ההשפעה של גילוי מידע וקיום מידע אסימטרי על הדיוק של מידע הגלום במחירי מניות יומיים

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מחירי מניות נעים בדרך כלל בעקבות פרסום מידע על השווי הכלכלי של החברה כאשר תהליך הגעת המידע לשוק והשינוי במחירי המניות הוא רציף על פני זמן. עם זאת, מחירי מניות יכולים לנוע שלא בעקבות פרסום מידע חדש, דבר הנקרא Noise trading. סביר להניח שתזוזות במחירי המניה כתוצאה מ״רעש״ לא יחזיקו מעמד זמן רב ומחיר המניה יחזור למסלולו הקודם, המשקף את השווי הכלכלי של החברה. במחקר זה אנו מודדים את רמת הדיוק של מידע הטמון במחירי המניות. הרעיון הבסיסי הוא שככל שהמידע מדויק יותר, הוא ישפיע על מחיר המניה בטווח הארוך, כלומר, מידע מדויק הוא בעל אורך חיים גבוה בעוד שמידע לא מדויק (לדוגמא, ״רעש״) הוא בעל אורך חיים קצר. מדידת רמת הדיוק מבוצעת לכל מניה בכל שנה בצורה הבאה: נניח שבכל שנה יש 250 ימי מסחר, כאשר בכל יום מחושבת התשואה היומית על המניה (אם נתעלם מדיבידנדים, התשואה היומית היא השינוי היומי באחוזים במחיר המניה). לכן, בשלב הראשון מחשבים לכל חברה 250 תשואות יומיות בכל שנה. בשלב השני, מסביב לכל תשואה יומית, מודדים את התשואה ארוכת הטווח, כאשר תשואה ארוכת טווח מוגדרת כתשואה על פני שלושה חודשים (ניתן להגדיר תשואה ארוכת טווח על פני טווחי זמן שונים, למשל 5, 7, או 9 חודשים). כך לדוגמא, התשואה ארוכת הטווח מסביב ליום 15/5/2010 נמדדת על פני התקופה 1/4/2010 עד 1/7/2010. בכך אנו משיגים לכל חברה ולכל שנה 250 תצפיות של תשואות יומיות ותשואות ארוכות טווח המתייחסות אליהן. בשלב השלישי אנו בודקים את הקשר בין התשואות היומיות לתשואות ארוכות הטווח באמצעות הרצת רגרסיה לינארית לכל חברה/שנה. אם התשואות היומיות כוללות מידע מדויק, הרי שהשיפוע של הרגרסיה הלינארית יהיה 1. אם, לעומת זאת, התשואות היומיות כוללות רעש בלבד, השיפוע של הרגרסיה הלינארית ינוע לכיוון ה- 0. ככל שעולה רמת הדיוק של המידע, יהיה השיפוע גבוה יותר.

בשלב הבא של המחקר בדקנו מה משפיע על רמת הדיוק של מחירי מניות. מצאנו שרמת הדיוק עולה בימים בהם מתפרסמים רווחים רבעוניים ובימים בהם מפרסמת החברה תחזיות לרווחים עתידיים. בימים אחרים בממוצע, מחירי המניות כוללים יותר ״רעש״. נובע מכך שמשקיעים המעוניינים לסחור במניה שלא על בסיס מידע, עושים זאת בימים בהם יש פחות מידע בידי הציבור. נהוג לחלק משקיעים במניות לשתי סוגים: אלה הסוחרים במניות על בסיס מידע ציבורי (לדוגמא, פרסום רווחים רבעוניים), ואלה הסוחרים במניות גם על בסיס מידע פרטי שאיננו נמצא בידי כלל הציבור. קיום מידע פרטי בידי חלק מהמשקיעים גורם לאסימטריה של מידע (Information asymmetry), דבר העלול לגרום למשקיעים מסוימים להימנע ממסחר. אנו מוצאים שרמת הדיוק במחירי מניות עולה ככל שרמת האסימטריה נמוכה יותר. ממצא זה מעניין מכיוון שרובינו נוטים לעיתים לסחור במניות בודדות, על אף הסיכון הטמון בכך. הסיכון הטמון במסחר במניות בודדות יורד ככל שיורדת האסימטריה של המידע, וככל שעולה רמת הדיוק של המידע הטמון במחירי המניות. בשלב האחרון של המחקר התמקדנו במשמעות הכלכלית של רמת הדיוק. מהי ההטבה למשקיע מצד אחד ולחברה מצד שני של מידע מדויק יותר על שווי החברה? תשובה אחת לשאלה זו היא מחיר הון נמוך יותר. אנו מוצאים שככל שעולה רמת הדיוק של המידע הטמון במחירי המניה, יורד מחיר ההון שלה, כאשר הירידה היא משמעותית מאד. ממצא זה מהווה מוטיבציה לחברות לפרסם מידע מדויק ככל האפשר, כי ההטבה הכלכלית הנובעת מכך משמעותית מאד.

