183	0.000	0.887
ΔFD	0.061	0.172	-0.265	0.672

This table reports the mean, standard deviation, minimum, and maximum of main variables constructed using the industry match-pairing approach (the methodology is described in section 3). The variables are defined as follows:

- $\Delta FERC$ = future earnings return coefficient; the sum of the coefficients on future changes in earnings $\sum_{\tau} b_{\tau}$ ($\tau = 1, 2, 3$) in the regression: $r_t = a + b_0 \Delta E_t + \sum_{\tau} b_{\tau} \Delta E_{t+\tau} + \sum_{\tau} d_{\tau} r_{t+\tau} + u_t$ ($\tau = 1, 2, 3$), where r is annual return and E is earnings per share (operating income before depreciation over common shares outstanding). The regression is performed on a four-digit industry cross-section of firms.
- $\Delta FINC$ = future earnings explanatory power increase; the increase in the coefficient of determination of the regression: $r_t = a + b_0 \Delta E_t + \sum_{\tau} b_{\tau} \Delta E_{t+\tau} + \sum_{\tau} d_{\tau} r_{t+\tau} + u_t$ ($\tau = 1, 2, 3$) relative to the base regression: $r_t = a + b_0 \Delta E_t + \eta_t$. The regression is performed on a four-digit cross-section of firms.
- $\Delta \Psi$ = relative firm-specific return variation; two-digit industry aggregate of firm-specific relative to systematic return variation. It is calculated as the ratio of residual sum of squares to total sum of squares (residual plus explained sum of squares) from the regressions of firm return on market and two-digit industry value-weighted indexes (constructed excluding own return) performed on weekly data.
- I = industry structure; the square root of the aggregate number of firms in a two-digit industry used to construct future earnings response and return variation measures.
- ΔS = size; log of average of inflation adjusted total assets in a two-digit industry.
- ΔD = diversification; average number of four-digit industries a firm operates in, two-digit industry average.
- ΔVE = past earnings volatility; two-digit average standard deviation of past changes in earnings. Firm-level volatility is constructed using five years of lagged data.
- $\Delta V\beta$ = volatility of beta; two-digit industry standard deviation of beta. Volatility of beta is calculated as a simple average of the variances of monthly firms' betas belonging to a corresponding four-digit industry.
- ΔINS = institutional ownership; two-digit industry total assets-weighted institutional ownership.
- $\Delta R\&D$ = research and development expenses; two-digit industry total assets-weighted ratio of research and expenditure expenditures to total assets.
- Δr = past industry return; two-digit industry value-weighted return in $t - 1$.
- ΔFD = future dividends explanatory power; the coefficient of determination of the regression: $\Delta E_t = a + b_0 \Delta DIV_t + \sum_{\tau} b_{\tau} \Delta DIV_{t+\tau} + \varepsilon_t$ ($\tau = 1, 2, 3$), where DIV is dividends per share plus the value of stock repurchase over common shares outstanding. The regression is performed on a four-digit cross-section of firms.

The match-pairing approach is conducted as follows: (1) we identify two high- Ψ and two low- Ψ firms in each four-digit SIC industry within a two-digit SIC industry; (2) we use those firms to calculate the corresponding H (based on the sample of high- Ψ firms) and L (based on the sample of low- Ψ firms) measures; and (3) we take the difference between the H and L variables to calculate the corresponding differential, Δ , measures. The sample consists of 47 two-digit industries in 1995 constructed using 1,446 firms for all variables. Financial and utilities industries (SIC 6000–6999 and 4900–4999, respectively) are omitted. The fraction of positive ΔINF is 0.83; the fraction of positive ΔERC is 0.91.

This result suggests that higher relative firm-specific return variability is correlated with more information-laden stock prices, not with noisier stock prices.²²

²² Graphs of $\Delta FINC$ against $\Delta \Psi$ and $\Delta FERC$ against $\Delta \Psi$ both show a strong and positive relation. We do not present the graphs to save space.

TABLE 3

Simple Correlation Coefficients: All Variables Constructed Using Industry Match-Pairing Approach, 1995 Data

Panel A: Correlation matrix of future earnings response measures with relative firm-specific return variation, and control variables										
ΔERC	$\Delta \Psi$	ΔI	ΔS	ΔD	ΔVE	$\Delta V\beta$	ΔINS	$\Delta R\&D$	Δr	ΔFD
0.333 (0.03)	0.317 (0.03)	0.047 (0.75)	-0.240 (0.10)	-0.120 (0.42)	0.019 (0.90)	-0.181 (0.22)	-0.07 (0.66)	0.245 (0.10)	-0.009 (0.95)	-0.016 (0.91)
		0.180 (0.23)	-0.054 (0.72)	-0.157 (0.29)	-0.092 (0.54)	0.011 (0.94)	-0.087 (0.56)	-0.061 (0.68)	0.259 (0.08)	0.026 (0.86)
										-0.087 (0.56)
Panel B: Correlation matrix of control variables with relative firm-specific return variation, and each other										
		ΔI	ΔS	ΔD	ΔVE	$\Delta V\beta$	ΔINS	$\Delta R\&D$	Δr	ΔFD
			0.591 (0.00)	-0.370 (0.01)	0.085 (0.57)	-0.030 (0.84)	0.3×10^{-3} (0.99)	-0.067 (0.66)	-0.011 (0.94)	0.104 (0.49)
				-0.443 (0.00)	-0.105 (0.48)	0.036 (0.81)	0.108 (0.47)	-0.178 (0.23)	0.091 (0.54)	-0.099 (0.51)
					0.201 (0.17)	0.043 (0.78)	-0.027 (0.86)	0.110 (0.46)	-0.255 (0.08)	0.070 (0.63)
						0.261 (0.08)	0.168 (0.26)	0.446 (0.00)	-0.276 (0.06)	0.074 (0.64)
							0.046 (0.76)	0.192 (0.20)	0.070 (0.66)	0.011 (0.94)
								-0.106 (0.48)	-0.209 (0.16)	-0.062 (0.68)
									-0.047 (0.76)	-0.089 (0.55)
										0.047 (0.76)
									-0.136 (0.25)	-0.044 (0.77)
										-0.270 (0.07)

The variables are defined as follows:

- $\Delta FERC$ = future earnings return coefficient; the sum of the coefficients on future changes in earnings $\sum_{\tau} b_{\tau}$ ($\tau = 1, 2, 3$) in the regression: $r_t = a + b_0 \Delta E_t + \sum_{\tau} b_{\tau} \Delta E_{t+\tau} + \sum_{\tau} d_{\tau} r_{t+\tau} + u_t$ ($\tau = 1, 2, 3$), where r is annual return and E is earnings per share (operating income before depreciation over common shares outstanding). The regression is performed on a four-digit industry cross-section of firms.
- $\Delta FINC$ = future earnings explanatory power increase; the increase in the coefficient of determination of the regression: $r_t = a + b_0 \Delta E_t + \sum_{\tau} b_{\tau} \Delta E_{t+\tau} + \sum_{\tau} d_{\tau} r_{t+\tau} + u_t$ ($\tau = 1, 2, 3$) relative to the base regression: $r_t = a + b_0 \Delta E_t + \eta_t$. The regression is performed on a four-digit cross-section of firms.
- $\Delta \Psi$ = relative firm-specific return variation; two-digit industry aggregate of firm-specific relative to systematic return variation. It is calculated as the ratio of residual sum of squares to total sum of squares (residual plus explained sum of squares) from the regressions of firm return on market and two-digit industry value-weighted indexes (constructed excluding own return) performed on weekly data.
- I = industry structure; the square root of the aggregate number of firms in a two-digit industry used to construct future earnings response and return variation measures.
- ΔS = size; log of average of inflation adjusted total assets in a two-digit industry.
- ΔD = diversification; average number of four-digit industries a firm operates in, two-digit industry average.
- ΔVE = past earnings volatility; two-digit average standard deviation of past changes in earnings. Firm-level volatility is constructed using five years of lagged data.
- $\Delta V\beta$ = volatility of beta; two-digit industry standard deviation of beta. Volatility of beta is calculated as a simple average of the variances of monthly firms' betas belonging to a corresponding four-digit industry.
- ΔINS = institutional ownership; two-digit industry total assets-weighted institutional ownership.
- $\Delta R\&D$ = research and development expenses; two-digit industry total assets-weighted ratio of research and expenditure expenditures to total assets.
- Δr = past industry return; two-digit industry value-weighted return in $t - 1$.
- ΔFD = future dividends explanatory power; the coefficient of determination of the regression: $\Delta E_t = a + b_0 \Delta DIV_t + \sum_{\tau} b_{\tau} \Delta DIV_{t+\tau} + \varepsilon_t$ ($\tau = 1, 2, 3$), where DIV is dividends per share plus the value of stock repurchase over common shares outstanding. The regression is performed on a four-digit cross-section of firms.

The match-pairing approach is conducted as follows: (1) we identify two high- Ψ and two low- Ψ firms in each four-digit SIC industry within a two-digit SIC industry; (2) we use those firms to calculate the corresponding H (based on the sample of high- Ψ firms) and L (based on the sample of low- Ψ firms) measures; and (3) we take the difference between the H and L variables to calculate the corresponding differential, Δ , measures. The sample consists of 47 two-digit industries in 1995 constructed using 1,446 firms for all variables. Financial and utilities industries (SIC 6000-6999 and 4900-4999, respectively) are omitted. Numbers in parentheses are probability levels at which the null hypothesis of zero correlation is rejected. Coefficients significant at 10% or better are in boldface.

The correlations between the control variables and our focal variables, the informativeness measures and relative firm-specific return variation, are generally not stable and significant (except for size and R&D). This suggests that our matching-pairs methodology successfully controls for factors affecting *FERC* and *FINC*.