The effect of disclosure and information asymmetry on the precision of information in daily stock prices

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Abstract

We examine the effect of public disclosure and information asymmetry on the precision of information in daily stock prices. Daily prices move because of information but also because of noise, and noise-driven movements will presumably not endure in the long run. We find that returns on earnings announcement days more precisely reflect the change in the long-term value of the firm, whereas returns on nonannouncement days contain relatively more noise. Disclosure increases precision also on nonannouncement days, and firms providing guidance during the quarter have less noisy returns. Moreover, we find that stocks with lower information asymmetry have more precise daily returns, because liquidity and other noninformative trades that increase noise have a smaller impact on their prices. Prices that reflect value more precisely will reduce investor risk when trading the individual stock. We find that the precision of information in daily stock prices is also associated with lower expected returns.

The effect of disclosure and information asymmetry on the precision of information in daily stock prices

1. Introduction

We examine the effect of public disclosure and information asymmetry on the precision of information reflected in prices. Stock prices can move because of information but also because of noise. Stock prices that reflect the value of a stock more precisely, and with less noise, will reduce investor risk in trading individual stocks.[1] The precision of information that investors learn from prices can also determine the cost of equity (Admati 1985; Lambert et al. 2012).[2] We examine the effect of public information on the precision of information in prices, and the relation between precision and the cost of equity.

Public information will increase the precision of prices. Upon disclosure, information moves prices (e.g., Ball and Brown 1968). We test and find that returns on earnings announcement days more precisely reflect the change in the long-term value of the firm, whereas returns on nonannouncement days contain relatively more noise. More generally, when more of the information that investors have on the firm is public, and information asymmetry is on average lower during the year, noise is expected to have a lower effect on prices, because liquidity and other trades that are unrelated to information will have a lower impact on prices of stocks with lower information asymmetry (Kyle 1985).

To test our hypotheses, we estimate the precision of information in daily stock prices. We use a methodology similar to that used by Hodrick (1987) for the analysis of the information in forward and spot exchange rates, and by Biais et al. (1999) for the analysis of information in the opening stock prices. Specifically, we regress long-term stock returns (3-

[1] More precise and less noisy stock prices will particularly benefit small, undiversified investors. Disclosure should serve the investing decisions of the public, not only of large and institutional investors (e.g., U.S. Securities and Exchange Commission 2014). Therefore, the effect of disclosure on precision of information in prices is of interest.
[2] Admati (1985), for example, presents a noisy rational expectations model in which investors learn from noisy prices, and shows that the precision of information will affect the pricing of stocks.

13 months around each day) on daily stock returns and use the slope coefficient on the daily stock returns as a firm-/year-specific measure of precision. Long-term stock returns serve as a proxy for the change in the value of the firm. Imprecise or noisy information is information that does not reflect the change in the value of the firm. If daily returns contain noisy information on the change in the long-term value of the firm, the precision coefficient will be attenuated to 0, and the coefficient will increase toward 1 as the precision of information in daily stock returns increases.

We find that the precision coefficient is higher on earnings announcement days than on other days during the quarter. In fact, the precision coefficient on earnings announcement days converges to 1, whereas this coefficient remains much lower (about 0.68) on nonannouncement days. This finding suggests that although noise affects stock prices on nonannouncement days, information is mostly driving returns on announcement days. Announcement days with larger price movements are not necessarily more precise. Our precision measure gauges the noise or precision with which daily returns reflect information on the long-term change in stock prices, and not the amount of information impounded. Large price movements may be driven by an increase in information, but also by an increase in noise. We find, for example, that announcement days with higher absolute returns are not more precise than other announcement days.[3] Yet disclosure increases precision also on days other than earnings announcement days. We find that the precision coefficient on nonannouncement days is higher, as expected, for firms that provide management earnings guidance than for firms that do not disclose such information during the quarter.

We find that information asymmetry is negatively associated with the average precision of information in stock prices during the year. When stock prices move not because of information, but because of noise, precision should decrease. Liquidity trades, trades that

[3] See, for example, the multivariate analysis in Table 5 below.

are unrelated to information, have a higher impact on prices of stocks with higher information asymmetry, and the prices of these stocks are expected to be less precise as a result. We find that stocks with a higher price impact have lower precision coefficients.

Finally, we find that higher precision of information in stock prices is associated with a lower cost of equity capital. Theory predicts that the precision of overall information, public and private, will affect the cost of equity (Admati 1985; Lambert et al., 2012). We estimate the precision of total information aggregated in prices, and find that it is negatively associated with expected returns. Both the precision of the information on nonannouncement days, which are the majority of days during the year, and the incremental precision of information in earnings announcement days (the three days around quarterly earnings announcements, 12 days during each year) are negatively associated with expected abnormal stock returns.[4]

We also show that the effect of precision on expected returns remains after controlling for information asymmetry and competition between investors. The literature is undecided on whether and when information asymmetry affects the cost of equity. Easley and O'Hara (2004) argue that investors demand higher returns to holding stocks with greater private information. Lambert et al. (2012) and Armstrong et al. (2011), however, show that with perfect competition, information asymmetry should not affect the cost of equity.[5] Lambert et al. argue that even if information asymmetry is not priced, the precision of average information, public and private, will affect the cost of equity. Consistent with this prediction, we find that although competition between investors lowers the effect of information asymmetry on expected returns, it does not change the effect of precision on expected

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[4] We also show that precision is priced using the two-stage cross-sectional regression technique similar to that used, for example, by Core et al. (2008). In the first stage, we estimate factor betas on the market, size, book-to-market, and precision factors, and in the second stage, we estimate factor risk premia. The premium on the precision factor beta is found to be positive, suggesting that precision is priced as a risk factor.

[5] Hughes et al. (2007) also show conditions under which information asymmetry should not be a stand-alone priced factor. The empirical literature is also undecided on whether information asymmetry is priced (see Core et al. 2008, and Mohanram and Rajgopal 2009).

returns. To the best of our knowledge, this study is the first that empirically demonstrates the different effect that competition has on the pricing of information asymmetry and precision.

Our study also contributes to the literature that examines the relation between information precision and the cost of equity. Prior studies find a negative relation between the quality of financial disclosures and the cost of equity (e.g., Francis et al. 2005; Leuz and Verrecchia 2000). If high-quality disclosures are more precise, these prior findings suggest that more precise public disclosures decrease the cost of equity. Botosan et al. (2004) examine the relation between the cost of equity capital and the quality of public and private information, using measures derived from analysts' forecasts, and find that the precision of public information in analysts' forecasts is negatively associated with the cost of equity capital; the precision of private information in analysts' forecasts is, on the other hand, positively associated with the cost of equity, and these effects of private and public information can offset each other.[6] Lambert et al. (2012), however, argue that when the combination of public and private information (total information) is more precise, the cost of equity is lower. We measure the precision of total information and find that higher information precision is associated with a lower cost of equity capital.

More generally, we contribute to the literature that examines the information environment on disclosure days. Prior literature finds that the information on earnings announcements explains only a fraction of stock returns variation, and suggests the timeliness of earnings disclosures is low (e.g., Lev 1989, Ball and Shivakumar 2008). We estimate the precision of information impounded into daily stock prices, and find that information on quarterly earnings announcement days reflects the change in the long-term value of the stock more accurately than information on other days during the quarter. These

[6] A relation exists between precision of private and public information and information asymmetry. Higher precision of private information, for example, can be associated with higher information asymmetry. In our tests, we control for information asymmetry.

results are consistent with the idea of substitution between reliability and relevance of disclosures. The innovations on earnings announcements, although small, are accurate.