4.3 REGRESSIONS

Table 4 shows results of regressions (19) and (20) using 1995 two-digit industry observations. We regress our differential earnings response, measured using either $\Delta FERC_{i2,t}$ or $\Delta FINC_{i2,t}$, on differential relative firm-specific stock return variation, $\Delta \Psi_{i2,t}$, and some or all of our control variables. To safeguard against heteroskedasticity due to missing variables and general misspecification problems, we use Newey-West standard errors to calculate two-tailed significance levels. We report the following combinations: (1) $\Delta \Psi$ with the first set of variables that controls for problems in variable construction, (2) adding the controls for factors that have an intrinsic effect on informativeness, and (3) adding the controls for the timeliness effects. $\Delta \Psi$ is positively and significantly related to both of future earnings response measures in all specifications.

We also pool the years of annual data from 1983 to 1995 and perform a time-random effects panel regression model. The results, reported in table 5, are similar to those reported in table 4. To the extent that the panel regressions use data more extensively, and if there are no severe misspecification problems, the panel regressions are more efficient and the high statistical significance of the independent variables is meaningful.²³

4.4 ROBUSTNESS

The results in tables 4 and 5 are highly robust. Reasonable specification changes and alternative statistical procedures generate qualitatively similar results, by which we mean that the pattern of signs and statistical significance shown for the differential relative firm-specific stock return variation measure, $\Delta \Psi$, in tables 4 and 5 are preserved. Our robustness examinations are as follows.

4.4.1. Outliers. We test for outliers in two ways. Hadi's [1992, 1994] method, with a 5% cutoff, detects no outliers. Likewise, using critical values of 1, Cook's *D*-statistics indicate no significant outlier problems.

²³ We start in 1983 because that is the year when reliable firm-level business diversification data are available. We also broke the panel into two periods, 1983 through 1987 and 1988 through 1995, and repeated the time-random effects panel regressions. Some may argue that 1987 was an exceptional year because of the high volatility in October of that year. Our results remain whether we include or exclude 1987. The regression coefficient for $\Delta \Psi$ remains highly statistically significant and positive in the 1988-to-1995 panel. In the 1983-to-1987 panel, the regression coefficient for $\Delta \Psi$ remains positive but is mostly insignificant. We do not report these results to save space; they are available on request.

TABLE 4

Ordinary Least Squares Regressions of Future Earnings Response Measures on Relative Firm-Specific Return Variation and Control Variables: All Variable Constructed Using Industry Match-Pairing Approach, 1995 Data

This table reports the results of the following regressions:

$$\Delta FINC_i = \alpha + \beta \Delta \Psi_i + \gamma_1 I_i + \gamma_2 \Delta S_i + \gamma_3 \Delta D_i + e_i \quad (4.1)$$

$$\Delta FINC_i = \alpha + \beta \Delta \Psi_i + \gamma_1 I_i + \gamma_2 \Delta S_i + \gamma_3 \Delta D_i + \gamma_4 \Delta VE_i + \gamma_5 \Delta V\beta_i + \gamma_6 \Delta INS_i + e_i \quad (4.2)$$

$$\Delta FINC_i = \alpha + \beta \Delta \Psi_i + \gamma_1 I_i + \gamma_2 \Delta S_i + \gamma_3 \Delta D_i + \gamma_4 \Delta VE_i + \gamma_5 \Delta V\beta_i + \gamma_6 \Delta INS_i + \gamma_7 \Delta R\&D_i + \gamma_8 \Delta r_i + e_i \quad (4.3)$$

$$\Delta FINC_i = \alpha + \beta \Delta \Psi_i + \gamma_1 I_i + \gamma_2 \Delta S_i + \gamma_3 \Delta D_i + \gamma_4 \Delta VE_i + \gamma_5 \Delta V\beta_i + \gamma_6 \Delta INS_i + \gamma_7 \Delta R\&D_i + \gamma_8 \Delta r_i + \gamma_9 \Delta FD_i + e_i \quad (4.4)$$

and

$$\Delta FERC_i = \alpha + \beta \Delta \Psi_i + \gamma_1 I_i + \gamma_2 \Delta S_i + \gamma_3 \Delta D_i + e_i \quad (4.5)$$

$$\Delta FERC_i = \alpha + \beta \Delta \Psi_i + \gamma_1 I_i + \gamma_2 \Delta S_i + \gamma_3 \Delta D_i + \gamma_4 \Delta VE_i + \gamma_5 \Delta V\beta_i + \gamma_6 \Delta INS_i + e_i \quad (4.6)$$

$$\Delta FERC_i = \alpha + \beta \Delta \Psi_i + \gamma_1 I_i + \gamma_2 \Delta S_i + \gamma_3 \Delta D_i + \gamma_4 \Delta VE_i + \gamma_5 \Delta V\beta_i + \gamma_6 \Delta INS_i + \gamma_7 \Delta R\&D_i + \gamma_8 \Delta r_i + e_i \quad (4.7)$$

$$\Delta FERC_i = \alpha + \beta \Delta \Psi_i + \gamma_1 I_i + \gamma_2 \Delta S_i + \gamma_3 \Delta D_i + \gamma_4 \Delta VE_i + \gamma_5 \Delta V\beta_i + \gamma_6 \Delta INS_i + \gamma_7 \Delta R\&D_i + \gamma_8 \Delta r_i + \gamma_9 \Delta FD_i + e_i, \quad (4.8)$$

where i indexes two-digit industries.

Dependent Variable	Differential Explanatory Power Increase, $\Delta FINC$				Differential Future Earnings Return Coefficient, $\Delta FERC$			
	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8
Specification								
$\Delta \Psi$	0.844 (0.10)	0.850 (0.10)	0.900 (0.14)	1.152 (0.04)	5.568 (0.07)	5.461 (0.07)	5.739 (0.07)	6.668 (0.01)
I	-0.021 (0.09)	-0.021 (0.10)	-0.022 (0.15)	-0.027 (0.05)	-0.095 (0.07)	-0.093 (0.12)	-0.096 (0.12)	-0.114 (0.07)
ΔS	-0.038 (0.33)	-0.039 (0.36)	-0.025 (0.54)	-0.020 (0.63)	-0.208 (0.15)	-0.216 (0.15)	-0.163 (0.28)	-0.147 (0.46)
ΔD	-0.014 (0.42)	-0.013 (0.55)	-0.007 (0.75)	-0.010 (0.65)	-0.082 (0.33)	-0.072 (0.48)	-0.045 (0.63)	-0.056 (0.58)
ΔVE	-	0.101 (0.61)	0.075 (0.59)	0.039 (0.86)	-	0.607 (0.26)	0.370 (0.54)	0.237 (0.82)
$\Delta V\beta$	-	-0.001 (0.78)	2×10^{-4} (0.98)	3×10^{-4} (0.95)	-	-0.018 (0.46)	-0.014 (0.54)	-0.013 (0.51)
ΔINS	-	-0.055 (0.77)	-0.063 (0.75)	-0.052 (0.78)	-	-0.225 (0.80)	-0.282 (0.75)	-0.240 (0.78)
$\Delta R\&D$	-	-	2.04×10^2 (0.04)	1.94×10^2 (0.16)	-	-	7.36×10^2 (0.14)	7.01×10^2 (0.27)
Δr	-	-	0.019 (0.87)	-0.047 (0.75)	-	-	-0.104 (0.82)	-0.349 (0.61)

4.4.2. Industry Population Size. The difference between the two firms with the highest relative firm-specific stock return variation and the two with the lowest relative firm-specific stock return variation is likely to be greater in industries containing more firms. To ensure that our findings are not an artifact of this effect, we add the average number of firms in the four-digit industries contained in each two-digit industry as an additional control

TABLE 4—Continued

Dependent Variable	Differential Explanatory Power Increase, $\Delta FINC$				Differential Future Earnings Return Coefficient, $\Delta FERC$			
Specification	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8
ΔFD	—	—	—	−0.165 (0.23)	—	—	—	−0.608 (0.34)
F-statistic	5.990 (0.12)	6.770 (0.10)	6.960 (0.10)	6.920 (0.15)	4.150 (0.13)	4.770 (0.16)	4.850 (0.17)	4.270 (0.16)
R^2	0.113	0.121	0.172	0.204	0.060	0.172	0.189	0.216
Number of observations	47							

The variables are defined as follows:

$\Delta FERC$ = future earnings return coefficient; the sum of the coefficients on future changes in earnings $\sum_{\tau} b_{\tau}$ ($\tau = 1, 2, 3$) in the regression: $r_t = a + b_0 \Delta E_t + \sum_{\tau} b_{\tau} \Delta E_{t+\tau} + \sum_{\tau} d_{\tau} r_{t+\tau} + u_t$ ($\tau = 1, 2, 3$), where r is annual return and E is earnings per share (operating income before depreciation over common shares outstanding). The regression is performed on a four-digit industry cross-section of firms.

$\Delta FINC$ = future earnings explanatory power increase; the increase in the coefficient of determination of the regression: $r_t = a + b_0 \Delta E_t + \sum_{\tau} b_{\tau} \Delta E_{t+\tau} + \sum_{\tau} d_{\tau} r_{t+\tau} + u_t$ ($\tau = 1, 2, 3$) relative to the base regression: $r_t = a + b_0 \Delta E_t + \eta_t$. The regression is performed on a four-digit cross-section of firms.

$\Delta \Psi$ = relative firm-specific return variation; two-digit industry aggregate of firm-specific relative to systematic return variation. It is calculated as the ratio of residual sum of squares to total sum of squares (residual plus explained sum of squares) from the regressions of firm return on market and two-digit industry value-weighted indexes (constructed excluding own return) performed on weekly data.

I = industry structure; the square root of the aggregate number of firms in a two-digit industry used to construct future earnings response and return variation measures.

ΔS = size; log of average of inflation adjusted total assets in a two-digit industry.

ΔD = diversification; average number of four-digit industries a firm operates in, two-digit industry average.

ΔVE = past earnings volatility; two-digit average standard deviation of past changes in earnings. Firm-level volatility is constructed using five years of lagged data.

$\Delta V\beta$ = volatility of beta; two-digit industry standard deviation of beta. Volatility of beta is calculated as a simple average of the variances of monthly firms' betas belonging to a corresponding four-digit industry.

ΔINS = institutional ownership; two-digit industry total assets-weighted institutional ownership.

$\Delta R\&D$ = research and development expenses; two-digit industry total assets-weighted ratio of research and expenditure expenditures to total assets.

Δr = past industry return; two-digit industry value-weighted return in $t - 1$.

ΔFD = future dividends explanatory power; the coefficient of determination of the regression: $\Delta E_t = a + b_0 \Delta DIV_t + \sum_{\tau} b_{\tau} \Delta DIV_{t+\tau} + \varepsilon_t$ ($\tau = 1, 2, 3$), where DIV is dividends per share plus the value of stock repurchase over common shares outstanding. The regression is performed on a four-digit cross-section of firms.

The match-pairing approach is conducted as follows: (1) we identify two high- Ψ and two low- Ψ firms in each four-digit SIC industry within a two-digit SIC industry; (2) we use those firms to calculate the corresponding H (based on the sample of high- Ψ firms) and L (based on the sample of low- Ψ firms) measures; and (3) we take the difference between the H and L variables to calculate the corresponding differential, Δ , measures. The sample consists of 47 two-digit industries in 1995 constructed using 1,446 firms for all variables. Financial and utilities industries (SIC 6000–6999 and 4900–4999, respectively) are omitted. Numbers in parentheses are probability levels based on Newey-West standard errors at which the null hypothesis of zero correlation is rejected. Coefficients significant at 10% or better (based on two-tailed test) are in boldface.

variable. This generates qualitatively similar results to those shown, as does adding the total number of firms in each two-digit industry as an additional control. We conclude that differences in industry population size are not generating our findings.

4.4.3. *Length of Forecast Horizon and the Specification in Estimating Future Earnings Response Measures.* Our estimation of future earnings response variables is based on regressing current stock returns on three years of future earnings changes as in equation (4). This is based on the recommendations of Kothari and Sloan [1992] and Collins et al. [1994]. Including one more or one less

TABLE 5

Time-Random Effects Panel Regressions of Future Earnings Response Measures on Differential Relative Firm-Specific Return Variation and Control Variables: All Variables Constructed Using Industry Match-Pairing Approach

This table reports the results of the following regressions:

$$\Delta FINC_{i,t} = \alpha + \beta \Delta \Psi_{i,t} + \gamma_1 I_{i,t} + \gamma_2 \Delta S_{i,t} + \gamma_3 \Delta D_{i,t} + e_{i,t} \quad (5.1)$$

$$\Delta FINC_{i,t} = \alpha + \beta \Delta \Psi_{i,t} + \gamma_1 I_{i,t} + \gamma_2 \Delta S_{i,t} + \gamma_3 \Delta D_{i,t} + \gamma_4 \Delta VE_{i,t} + \gamma_5 \Delta V\beta_{i,t} + \gamma_6 \Delta INS_{i,t} + e_{i,t} \quad (5.2)$$

$$\Delta FINC_{i,t} = \alpha + \beta \Delta \Psi_{i,t} + \gamma_1 I_{i,t} + \gamma_2 \Delta S_{i,t} + \gamma_3 \Delta D_{i,t} + \gamma_4 \Delta VE_{i,t} + \gamma_5 \Delta V\beta_{i,t} + \gamma_6 \Delta INS_{i,t} + \gamma_7 \Delta R\&D_{i,t} + \gamma_8 \Delta r_{i,t} + e_{i,t} \quad (5.3)$$

$$\Delta FINC_{i,t} = \alpha + \beta \Delta \Psi_{i,t} + \gamma_1 I_{i,t} + \gamma_2 \Delta S_{i,t} + \gamma_3 \Delta D_{i,t} + \gamma_4 \Delta VE_{i,t} + \gamma_5 \Delta V\beta_{i,t} + \gamma_6 \Delta INS_{i,t} + \gamma_7 \Delta R\&D_{i,t} + \gamma_8 \Delta r_{i,t} + \gamma_9 \Delta FD_{i,t} + e_{i,t} \quad (5.4)$$

and

$$\Delta FERC_{i,t} = \alpha + \beta \Delta \Psi_{i,t} + \gamma_1 I_{i,t} + \gamma_2 \Delta S_{i,t} + \gamma_3 \Delta D_{i,t} + e_{i,t} \quad (5.5)$$

$$\Delta FERC_{i,t} = \alpha + \beta \Delta \Psi_{i,t} + \gamma_1 I_{i,t} + \gamma_2 \Delta S_{i,t} + \gamma_3 \Delta D_{i,t} + \gamma_4 \Delta VE_{i,t} + \gamma_5 \Delta V\beta_{i,t} + \gamma_6 \Delta INS_{i,t} + e_{i,t} \quad (5.6)$$

$$\Delta FERC_{i,t} = \alpha + \beta \Delta \Psi_{i,t} + \gamma_1 I_{i,t} + \gamma_2 \Delta S_{i,t} + \gamma_3 \Delta D_{i,t} + \gamma_4 \Delta VE_{i,t} + \gamma_5 \Delta V\beta_{i,t} + \gamma_6 \Delta INS_{i,t} + \gamma_7 \Delta R\&D_{i,t} + \gamma_8 \Delta r_{i,t} + e_{i,t} \quad (5.7)$$

$$\Delta FERC_{i,t} = \alpha + \beta \Delta \Psi_{i,t} + \gamma_1 I_{i,t} + \gamma_2 \Delta S_{i,t} + \gamma_3 \Delta D_{i,t} + \gamma_4 \Delta VE_{i,t} + \gamma_5 \Delta V\beta_{i,t} + \gamma_6 \Delta INS_{i,t} + \gamma_7 \Delta R\&D_{i,t} + \gamma_8 \Delta r_{i,t} + \gamma_9 \Delta FD_{i,t} + e_{i,t}, \quad (5.8)$$

where i indexes two-digit industries and t indexes years. $E[e_{i,t}] = 0$, $E[e_{i,t} e_{j,t}] \neq 0 \forall i, j$, E is the expectation operator, and α is a constant (coefficient is not reported).

Dependent Variable	Differential Explanatory Power Increase, $\Delta FINC$				Differential Future Earnings Return Coefficient, $\Delta FERC$			
	5.1	5.2	5.3	5.4	5.5	5.6	5.7	5.8
$\Delta \Psi$	1.505 (0.00)	1.109 (0.01)	1.942 (0.01)	1.778 (0.03)	7.965 (0.00)	7.296 (0.00)	8.466 (0.00)	8.386 (0.00)
I	-0.026 (0.09)	-0.017 (0.31)	-0.014 (0.43)	-0.010 (0.56)	-0.151 (0.03)	-0.143 (0.05)	-0.091 (0.26)	-0.089 (0.27)
ΔS	0.031 (0.13)	0.015 (0.48)	0.007 (0.73)	0.003 (0.90)	0.268 (0.00)	0.247 (0.01)	0.122 (0.21)	0.124 (0.21)
ΔD	-0.022 (0.02)	-0.020 (0.06)	-0.019 (0.09)	-0.018 (0.10)	-0.098 (0.02)	-0.099 (0.03)	-0.095 (0.06)	-0.095 (0.06)
ΔVE	- (0.55)	3×10^{-4} (0.55)	2×10^{-4} (0.62)	2×10^{-4} (0.57)	- (0.77)	3×10^{-4} (0.77)	7×10^{-5} (0.78)	8×10^{-5} (0.75)
$\Delta V\beta$	- (0.93)	2×10^{-4} (0.93)	2×10^{-4} (0.73)	2×10^{-4} (0.78)	- (0.99)	2×10^{-4} (0.99)	-0.001 (0.84)	-0.001 (0.87)
ΔINS	- (0.45)	0.070 (0.45)	0.076 (0.42)	0.079 (0.41)	- (0.63)	-0.189 (0.63)	-0.077 (0.86)	-0.088 (0.84)

year of future earnings changes in equation (4) does not qualitatively affect our results. Neither does using levels rather than changes. Finally, including both changes and levels of future earnings on the right-hand side of equation (4) causes no qualitative changes in our results.

TABLE 5 — Continued

Dependent Variable	Differential Explanatory Power Increase, $\Delta FINC$				Differential Future Earnings Return Coefficient, $\Delta FERC$			
	5.1	5.2	5.3	5.4	5.5	5.6	5.7	5.8
Specification								
$\Delta R\&D$	—	—	0.112 (0.49)	0.114 (0.50)	—	—	0.292 (0.70)	0.285 (0.71)
Δr	—	—	−0.001 (0.78)	−0.001 (0.72)	—	—	−0.001 (0.97)	−0.001 (0.97)
ΔFD	—	—	—	−0.055 (0.24)	—	—	—	−0.096 (0.65)
Chi-squared statistic	140.040 (0.00)	111.880 (0.00)	103.230 (0.00)	99.390 (0.00)	146.440 (0.00)	133.530 (0.00)	90.670 (0.00)	90.500 (0.00)
R^2	0.323	0.330	0.333	0.338	0.312	0.313	0.316	0.317
Number of observations	491							

The variables are defined as follows:

$\Delta FERC$ = future earnings return coefficient; the sum of the coefficients on future changes in earnings $\sum_{\tau} b_{\tau}$ ($\tau = 1, 2, 3$) in the regression: $r_t = a + b_0 \Delta E_t + \sum_{\tau} b_{\tau} \Delta E_{t+\tau} + \sum_{\tau} d_{\tau} r_{t+\tau} + u_t$ ($\tau = 1, 2, 3$), where r is annual return and E is earnings per share (operating income before depreciation over common shares outstanding). The regression is performed on a four-digit industry cross-section of firms.

$\Delta FINC$ = future earnings explanatory power increase; the increase in the coefficient of determination of the regression: $r_t = a + b_0 \Delta E_t + \sum_{\tau} b_{\tau} \Delta E_{t+\tau} + \sum_{\tau} d_{\tau} r_{t+\tau} + u_t$ ($\tau = 1, 2, 3$) relative to the base regression: $r_t = a + b_0 \Delta E_t + \eta_t$. The regression is performed on a four-digit cross-section of firms.