2. Research Design

2.1. Measuring Precision

Daily prices move because of information but also because of noise. Public and private information are expected to have a different effect on the precision of prices. Whereas public information should be reflected in prices upon its disclosure, private information can be impounded into prices with noise. Theory suggests that informed investors will try to trade without making prices informative, and may actively introduce noise to prices to maximize their profits (e.g., Mederano and Vives 2001).[7] Additionally, noisy trades will affect stocks that have more private information and less public information. When information asymmetry is high, liquidity trades and trades that are unrelated to information in general will have a higher impact on stock prices (Kyle 1985). In high-asymmetry stocks, liquidity demands lead to short-term price changes that quickly reverse, as shown, for example, by Huang and Stoll (1996). Prices of stocks with higher information asymmetry are expected to be less precise as a result.

We estimate the precision of information in daily stock returns to test our hypotheses. Imprecise or noisy returns do not reflect the change in the value of the firm. To gauge the precision of information reflected in returns on day t, we use the following model:

$$RET_i(t-\tau, t+\tau) = \gamma_0 + \gamma_1 RET(t)_i + \varepsilon_i \,. \tag{a}$$

The independent (right-hand side) variable is a vector of daily returns for firm *i*. The dependent (left-hand side) variable is the cumulative return for a window starting τ days

[7] In perfect competition between informed investors that hold the same information, prices will become fully informative and reflect private information (Kyle 1989).

before and ending τ days after day t, and it serves as a proxy for the change in the fundamental value of the firm. The slope coefficient is a measure of the precision of information impounded in daily stock returns. If information on the value of the firm drives the stock returns in day t, the slope coefficient will be 1. However, if daily stock returns contain noise, the slope coefficient will be attenuated to 0.

Consider, for example, a simple case in which τ is equal to 1, and the change in the value of the firm over the three trading days is the sum of the daily information:

$$\Delta Value_i(t-1,t+1) = Info(t-1)_i + Info(t)_i + Info(t+1)_i . \tag{b}$$

If information on days t-1, t, and t+1 are uncorrelated, the coefficient γ_1 will be exactly 1 when we estimate the following regression, for example, using the 252 trading days of the stock in one year:

$$\Delta Value_i(t-1,t+1) = \gamma_0 + \gamma_1 Info(t)_i + \varepsilon_i . \tag{c}$$

Following Biais et al. (1999), we use stock returns from time t-τ to t+τ as a proxy for change in the value of the stock (dependent variable):

$$\mathrm{Re}\,t_i(t-1,t+1) = \gamma_0 + \gamma_1 \mathrm{Re}\,t(t)_i + \varepsilon_i . \tag{d}$$

If returns on day t reflect only information, then $\gamma_1 = 1$, and if returns also contain noise, $\gamma_1 < 1$ because the independent variable is measured with error.[8]

The empirical equation we estimate here allows the precision coefficient to be different during and outside quarterly earnings announcements, as in eq. (1):

$$RET3M(T)_{it} = \gamma_{0t} + \gamma_{1t} ANND_{it} + \gamma_{2t} RET(T)_{it} + \gamma_{3t} ANND_{it} \times RET(T)_{it} + \varepsilon_{it} . \tag{1}$$

The independent variable, $RET(T)_{it}$, is firm i's daily stock return in day t during calendar year T. $ANND_{it}$ is an indicator variable that equals 1 in the three-day window around the

[8] For an unbiased estimation of eq. (d), the information impounded into prices on different days should not be correlated. In our robustness tests below, we estimate our models using a sub-sample of firms with near-zero autocorrelation in daily returns.

four quarterly earnings announcements of year T (12 days in total), and $ANND_{it} \times RET(T)_{it}$ is a multiplicative variable that allows the slope coefficient to be different for earnings announcement days. The dependent variable, $RET3M(T)_{it}$, is the cumulative stock return in the three months surrounding the month containing day t.[9]

Consider, for example, a company with 252 trading days in calendar year 2012. $RET(2012)_{it}$ is a vector of 252 observations of daily stock returns in calendar year 2012. RET3M(2012) is a vector of 252 observations, constructed as follows: for all trading days in June 2012, $RET3M_{it}$ is the cumulative return from May 1, 2012, through July 31, 2012; for all trading days in July 2012, $RET3M_{it}$ is the cumulative return from June 1, 2012, through August 31, 2012, and similarly for all months. $ANND_{it}$ is a vector of 252 observations in which 12 of the observations corresponding to quarterly earnings announcement days are equal to 1, and the remaining 240 observations are equal to 0.