$\Delta \Psi$ = relative firm-specific return variation; two-digit industry aggregate of firm-specific relative to systematic return variation. It is calculated as the ratio of residual sum of squares to total sum of squares (residual plus explained sum of squares) from the regressions of firm return on market and two-digit industry value-weighted indexes (constructed excluding own return) performed on weekly data.

I = industry structure; the square root of the aggregate number of firms in a two-digit industry used to construct future earnings response and return variation measures.

ΔS = size; log of average of inflation adjusted total assets in a two-digit industry.

ΔD = diversification; average number of four-digit industries a firm operates in, two-digit industry average.

ΔVE = past earnings volatility; two-digit average standard deviation of past changes in earnings. Firm-level volatility is constructed using five years of lagged data.

$\Delta V\beta$ = volatility of beta; two-digit industry standard deviation of beta. Volatility of beta is calculated as a simple average of the variances of monthly firms' betas belonging to a corresponding four-digit industry.

ΔINS = institutional ownership; two-digit industry total assets-weighted institutional ownership.

$\Delta R\&D$ = research and development expenses; two-digit industry total assets-weighted ratio of research and expenditure expenditures to total assets.

Δr = past industry return; two-digit industry value-weighted return in $t - 1$.

ΔFD = future dividends explanatory power; the coefficient of determination of the regression: $\Delta E_t = a + b_0 \Delta DIV_t + \sum_{\tau} b_{\tau} \Delta DIV_{t+\tau} + \varepsilon_t$ ($\tau = 1, 2, 3$), where DIV is dividends per share plus the value of stock repurchase over common shares outstanding. The regression is performed on a four-digit cross-section of firms.

The match-pairing approach is conducted as follows: (1) we identify two high- Ψ and two low- Ψ firms in each four-digit SIC industry within a two-digit SIC industry; (2) we use those firms to calculate the corresponding H (based on the sample of high- Ψ firms) and L (based on the sample of low- Ψ firms) measures; and (3) we take the difference between the H and L variables to calculate the corresponding differential, Δ , measures. All regressions include time-random effects and the regressions are estimated by generalized least squares. Financial and utilities industries (SIC 6000–6999 and 4900–4999, respectively) are omitted. Coefficients significant at 10% or better (based on two-tailed test) are in boldface. Numbers in parentheses are probability levels at which the null hypothesis of a zero coefficient can be rejected. The sample consists of 491 two-digit industry-year observations constructed using 11,338 firms spanning 1983 through 1995. The results using the 1980-to-1995 sample (without diversification variable, ΔD , which is available from 1983 through 1995) and the 1975-to-1995 sample (without diversification variable, ΔD , and institutional ownership variable, ΔINS , which is available from 1980 through 1995) are qualitatively similar.

4.4.4. Pure-Play Firms. We are concerned that our control for diversification might not fully nullify the impact of firm diversification, which tends to reduce both the future earnings response measures, $FERC$ and $FINC$, and the relative firm-specific return variation measure, Ψ . Note, however, that the negative impact of diversification on future earnings response measures and relative firm-specific stock return variation is not strictly a variable

construction problem; it is also an economic problem because management may actually want to diversify to affect stock price informativeness. Completely eliminating diversified firms may therefore amount to throwing out information useful to our understanding of stock price information content.

Nevertheless, we drop from our 1995 sample all firms that report segments outside of their reported main two-digit industry segment. We lose 797 firms (out of 3,120 firms and 14 out of 47 two-digit industries because of inadequate sample sizes for estimating *FERC* and *FINC*). We then repeat the procedure reported in section 3 to perform the regressions reported in tables 4 and 5. Our results are qualitatively unchanged: $\Delta\Psi$ attracts a highly statistically significant positive regression coefficient.²⁴ We admit, however, the number of industries lost is significant and our regressions have only limited degrees of freedom.

4.4.5. Fiscal and Calendar Year-Ends. We match our earnings response measures, which given our data sources are necessarily estimated as of fiscal year-ends, to our return variability estimates, which are measured over calendar years to allow comparability. To evaluate the behavior of all firms' stock returns in an identical macroeconomic environment, we need to have the same calendar window in generating all of our $\Delta\Psi_{i_2,t}$ measures. We therefore estimate return variability from January 1 to December 31 because this is the most common firm fiscal year.²⁵ Clearly, some of our sample firms have mismatched fiscal-year and calendar-year windows.²⁶

Such asynchronous timing clearly adds noise to our estimation of the relation between earnings responses and relative firm-specific stock return variation. However, this need not create a systematic bias. We examine the distribution of fiscal year-ends for our sets of high and low return variability firms, H_{i_2} and L_{i_2} , respectively. A Kolmogorov-Smirnov test rejects the hypothesis that the two distributions are different at the 10% level.²⁷ Furthermore, the hypothesis that the probability of a firm's fiscal year ending on December 31 is different for firms in H_{i_2} and firms in L_{i_2} is also rejected at the 10% level. These tests lead us to conclude that asynchronous fiscal and calendar years may add noise to our differential variables but that they probably do not bias our tests.

²⁴ These unreported results are available on request.

²⁵ For example, in 1995, 63% of firms in our Compustat sample have a December 31 fiscal year-end.

²⁶ We do not drop non-December fiscal-year firms because this causes us to lose approximately 1,380 of our 3,120 firms. Many four-digit industries end up containing too few firms, and we then lose many two-digit industries: 17 are lost, leaving only 30. We therefore retain all observations and accept asynchronicity in fiscal and calendar year-ends. However, in the industry-level analyses reported in section 5, we are able to conduct our robustness check by dropping non-December fiscal-year firms.

²⁷ The *D*-statistic is 0.134, corresponding to a *p*-value of 0.29; therefore, it does not meet standard criteria for statistical significance.

5. Cross-Industry Tests

A criticism of our matching-pairs technique is that we pool firms in different four-digit industries to estimate future earnings response measures, the *FERC* and *FINC* in equations (5) and (6), respectively. This approach might control for industry-specific impacts on *FERC* and *FINC* poorly if the four-digit industries within a two-digit industry are heterogeneous. To ascertain the robustness of our empirical results, we also estimate *FERC* and *FINC* for all firms in a given four-digit SIC industry, i_4 , as stipulated in equations (5) and (6), and regress these industry average future earnings response measures on industry (weighted) average firm-specific stock return variation measures, $\Psi_{i_4,t}$, defined as

$$\Psi_{i_4,t} \equiv \frac{\sum_{j \in i_4} \sum_{w \in t} \varepsilon_{j,w,t}^2}{\sum_{j \in i_4} \sum_{w \in t} (r_{j,w,t} - \bar{r}_{j,w,t})^2} \quad (21)$$

and our control variables. Note that (21) is analogous to the construction of $\Psi_{i_2,t}^H$ and $\Psi_{i_2,t}^L$ in equations (9) and (10).

The list of control variables required here might be longer than that used in tables 4 and 5 because we are no longer controlling for industry differences by using matched pairs. We add to the control variables used previously, *property, plant and equipment (PP&E) over total assets* (a measure of capital intensity) and *PP&E over current depreciation* (a measure of the average useful life span of the industry's fixed capital) because these variables differ greatly across industries and are related to earnings timeliness (Beaver and Ryan [1993]) and volatility. The economic content and behavior of these variables are similar to the earnings volatility variable. Because adding them does not change our results, we suppress them to reduce collinearity, to improve efficiency, and to keep the current empirical specification directly comparable to those reported earlier. Our base year remains 1995 to be consistent with results reported earlier. Our 1995 sample includes 1,888 firms in 86 four-digit industries.

To save space, we do not report the univariate statistics and correlations of our focal variables and controls. In general, these cross-industry correlations are more significant than the corresponding table 3 but are broadly consistent in sign. In particular, *FERC* and *FINC* are positively and significantly correlated with Ψ .²⁸

Table 6 displays 1995 data regressions of industry-average future earnings response measures (*FERC* and *FINC*) on industry-average relative firm-specific stock return variation, $\Psi_{i_4,t}$, and the control variables discussed previously. As in the previous set of regressions, we use Newey-West standard errors to calculate the t -statistics to safeguard against heteroskedasticity due to missing variables and general misspecification problems. Also, to control

²⁸ Graphs of *FINC* versus Ψ and *FERC* versus Ψ using 1995 data show a clear positive relation. We do not show the graphs to save space.

TABLE 6

Ordinary Least Squares Regressions of Future Earnings Response Measures on Relative Firm-Specific Return Variation and Control Variables: All Variables Constructed Using Four-Digit Cross-Industry Approach, 1995 Data

This table reports the results of the following regressions:

$$FINC_i = d_i + \beta\Psi_i + \gamma_1 I_i + \gamma_2 S_i + \gamma_3 D_i + e_i \quad (6.1)$$

$$FINC_i = d_i + \beta\Psi_i + \gamma_1 I_i + \gamma_2 S_i + \gamma_3 D_i + \gamma_4 VE_i + \gamma_5 V\beta_i + \gamma_6 INS_i + e_i \quad (6.2)$$

$$FINC_i = d_i + \beta\Psi_i + \gamma_1 I_i + \gamma_2 S_i + \gamma_3 D_i + \gamma_4 VE_i + \gamma_5 V\beta_i + \gamma_6 INS + \gamma_7 R\&D_i + \gamma_8 r_i + e_i \quad (6.3)$$

$$FINC_i = d_i + \beta\Psi_i + \gamma_1 I_i + \gamma_2 S_i + \gamma_3 D_i + \gamma_4 VE_i + \gamma_5 V\beta_i + \gamma_6 INS_i + \gamma_7 R\&D_i + \gamma_8 r_i + \gamma_9 FD_i + e_i \quad (6.4)$$

and

$$FERC_i = d_i + \beta\Psi_i + \gamma_1 I_i + \gamma_2 S_i + \gamma_3 D_i + e_i \quad (6.5)$$

$$FERC_i = d_i + \beta\Psi_i + \gamma_1 I_i + \gamma_2 S_i + \gamma_3 D_i + \gamma_4 VE_i + \gamma_5 V\beta_i + \gamma_6 INS_i + e_i \quad (6.6)$$

$$FERC_i = d_i + \beta\Psi_i + \gamma_1 I_i + \gamma_2 S_i + \gamma_3 D_i + \gamma_4 VE_i + \gamma_5 V\beta_i + \gamma_6 INS_i + \gamma_7 R\&D_i + \gamma_8 r_i + e_i \quad (6.7)$$

$$FERC_i = d_i + \beta\Psi_i + \gamma_1 I_i + \gamma_2 \Delta S_i + \gamma_3 D_i + \gamma_4 VE_i + \gamma_5 V\beta_i + \gamma_6 INS_i + \gamma_7 R\&D_i + \gamma_8 r_i + \gamma_9 FD_i + e_i, \quad (6.8)$$

where i indexes four-digit industries and d is one-digit industry dummies (coefficients are not reported).

Dependent Variable	Explanatory Power Increase, <i>FINC</i>				Future Earnings Return Coefficient, <i>FERC</i>			
	6.1	6.2	6.3	6.4	6.5	6.6	6.7	6.8
Specification								
Ψ	1.269 (0.03)	1.206 (0.02)	1.198 (0.05)	1.489 (0.02)	1.899 (0.00)	1.767 (0.01)	2.377 (0.03)	2.405 (0.03)
I	-0.006 (0.00)	-0.006 (0.00)	-0.006 (0.00)	-0.006 (0.00)	-0.022 (0.00)	-0.023 (0.00)	-0.023 (0.00)	-0.022 (0.00)
S	0.019 (0.45)	0.019 (0.42)	0.016 (0.58)	0.016 (0.59)	0.080 (0.09)	0.077 (0.13)	0.125 (0.10)	0.125 (0.10)
D	0.083 (0.00)	0.082 (0.00)	0.082 (0.00)	0.082 (0.00)	0.092 (0.05)	0.086 (0.08)	0.087 (0.08)	0.092 (0.07)
VE	-	0.046 (0.00)	0.045 (0.00)	0.040 (0.01)	-	0.234 (0.17)	0.174 (0.36)	0.160 (0.42)
$V\beta$	-	-0.020 (0.13)	-0.020 (0.13)	-0.017 (0.17)	-	0.002 (0.99)	-0.013 (0.94)	-0.017 (0.91)
INS	-	-0.277 (0.05)	-0.282 (0.06)	-0.212 (0.14)	-	-0.199 (0.58)	-0.128 (0.73)	-0.138 (0.72)
$R\&D$	-	-	-3.596 (0.68)	-3.216 (0.71)	-	-	30.753 (0.18)	32.235 (0.73)

further for differences among industries, we include one-digit industry-fixed effects. (We do not use two-digit industry-fixed effects to conserve degrees of freedom.) Consistent with the matched-pair results in table 4, firm-specific stock return variation attracts a positive and significant coefficient across all specifications for both *FINC* and *FERC*.

TABLE 6 — Continued

Dependent Variable	Explanatory Power Increase, <i>FINC</i>				Future Earnings Return Coefficient, <i>FERC</i>			
	6.1	6.2	6.3	6.4	6.5	6.6	6.7	6.8
<i>R</i>	—	—	0.003 (0.89)	0.014 (0.52)	—	—	0.244 (0.38)	0.220 (0.42)
<i>FD</i>	—	—	—	−0.013 (0.90)	—	—	—	0.089 (0.16)
<i>F-statistic</i>	13.960 (0.00)	14.860 (0.00)	13.110 (0.00)	13.250 (0.00)	2.680 (0.01)	2.370 (0.02)	2.060 (0.03)	1.800 (0.07)
<i>R</i> ²	0.513	0.550	0.550	0.571	0.430	0.437	0.451	0.453
<i>Number of observations</i>	88		86		88		86	

The variables are defined as follows:

FERC = future earnings return coefficient; the sum of the coefficients on future changes in earnings $\sum_{\tau} b_{\tau}$ ($\tau = 1, 2, 3$) in the regression: $r_t = a + b_0 \Delta E_t + \sum_{\tau} b_{\tau} \Delta E_{t+\tau} + \sum_{\tau} d_{\tau} r_{t+\tau} + u_t$ ($\tau = 1, 2, 3$), where r is annual return and E is earnings per share (operating income before depreciation over common shares outstanding). The regression is performed on a four-digit industry cross-section of firms.

FINC = future earnings explanatory power increase; the increase in the coefficient of determination of the regression: $r_t = a + b_0 \Delta E_t + \sum_{\tau} b_{\tau} \Delta E_{t+\tau} + \sum_{\tau} d_{\tau} r_{t+\tau} + u_t$ ($\tau = 1, 2, 3$) relative to the base regression: $r_t = a + b_0 \Delta E_t + \eta_t$. The regression is performed on a four-digit cross-section of firms.

Ψ = relative firm-specific return variation; two-digit industry aggregate of firm-specific relative to systematic return variation. It is calculated as the ratio of residual sum of squares to total sum of squares (residual plus explained sum of squares) from the regressions of firm return on market and two-digit industry value-weighted indexes (constructed excluding own return) performed on weekly data.

I = industry structure; the square root of the aggregate number of firms in a two-digit industry used to construct future earnings response and return variation measures.

S = size; log of average of inflation adjusted total assets in a two-digit industry.

D = diversification; average number of four-digit industries a firm operates in, two-digit industry average.

VE = past earnings volatility; two-digit average standard deviation of past changes in earnings. Firm-level volatility is constructed using five years of lagged data.

Vβ = volatility of beta; two-digit industry standard deviation of beta. Volatility of beta is calculated as a simple average of the variances of monthly firms' betas belonging to a corresponding four-digit industry.

INS = institutional ownership; two-digit industry total assets-weighted institutional ownership.

R&D = research and development expenses; two-digit industry total assets-weighted ratio of research and expenditure expenditures to total assets.

r = past industry return; two-digit industry value-weighted return in $t - 1$.

FD = future dividends explanatory power; the coefficient of determination of the regression: $\Delta E_t = a + b_0 \Delta DIV_t + \sum_{\tau} b_{\tau} \Delta DIV_{t+\tau} + \varepsilon_t$ ($\tau = 1, 2, 3$), where *DIV* is dividends per share plus the value of stock repurchase over common shares outstanding. The regression is performed on a four-digit cross-section of firms.

The four-digit SIC industry approach is conducted by the pool of firms in a four-digit SIC industry to calculate the corresponding measures. The sample size of specifications 6.1, 6.2, 6.3, 6.5, 6.6, and 6.7 is 88 four-digit industries constructed using 1,916 firms. The sample size of specifications 6.4 and 6.8 is 86 four-digit industries constructed using 1,888 firms. Financial and utility industries (SIC 6000–6999 and 4900–4999, respectively) are omitted. Numbers in parentheses are probability levels based on Newey-West standard errors at which the null hypothesis of zero coefficient can be rejected. Coefficients significant at 10% or better (based on two-tailed test) are in boldface.

In table 7, we pool years of annual data from 1983 to 1995 and use a four-digit industry-fixed effects and time-random effects regression model.²⁹ We obtain highly significant results consistent with the results in table 6,

²⁹ We also conduct the regressions based on the 1983-to-1987 panel and the 1988-to-1995 panel. For the 1988-to-1995 panel, we obtain results similar to those in table 7. The regression results in the 1983-to-1987 panel are statistically less significant but nevertheless indicate that higher relative firm-specific return variation is associated with more informativeness (in the case of *FINC*). We do not report these results to save space; they are available on request.

TABLE 7

1983-to-1995 One-Digit Industry-Fixed, Time-Random Effects Panel Regressions of Future Earnings Response Measures on Relative Firm-Specific Return Variation and Control Variables: All Variables Constructed Using Four-Digit Cross-Industry Approach

This table reports the results of the following regressions:

$$FINC_{i,t} = d_i + \beta\Psi_{i,t} + \gamma_1 I_{i,t} + \gamma_2 S_{i,t} + \gamma_3 D_{i,t} + e_{i,t} \quad (7.1)$$

$$FINC_{i,t} = d_i + \beta\Psi_{i,t} + \gamma_1 I_{i,t} + \gamma_2 S_{i,t} + \gamma_3 D_{i,t} + \gamma_4 VE_{i,t} + \gamma_5 V\beta_{i,t} + \gamma_6 INS_{i,t} + e_{i,t} \quad (7.2)$$

$$FINC_{i,t} = d_i + \beta\Psi_{i,t} + \gamma_1 I_{i,t} + \gamma_2 S_{i,t} + \gamma_3 D_{i,t} + \gamma_4 VE_{i,t} + \gamma_5 V\beta_{i,t} + \gamma_6 INS_{i,t} + \gamma_7 R\&D_{i,t} + \gamma_8 r_{i,t} + e_{i,t} \quad (7.3)$$

$$FINC_{i,t} = d_i + \beta\Psi_{i,t} + \gamma_1 I_{i,t} + \gamma_2 S_{i,t} + \gamma_3 D_{i,t} + \gamma_4 VE_{i,t} + \gamma_5 V\beta_{i,t} + \gamma_6 INS_{i,t} + \gamma_7 R\&D_{i,t} + \gamma_8 r_{i,t} + \gamma_9 FD_{i,t} + e_{i,t} \quad (7.4)$$

and

$$FERC_{i,t} = d_i + \beta\Psi_{i,t} + \gamma_1 I_{i,t} + \gamma_2 S_{i,t} + \gamma_3 D_{i,t} + e_{i,t} \quad (7.5)$$

$$FERC_{i,t} = d_i + \beta\Psi_{i,t} + \gamma_1 I_{i,t} + \gamma_2 S_{i,t} + \gamma_3 D_{i,t} + \gamma_4 VE_{i,t} + \gamma_5 V\beta_{i,t} + \gamma_6 INS_{i,t} + e_{i,t} \quad (7.6)$$

$$FERC_{i,t} = d_i + \beta\Psi_{i,t} + \gamma_1 I_{i,t} + \gamma_2 S_{i,t} + \gamma_3 D_{i,t} + \gamma_4 VE_{i,t} + \gamma_5 V\beta_{i,t} + \gamma_6 INS_{i,t} + \gamma_7 R\&D_{i,t} + \gamma_8 r_{i,t} + e_{i,t} \quad (7.7)$$

$$FERC_{i,t} = d_i + \beta\Psi_{i,t} + \gamma_1 I_{i,t} + \gamma_2 S_{i,t} + \gamma_3 D_{i,t} + \gamma_4 VE_{i,t} + \gamma_5 V\beta_{i,t} + \gamma_6 INS_{i,t} + \gamma_7 R\&D_{i,t} + \gamma_8 r_{i,t} + \gamma_9 FD_{i,t} + e_{i,t}, \quad (7.8)$$

where i indexes four-digit industries and t indexes years. $E[e_{i,t}] = 0$, $E[e_{i,t} e_{j,t}] \neq 0 \forall i, j$ E is the expectation operator and d is one-digit industry fixed-effects dummy variables (coefficients are not reported).