The coefficient γ_{2t} captures the average precision of nonannouncement daily stock returns for company i in calendar year t. The coefficient γ_{3t} captures the *incremental* precision of information released during quarterly earnings announcements by firm i during calendar year t. The sum $[\gamma_{2t} + \gamma_{3t}]$ represents the precision of information released during quarterly earnings announcements by firm i during calendar year t.

By estimating eq. (1) for each firm/year, we obtain a firm-specific annual measure of precision of information released during nonannouncement days, and a measure of the incremental precision of information released during earnings announcement days. Note that the slope coefficients in eq. (1) measure the precision of the information, not the information

[9] To construct our precision measure, we use a symmetric return window, that is, price changes after day t but also price changes before day t. The reason is that noise could arise because current returns reflect information released in the future, but also when current returns reflect information that has already been impounded into prices before. In the robustness section we show that results are similar when we use a forward looking return window as the dependent variable.

content (often measured by the regression's adjusted-R^2).[10] The information in daily returns can be precise but with low information content, so the coefficient γ_2 could be close to 1 and, at the same time, the adjusted-R^2 could be low. For convenience, we label the coefficient γ_2 NONANN (precision of information released during nonannouncement days); we also label the coefficient γ_3 ANN (incremental precision of information released during earnings announcement days).[11]

2.2. The determinants of precision

Precision should be positively associated with information supply and negatively associated with information asymmetry. We use firm size and book-to-market ratio as measures of firm risk. Information supply is measured by the earnings news captured by the absolute stock returns during earnings announcements days, and by whether the firm issues management forecasts. Information asymmetry is measured by the bid-ask spread.[12] Initially, we identify the determinants of precision of information released during nonannouncement days by estimating eq. (2) with firm and year fixed effects:

$$NONANN_{it} = \delta_0 + \delta_1 MV_{it} + \delta_2 BM_{it} + \delta_3 NEWS_{it} + \delta_4 GUID_{it} + \delta_5 BAS_{it} + \eta_{it} \quad (2)$$

The dependent variable in eq. (2) is NONANN (the precision of information released during nonannouncement days). The first explanatory variable is firm size (MV_{it}), measured as the natural logarithm of the market value of equity at the beginning of each year. Atiase (1985) and Collins, Kothari, and Rayburn (1987) argue that smaller firms attract lower media

[10] Ball and Shivakumar (2008) regress annual stock returns on short-window returns around quarterly earnings announcements, and find that returns during announcement days explain only a small fraction of annual returns. Ball and Easton (2013) regress earnings on daily stock returns, and find that the coefficient on returns increases significantly in earnings announcement days. They argue that news released during these days signals a more transitory effect than news released during non-earnings announcement days. Both studies focus on timeliness, not precision.

11 Our results are similar when we use a one-month window, a five-month window, and a seven-month window instead of a three-month window as the dependent variable in eq. (1). Also, as we show later, our results are similar if we replace the symmetric window with a forward-looking return window.

[12] We also use price impact as an alternative measure of illiquidity, and report results in Table 9.

and analyst coverage, resulting in lower information production outside their earnings-announcement windows. This argument suggests a positive association between firm size and NONANN ($\delta_1 > 0$). The second explanatory variable is the book-to-market ratio (BM_{it}), measured as the book value of equity divided by the market value of equity at the beginning of each year. To the extent that higher book-to-market ratios reflect mature businesses, information released during nonannouncement days is likely to be more precise ($\delta_2 > 0$). The third variable in the model ($NEWS_{it}$) is the average absolute daily returns during quarterly earnings announcement days divided by average absolute daily returns on other days of the year. This variable measures the proportion of information released during earnings announcements. We expect the precision of information to increase with the increase in public disclosure ($\delta_3 > 0$).

The frequency of earnings guidance has been increasing over time, and more firms are using earnings guidance to reduce the uncertainty about their performance (Houston, Lev, and Tucker 2010). Much of the guidance is given immediately after earnings, but firms that provide guidance usually update investors during the quarter on news that can affect their previously provided forecasts. Therefore, guidance can reduce noise throughout the year. For example, rumors will have a lower effect on stock prices because managers are known to continuously update investors on news. Because most guidance is provided outside the earnings announcement window, we expect its effect on NONANN to be positive ($\delta_4 > 0$). We measure guidance (GUID) as an indicator variable that equals 1 for firms that issued management earnings forecasts, and 0 otherwise.

The fifth explanatory variable is the bid-ask spread (BAS), a proxy for information asymmetry.