Dependent Variable	Explanatory Power Increase, <i>FINC</i>				Future Earnings Return Coefficient, <i>FERC</i>			
	7.1	7.2	7.3	7.4	7.5	7.6	7.7	7.8
Ψ	0.428 (0.00)	0.429 (0.00)	0.431 (0.00)	0.463 (0.00)	1.382 (0.01)	1.303 (0.01)	1.368 (0.01)	1.450 (0.01)
I	-0.008 (0.00)	-0.008 (0.00)	-0.008 (0.00)	-0.008 (0.00)	-0.034 (0.00)	-0.033 (0.00)	-0.033 (0.00)	-0.032 (0.00)
S	0.037 (0.00)	0.034 (0.00)	0.034 (0.00)	0.035 (0.00)	0.102 (0.00)	0.090 (0.00)	0.091 (0.00)	0.092 (0.00)
D	0.021 (0.00)	0.021 (0.00)	0.021 (0.00)	0.019 (0.01)	0.042 (0.11)	0.042 (0.11)	0.044 (0.10)	0.039 (0.14)
VE	- (0.69)	4×10^{-4} (0.68)	4×10^{-4} (0.68)	4×10^{-4} (0.66)	- (0.66)	-0.006 (0.09)	-0.006 (0.10)	-0.006 (0.10)
$V\beta$	- (0.04)	-0.010 (0.04)	-0.010 (0.04)	-0.010 (0.05)	- (0.01)	-0.047 (0.01)	-0.048 (0.01)	-0.047 (0.02)
INS	- (0.93)	-0.004 (0.93)	-0.004 (0.93)	0.003 (0.96)	- (0.69)	0.075 (0.68)	0.078 (0.68)	0.105 (0.58)
$R\&D$	- (0.98)	- (0.98)	0.003 (0.98)	0.021 (0.85)	- (0.98)	- (0.98)	0.324 (0.46)	0.357 (0.42)

indicating that higher relative firm-specific return variation is associated with more informativeness.

As robustness checks, we also conduct the cross-industry analyses in the following ways: (1) using only pure-play firms (i.e., discarding all firms that have

TABLE 7 — Continued

Dependent Variable	Explanatory Power Increase, <i>FINC</i>				Future Earnings Return Coefficient, <i>FERC</i>			
	7.1	7.2	7.3	7.4	7.5	7.6	7.7	7.8
<i>R</i>	—	—	0.003 (0.89)	0.004 (0.85)	—	—	0.075 (0.37)	0.077 (0.36)
<i>FD</i>	—	—	—	0.109 (0.01)	—	—	—	0.275 (0.08)
Chi-squared statistic	407.920 (0.00)	413.020 (0.00)	412.100 (0.00)	421.200 (0.00)	385.350 (0.00)	396.990 (0.00)	418.320 (0.00)	399.190 (0.00)
<i>R</i> ²	0.302	0.306	0.306	0.312	0.291	0.297	0.298	0.301
Number of observations	958		950		958		950	

The variables are defined as follows:

FERC = future earnings return coefficient; the sum of the coefficients on future changes in earnings $\sum_{\tau} b_{\tau}$ ($\tau = 1, 2, 3$) in the regression: $r_t = a + b_0 \Delta E_t + \sum_{\tau} b_{\tau} \Delta E_{t+\tau} + \sum_{\tau} d_{\tau} r_{t+\tau} + u_t$ ($\tau = 1, 2, 3$), where r is annual return and E is earnings per share (operating income before depreciation over common shares outstanding). The regression is performed on a four-digit industry cross-section of firms.

FINC = future earnings explanatory power increase; the increase in the coefficient of determination of the regression: $r_t = a + b_0 \Delta E_t + \sum_{\tau} b_{\tau} \Delta E_{t+\tau} + \sum_{\tau} d_{\tau} r_{t+\tau} + u_t$ ($\tau = 1, 2, 3$) relative to the base regression: $r_t = a + b_0 \Delta E_t + \eta_t$. The regression is performed on a four-digit cross-section of firms.

Ψ = relative firm-specific return variation; two-digit industry aggregate of firm-specific relative to systematic return variation. It is calculated as the ratio of residual sum of squares to total sum of squares (residual plus explained sum of squares) from the regressions of firm return on market and two-digit industry value-weighted indexes (constructed excluding own return) performed on weekly data.

I = industry structure; the square root of the aggregate number of firms in a two-digit industry used to construct future earnings response and return variation measures.

S = size; log of average of inflation adjusted total assets in a two-digit industry.

D = diversification; average number of four-digit industries a firm operates in, two-digit industry average.

VE = past earnings volatility; two-digit average standard deviation of past changes in earnings. Firm-level volatility is constructed using five years of lagged data.

V β = volatility of beta; two-digit industry standard deviation of beta. Volatility of beta is calculated as a simple average of the variances of monthly firms' betas belonging to a corresponding four-digit industry.

INS = institutional ownership; two-digit industry total assets-weighted institutional ownership.

R&D = research and development expenses; two-digit industry total assets-weighted ratio of research and expenditure expenditures to total assets.

r = past industry return; two-digit industry value-weighted return in $t - 1$.

FD = future dividends explanatory power; the coefficient of determination of the regression: $\Delta E_t = a + b_0 \Delta DIV_t + \sum_{\tau} b_{\tau} \Delta DIV_{t+\tau} + \varepsilon_t$ ($\tau = 1, 2, 3$), where *DIV* is dividends per share plus the value of stock repurchase over common shares outstanding. The regression is performed on a four-digit cross-section of firms.

The four-digit SIC industry approach is conducted by the pool of firms in a four-digit SIC industry to calculate the corresponding measures. All regressions include time-random effects and the regressions are estimated by generalized least squares. Financial and utility industries (SIC 6000–6999 and 4900–4999, respectively) are omitted. Coefficients significant at 10% or better (based on two-tailed test) are in boldface. Numbers in parentheses are probability levels at which the null hypothesis of a zero coefficient can be rejected. The sample consists of 958 four-digit industry-year observations constructed using 18,903 firm-year observations spanning from 1983 through 1995 (panel A, specifications 7.1, 7.2, 7.3, 7.5, 7.6, and 7.7) and 950 four-digit industry-year observations constructed using 18,807 firm-year observations spanning from 1983 through 1995 (panel A, specifications 7.4 and 7.8). The results using the 1980-to-1995 sample (without diversification variable, *D*, which is available from 1983 through 1995) and the 1975-to-1995 sample (without diversification variable, *D*, and institutional ownership variable, *INS*, which is available from 1980 through 1995) are qualitatively similar.

business segments outside of their main four-digit industry), (2) using only firms with a December 31 fiscal year-end,³⁰ and (3) using three-digit industry groupings. In all cases, relative firm-specific stock return variation attracts a positive and statistically significant coefficient regardless of whether *FERC* or *FINC* is the dependent variable and regardless of whether the control variables are included.

³⁰ Unlike when we use the industry-matched-pairs approach, we do not lose many four-digit industries when we discard firms whose fiscal year-end is not December 31. Hence, we can conduct this robustness check.

TABLE 8

Year-by-Year Regressions of Future Earnings Response Measures on Relative Firm-Specific Return Variation and Control Variables

This table presents the estimates and the p -values of the relative firm-specific return variation measures, $\Delta\Psi$ (panel A) and Ψ (panel B) of the regression $Y = d + \beta X + \gamma Z + \varepsilon$, where Y is one of the earnings response measures (panel A: $\Delta FINC$, $\Delta FERC$; panel B: $FINC$, $FERC$), d is either a constant (panel A) or one-digit industry dummies (panel B), X is relative firm-specific return variation measure (panel A: $\Delta\Psi$; panel B: Ψ), and Z is a vector of control variables. The control variables in panel A are: industry structure, I ; differential size, ΔS ; differential diversification, ΔD ; differential past earnings volatility, ΔVE ; differential volatility of beta, $\Delta V\beta$; differential institutional ownership, ΔINS ; differential research and development expenses, $\Delta R\&D$; and differential past industry return, Δr . The control variables in panel B are: industry structure, I ; size, S ; diversification, D ; past earnings volatility, VE ; volatility of beta, $V\beta$; institutional ownership, INS ; research and development expenses, $R\&D$; and past industry return, r .

Year	Panel A: Variables constructed using industry match-pairing approach		Panel B: Variables constructed using cross-industry approach	
	Differential Explanatory Power Increase, $\Delta FINC$	Differential Future Earnings Return Coefficient, $\Delta FERC$	Explanatory Power Increase, $FINC$	Future Earnings Return Coefficient, $FERC$
1983	0.375 (0.34)	4.992 (0.10)	0.228 (0.05)	0.610 (0.21)
1984	0.946 (0.41)	1.852 (0.33)	0.090 (0.17)	-1.950 (0.29)
1985	0.752 (0.10)	2.886 (0.17)	0.145 (0.34)	2.152 (0.00)
1986	0.802 (0.18)	4.046 (0.22)	1.000 (0.01)	2.078 (0.05)
1987	0.962 (0.22)	0.989 (0.45)	-0.153 (0.32)	0.942 (0.13)
1988	1.372 (0.03)	4.619 (0.10)	-0.014 (0.56)	0.627 (0.10)
1989	0.993 (0.18)	7.316 (0.03)	0.425 (0.10)	1.091 (0.05)
1990	1.154 (0.04)	7.154 (0.03)	1.366 (0.00)	0.685 (0.10)
1991	1.379 (0.05)	6.747 (0.07)	0.715 (0.07)	-1.049 (0.20)
1992	0.894 (0.18)	5.574 (0.10)	0.196 (0.32)	2.677 (0.00)
1993	1.281 (0.10)	8.852 (0.00)	0.121 (0.20)	0.735 (0.18)

6. Changes in the Relation from 1983 to 1995

All our reported results are statistically more significant if we perform time-random effects panel regressions by pooling the years of data. To be conservative, however, we conduct year-by-year regressions. In the preceding discussion, we report regressions only for the latest year of data, 1995. In this section, we report the results of year-by-year regressions for all the years.

Panel A in table 8 displays the regression coefficients on differential relative firm-specific stock return variation, $\Delta\Psi$, in regressions explaining

TABLE 8 — Continued

Year	Panel A: Variables constructed using industry match-pairing approach		Panel B: Variables constructed using cross-industry approach	
	Differential Explanatory Power Increase,	Differential Future Earnings Return Coefficient, $\Delta FERC$	Explanatory Power Increase, $FINC$	Future Earnings Return Coefficient, $FERC$
	$\Delta FINC$			
1994	1.475 (0.00)	5.799 (0.05)	1.429 (0.03)	3.012 (0.03)
1995	1.152 (0.04)	6.668 (0.01)	1.198 (0.05)	2.377 (0.03)

The variables are defined as follows:

$FERC$ = future earnings return coefficient; the sum of the coefficients on future changes in earnings $\sum_{\tau} b_{\tau}$ ($\tau = 1, 2, 3$) in the regression: $r_t = a + b_0 \Delta E_t + \sum_{\tau} b_{\tau} \Delta E_{t+\tau} + \sum_{\tau} d_{\tau} r_{t+\tau} + u_t$ ($\tau = 1, 2, 3$), where r is annual return and E is earnings per share (operating income before depreciation over common shares outstanding). The regression is performed on a four-digit industry cross-section of firms.

$FINC$ = future earnings explanatory power increase; the increase in the coefficient of determination of the regression: $r_t = a + b_0 \Delta E_t + \sum_{\tau} b_{\tau} \Delta E_{t+\tau} + \sum_{\tau} d_{\tau} r_{t+\tau} + u_t$ ($\tau = 1, 2, 3$) relative to the base regression: $r_t = a + b_0 \Delta E_t + \eta_t$. The regression is performed on a four-digit cross-section of firms.

Ψ = relative firm-specific return variation; two-digit industry aggregate of firm-specific relative to systematic return variation. It is calculated as the ratio of residual sum of squares to total sum of squares (residual plus explained sum of squares) from the regressions of firm return on market and two-digit industry value-weighted indexes (constructed excluding own return) performed on weekly data.

I = industry structure; the square root of the aggregate number of firms in a two-digit industry used to construct future earnings response and return variation measures.

S = size; log of average of inflation adjusted total assets in a two-digit industry.

D = diversification; average number of four-digit industries a firm operates in, two-digit industry average.

VE = past earnings volatility; two-digit average standard deviation of past changes in earnings. Firm-level volatility is constructed using five years of lagged data.

$V\beta$ = volatility of beta; two-digit industry standard deviation of beta. Volatility of beta is calculated as a simple average of the variances of monthly firms' betas belonging to a corresponding four-digit industry.

INS = institutional ownership; two-digit industry total assets-weighted institutional ownership.

$R\&D$ = research and development expenses; two-digit industry total assets-weighted ratio of research and expenditure expenditures to total assets.

r = past industry return; two-digit industry value-weighted return in $t - 1$.

FD = future dividends explanatory power; the coefficient of determination of the regression: $\Delta E_t = a + b_0 \Delta DIV_t + \sum_{\tau} b_{\tau} \Delta DIV_{t+\tau} + \varepsilon_t$ ($\tau = 1, 2, 3$), where DIV is dividends per share plus the value of stock repurchase over common shares outstanding. The regression is performed on a four-digit cross-section of firms.

The match-pairing approach (panel A) is conducted as follows: (1) we identify two high- Ψ and two low- Ψ firms in each four-digit SIC industry within a two-digit SIC industry; (2) we use those firms to calculate the corresponding H (based on the sample of high- Ψ firms) and L (based on the sample of low- Ψ firms) measures; and (3) we take the difference between the H and L variables to calculate the corresponding differential, Δ , measures. The four-digit SIC industry approach (panel B) is conducted by the pool of firms in a four-digit SIC industry to calculate the corresponding measures. The sample years are 1983 through 1995. All equations are estimated by ordinary least squares. Financial and utility industries (SIC 6000–6999 and 4900–4999, respectively) are omitted. Coefficients significant at 10% or better (based on two-tailed test) are in boldface. Numbers in parentheses are probability levels based on Newey-West standard errors at which the null hypothesis of zero coefficient can be rejected. The 1983-to-1995 sample in panel A consists of 491 two-digit industry-year observations constructed using 11,338 firms. The 1983-to-1995 sample in panel B consists of 950 four-digit industry-year observations constructed using 18,807 firms. Refer to table 1 and its note for variable definitions.

differential future earnings response coefficients, $\Delta FERC$, and differential future earnings increase in explanatory power $\Delta FINC$. The regressions are analogous to equations (4.3) and (4.7) in table 4 but are performed separately for each year from 1983 to 1995. Differential relative firm-specific

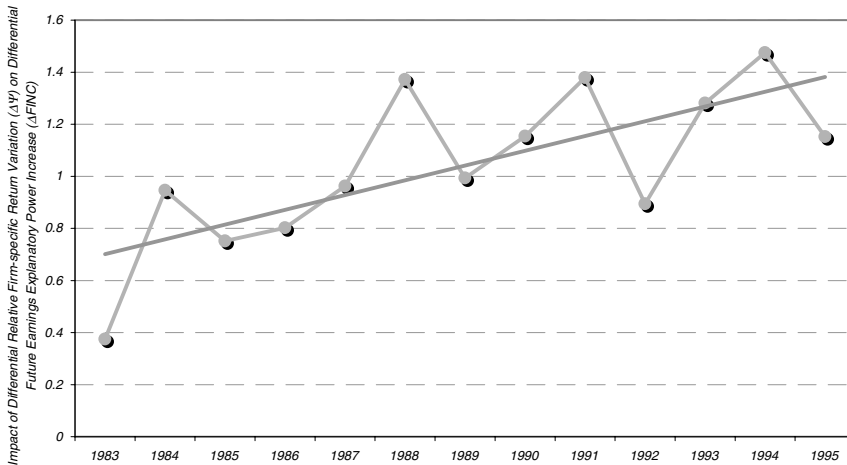


FIG. 1a.—The impact of differential relative firm-specific return variation ($\Delta\Psi$) on differential future earnings explanatory power increase ($\Delta FINC$) through time. This figure plots the year-by-year estimates of β of the regression $\Delta FINC = \alpha + \beta\Delta\Psi + \gamma Z + \varepsilon$, where $\Delta FINC$ is differential future earnings explanatory power increase, α is a constant, $\Delta\Psi$ is a differential relative firm-specific return variation measure, and Z is a vector of control variables. The control variables are: industry structure, I ; differential size, ΔS ; differential diversification, ΔD ; differential past earnings volatility, ΔVE ; differential volatility of beta, $\Delta V\beta$; differential institutional ownership, ΔINS ; differential research and development expenses, $\Delta R\&D$; and differential past industry return, Δr . Refer to table 1 for variable definitions. The sample years are 1983 through 1995. All year-by-year regressions are estimated by ordinary least squares. Financial and utility industries (SIC 6000–6999 and 4900–4999, respectively) are omitted. The sample consists of 491 two-digit industry-year observations constructed using 11,338 firms. The line has the slope and the intercept calculated from the regression of β on a constant and a time trend. The match-pairing approach is conducted as follows: (1) we identify two high- Ψ and two low- Ψ firms in each four-digit SIC industry within a two-digit SIC industry; (2) we use those firms to calculate the corresponding H (based on the sample of high- Ψ firms) and L (based on the sample of low- Ψ firms) measures; (3) we take the difference between the H and L variables to calculate the corresponding differential, Δ , measures.

stock return variation attracts a positive coefficient in every year. Note that the coefficients tend to drift upward, especially in the regressions using $\Delta FERC$ as the dependent variable.

Figures 1a and 1b plot the coefficient of $\Delta\Psi$, constructed using the matched-pairs technique, in regressions explaining $\Delta FINC$ and $\Delta FERC$, respectively, against time. They show that the regression coefficient of $\Delta\Psi$ when the dependent variable is $\Delta FINC$ is visibly smaller in the early 1980s than in the 1990s. We interpret the result as suggesting that firm-specific stock return variation is a more reliable indicator of stock price informativeness in the 1980s and 1990s. When the dependent variable is $\Delta FERC$, $\Delta\Psi$ attracts a regression coefficient that shows a similar but less visually obvious time trend.