We also use a model that explains the precision of information released during earnings announcements:

$$NONANN_{it} + ANN_{it} = \phi_0 + \phi_1 MV_{it} + \phi_2 BM_{it} + \phi_3 NEWS_{it} + \phi_4 GUID_{it} + \phi_5 BAS_{it} + \eta_{it} \ . \qquad (3)$$

The dependent variable in eq. (3) is NONANN+ANN (the precision of information released during earnings announcements). The independent variables in eq. (3) are the same as in eq. (2). We expect the sign of the coefficients on size (ϕ_1), book-to-market (ϕ_2), earnings news (ϕ_3), and bid-ask-spreads (ϕ_5) to be the same as in eq. (2). However, we expect the coefficient on management guidance (ϕ_4) to be smaller than δ_4 in eq. (2) because management forecasts are mostly issued outside earnings announcement windows.

2.3. Information precision and the cost of equity capital

Lambert et al. (2012) argue that providing more precise information is expected to decrease the cost of capital, even in the presence of information asymmetry. We test this prediction using the following equation:

$$ABRET_{it+1} = \theta_0 + \theta_1 NONANN_{it} + \theta_2 ANN_{it} + \theta_3 BAS_{it} + \omega_{it} \ . \qquad (4)$$

$ABRET_{it+1}$ is the average monthly risk-adjusted stock returns starting from February of year t+1 through January of year t+2. We adjust stock returns for risk using Daniel, Grinblatt, Titman, and Wermers' (1997) size, book-to-market, and momentum quintile portfolios. NONANN is the precision of information released during nonannouncement days, ANN is the incremental precision of information released during earnings announcements, and BAS is the bid-ask spread. The model is estimated with firm and year fixed effects.

We also test the pricing of precision using the two-stage cross-sectional regression technique similar to that used, for example, by Core et al. (2008). In the first stage, we estimate factor betas on the market, size, book-to-market, and precision factors, and in the second stage, we estimate factor risk premia. The methodology and results are described in section 4.4 below.

3. Sample Selection and Descriptive Statistics

The initial sample includes all firms for which four quarterly earnings announcement dates are available on COMPUSTAT and at least 200 trading days are available on CRSP. This sample includes 126,762 firm/year observations over the period 1972-2012. Because some of our tests require bid-ask spreads and management forecasts, the sample is reduced to 50,490 firm/years. Table 1 presents details on the sample.

Management forecasts are taken from First Call and Capital IQ databases. First Call data end on 2010 and Capital IQ data start on 2001.[13] We create an indicator variable that equals 1 each year for firms with management forecasts available either on First Call or Capital IQ. We calculate bid-ask spreads and the price impact using TAQ data. To adjust stock returns for risk, we use Daniel et al.'s (1997) size, book-to-market, and momentum quintile portfolios, with data available on R. Russ Wermers' website.

(Table 1 about here)

Figure 1 presents average annual precision coefficients (NONANN, ANN, and NONANN+ANN) from 1972 to 2012. NONANN seems to be decreasing over time, suggesting the information released during nonannouncement days has become less precise. ANN slightly increases over time, which means that incremental precision of information released during earnings announcements increased over time. The sum NONANN+ANN, which measures the precision of information released during earning announcements, seems to have increased over time, and especially during the last decade.

(Figure 1 about here)

Figure 2 presents the effective bid-ask spreads during nonannouncement and announcement days. The measure of information asymmetry is the effective bid-ask spread (BAS). We compute the effective bid-ask spread using TAQ data, which are available from

[13] The coverage of First Call before 1999 is limited. Results with guidance data that start on 1999 are qualitatively similar to those presented in Table 4 below.

1993, as $[2 \times (| P_{it} - V_{it} | / V_{it})]$, where P_{it} is the trading price and V_{it} is the security's bid-ask midpoint at the time of the transaction. We calculate the daily effective bid-ask spread by averaging the effective bid-ask spreads of all transactions during that day, and use the average daily effective bid-ask spread for the year (BAS_{it}) as a measure of information asymmetry. Bid-ask spreads sharply declined after 2000 and stabilized around 2004. Also, bid-ask spreads are slightly larger during earnings announcements, a finding consistent with Lee, Mucklow, and Ready (1993).