Panel B in table 8 displays the regressions coefficients on four-digit industry-average firm-specific stock return variation, Ψ , in regressions

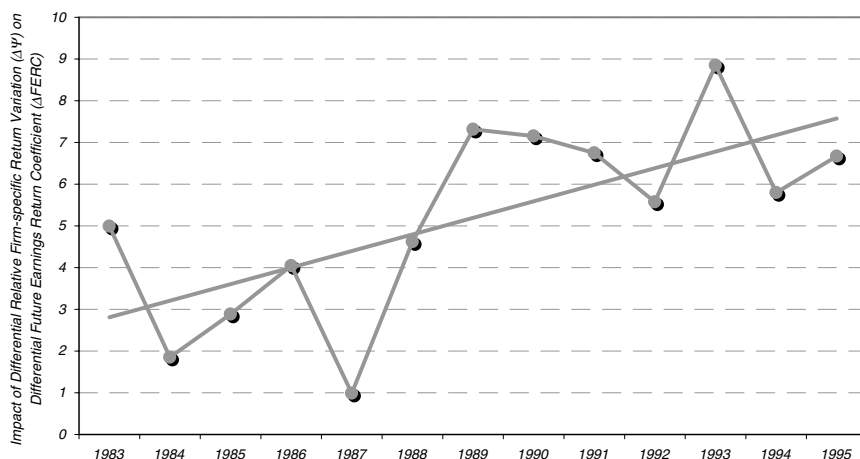


FIG. 1b.— The impact of differential relative firm-specific return variation ($\Delta\Psi$) on differential future earnings return coefficient ($\Delta FERC$) through time. This figure plots the year-by-year estimates of β of the regression $\Delta FERC = \alpha + \beta\Delta\Psi + \gamma Z + \varepsilon$, where $\Delta FERC$ is differential future earnings return coefficient, α is a constant, $\Delta\Psi$ is a differential relative firm-specific return variation measure, and Z is a vector of control variables. The control variables are: industry structure, I ; differential size, ΔS ; differential diversification, ΔD ; differential past earnings volatility, ΔVE ; differential volatility of beta, $\Delta V\beta$; differential institutional ownership, ΔINS ; differential research and development expenses, $\Delta R\&D$; and differential past industry return, Δr . The sample years are 1983 through 1995. All year-by-year regressions are estimated by ordinary least squares. Financial and utility industries (SIC 6000–6999 and 4900–4999, respectively) are omitted. The sample consists of 491 two-digit industry-year observation constructed using 11,338 firms. The line has the slope and the intercept calculated from the regression of β on a constant and a time trend. The match-pairing approach is conducted as follows: (1) we identify two high- Ψ and two low- Ψ firms in each four-digit SIC industry within a two-digit SIC industry; (2) we use those firms to calculate the corresponding H (based on the sample of high- Ψ firms) and L (based on the sample of low- Ψ firms) measures; and (3) we take the difference between the H and L variables to calculate the corresponding differential, Δ , measures.

explaining four-digit industry average *FERC* and *FINC*. The regressions are analogous to those in table 6. The results reported in table 6 are qualitatively replicated in almost every year. Also, these cross-industry regressions using industry-level *FERC* and *FINC* behave similarly to those using differential *FERC* and *FINC* based on the matching-pairs design. However, in the regressions in 1987 and 1988 using *FINC* as the dependent variable, relative firm-specific return variation attracts a negative and insignificant coefficient, as does the regression in 1984 and 1991 using *FERC* as the dependent variable. Still, the overall pattern in the panels shows that informativeness is positively associated with relative firm-specific return variation with an upward trend from 1983 to 1995). Figures 2a and 2b show the regression coefficients of Ψ when the dependent variable is *FINC* and *FERC*, respectively.

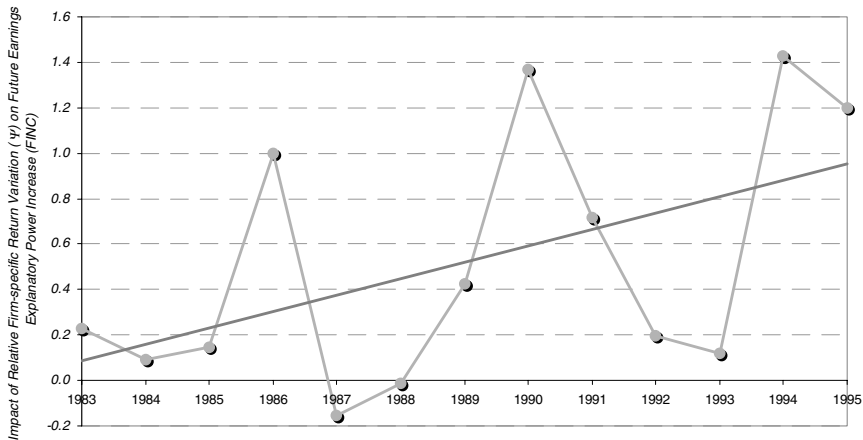


FIG. 2a.—The impact of relative firm-specific return variation (Ψ) on future earnings explanatory power increase ($FINC$) through time. This figure plots the year-by-year estimates of β of the regression $FINC = \alpha + \beta\Psi + \gamma Z + \varepsilon$, where $FINC$ is future earnings explanatory power increase, α is a constant, Ψ is a relative firm-specific return variation measure, and Z is a vector of control variables. The control variables are: industry structure, I ; size, S ; diversification, D ; past earnings volatility, VE ; volatility of beta, $V\beta$; institutional ownership, INS ; research and development expenses, $R\&D$; and past industry return, r . The sample years are 1983 through 1995. All year-by-year regressions are estimated by ordinary least squares. Financial and utility industries (SIC 6000–6999 and 4900–4999, respectively) are omitted. The sample consists of 950 four-digit industry-year observations constructed using 18,807 firms. The line has the slope and the intercept calculated from the regression of β on a constant and a time trend. The four-digit SIC industry approach (panel B) is conducted by the pool of firms in a four-digit SIC industry to calculate the corresponding measures.

7. Discussion and Conclusion

Roll [1988] finds much stock return variation to be firm specific and unrelated to news reports, and acknowledges that this implies “either private information or else occasional frenzy unrelated to concrete information” [p. 566]. West [1988] theoretically links high returns variation to noisy prices. Clarifying the economic interpretation of firm-specific variation is of increasing practical and theoretical importance, for Morck, Yeung, and Yu [2000] and Campbell et al. [2001] detect a long-term upward trend in this quantity in the United States.

In this article we find that greater firm-specific stock return variation, measured relative to total variation, is associated with more informative stock prices, where price informativeness is defined as how much information stock prices contain about future earnings. This result is highly robust and highly statistically significant. We also find that this positive relation appears to have an upward trend in our sample, which ranges from 1983 to 1995. We conclude that the importance of firm-specific variation in U.S. stock returns most likely reflects the capitalization of firm-specific information about fundamentals into stock prices and thus reflects an efficient stock

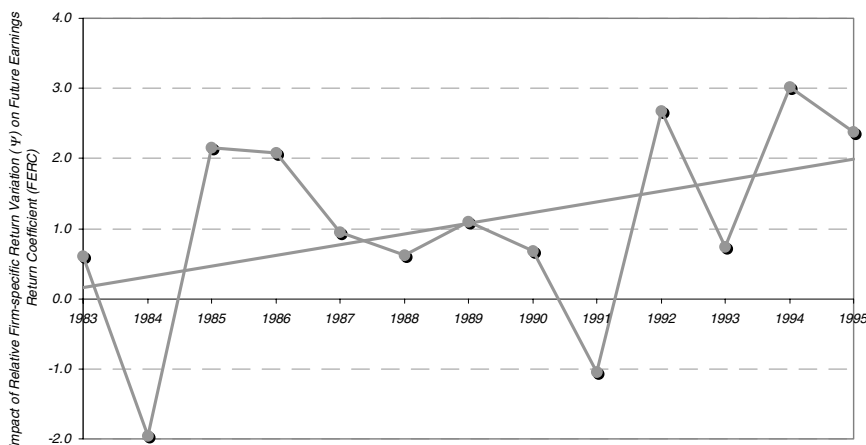


FIG. 2b.—The impact of relative firm-specific return variation (Ψ) on future earnings return coefficient ($FERC$) through time. This graph plots the year-by-year estimates of β of the regression $FERC = \alpha + \beta\Psi + \gamma Z + \varepsilon$, where $FERC$ is future earnings return coefficient, α is a constant, Ψ is a relative firm-specific return variation measure, and Z is a vector of control variables. The control variables are: industry structure, I ; size, S ; diversification, D ; past earnings volatility, VE ; volatility of beta, $V\beta$; institutional ownership, INS ; research and development expenses, $R\&D$; and past industry return, r . Refer to table 1 and its notes for variables definition. The sample years are 1983 through 1995. All year-by-year regressions are estimated by ordinary least squares. Financial and utility industries (SIC 6000–6999 and 4900–4999, respectively) are omitted. The sample consists of 950 four-digit industry-year observations constructed using 18,807 firms. The line has the slope and the intercept calculated from the regression of β on a constant and a time trend. The four-digit SIC industry approach is conducted by the pool of firms in a four-digit SIC industry to calculate the corresponding measures.

market rather than a noisy one. Higher firm-specific return variation appears to indicate stock prices closer to fundamentals, not farther from them.

This finding is economically important. Tobin [1982] argues that stock market efficiency matters because the stock market is a device for allocating capital. If stock prices are near their fundamental values, capital is priced correctly in its different uses, and corporate managers receive meaningful feedback when stock prices move. Both of these effects should lead to more economically efficient capital allocation, both between and within firms. Tobin defines the stock market as exhibiting functional efficiency if stock prices lead to an economically efficient microeconomic allocation of capital.

Our findings contribute to the literature on the functional efficiency of the stock market in that they are consistent with previous cross-country studies that suggest that higher firm-specific stock return variation reflects more informationally efficient stock prices. In a cross-sectional study, Morck, Yeung, and Yu [2000] show that firm-specific return variation relative to systematic return variation rises as public investors' property rights as residual claimants are better legally protected. Wurgler [2000] finds that Morck, Yeung, and Yu's synchronicity measure is negatively correlated with his measure of the quality of capital allocation. Our findings also suggest that higher

firm-specific stock returns may also reflect more informationally efficient stock prices in the United States. In this, they support Durnev, Morck, and Yeung [2000], who show that industries and firms for which firm-specific stock price variation is larger use more external financing and allocate capital more efficiently. Also, the results support the finding in Durnev, Morck, and Yeung [2003] that U.S. industries and firms exhibiting larger firm-specific variation make more value-enhancing capital budgeting decisions.

In summary, our findings are consistent with the view that greater firm-specific price variation is associated with more informative stock prices. This ultimately attests to the role of stock prices as efficient signals for resource allocation and thus to the functional efficiency of the stock market.

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