(Figure 2 about here)

Table 2 presents average precision coefficients for different long-term return windows. We estimate eq. (1) with firm fixed effects, increasing the return window of the dependent variable from 3 to 13 months. When the dependent variable is defined as the surrounding three months, the average precision of information released during non-announcement days is 0.674, and the average incremental precision of information released during quarterly earnings announcements is 0.210; that is, the precision of information released during quarterly earnings announcements is (0.674 + 0.210 =) 0.884, higher at the 0.01 level than the precision of information released during nonannouncement days. The average precision of daily returns during nonannouncement days remains relatively stable as we increase the return window to 13 months; however, the average precision of information released during earnings announcements is close to 1.00 for all windows longer than five months. The results in Table 2 suggest the precision of information released during earnings announcement days is higher than that released outside earnings announcements, and that this finding is not sensitive to the length of the long-term return window.

(Table 2 about here)

Table 3 presents descriptive statistics in panel A, and a correlation matrix in panel B (Pearson above diagonal and Spearman below diagonal). The correlations between

NONANN and ANN are negative (Pearson = -0.15, Spearman = -0.16), suggesting that when the precision of information released during nonannouncement days is high, the incremental precision of information released during earnings announcements tends to be lower, and vice versa. This result suggests that when earnings are less precise, the demand for more precise information outside earnings announcements increases.

Larger firms release more precise information during nonannouncement days, as the positive correlations between NONANN and MV reflect (Pearson = 0.09, Spearman = 0.16). Surprisingly, firms with larger book-to-market ratios release less precise information during nonannouncement days (Pearson = -0.01, Spearman = -0.07), but the Pearson correlation is not significantly different from 0. In addition, earnings news is associated with more precise information released during nonannouncement days, as the positive correlations between NONANN and NEWS reflect (Pearson = 0.08, Spearman = 0.09). Furthermore, management guidance is positively associated with the precision of information released during nonannouncement days, as the positive correlations between NONANN and GUID reflect (Pearson = 0.09, Spearman = 0.12). Companies with larger bid-ask spreads have less precise stock prices during nonannouncement days, as the negative correlations between NONANN and BAS reflect (Pearson = -0.18, Spearman = -0.21).

The correlations between the precision of information released during earnings announcement days (NONANN+ANN) and the main research variables are in the same direction, but smaller, probably because our precision measure is much noisier for earnings because it is based only on 12 trading days.

Larger firms release more news on earnings announcements, as the positive correlation between MV and NEWS (Pearson = 0.18, Spearman = 0.21) and the smaller bid-ask spreads (Pearson = -0.69, Spearman = -0.89) reflect. Also, the bid-ask spreads are negatively correlated with management guidance (Pearson=-0.27, -0.22).

(Table 3 about here)

4. Results

4.1. Change in precision after REG FD

Regulatory shocks may affect the precision of information. Such regulatory shocks may be REG FD and the Sarbanes-Oxley Act (SOX), for instance. REG FD, which came into effect after 2000, is likely to reduce information asymmetry by preventing selective disclosures, but could also reduce the total amount of information available to investors. SOX, which became effective after 2002, aimed at increasing the reliability of financial disclosures, primarily earnings. Both REG FD and SOX are expected to be more effective for firms with larger information asymmetry and less reliable earnings, respectively, namely, smaller firms.

Panel A of Table 4 presents means of the precision variables and the bid-ask spread for small firms (below-median market value of equity) and large firms (above-median market value of equity) before and after REG FD. We find that the average precision of information released during nonannouncement days (NONANN) increased after 2000 for small firms (at the 0.01 level) but decreased for large firms after 2000 (at the 0.01 level). Following REG FD, large firms that often maintained close relations with financial analysts were unable to selectively disclose information to analysts, which may explain the decrease in the precision of information released during nonannouncement days that we document for large firms.

We also document a decrease in bid-ask spreads following the decimalization of stock prices after 2000 and the general decrease in trading costs. Lower trading costs enable more private information to be traded into stock prices, which may also affect the precision of information released during nonannouncement days. The decrease in trading costs had a bigger impact on smaller firms, and the precision of the information released during nonannouncement days increased.

The **incremental** precision of information released during earnings announcements (ANN) increased after 2000 for small firms (at the 0.01 level) and remained similar for large firms. Furthermore, the precision of information released during earnings announcements (NONANN+ANN) increased for small firms (at the 0.01 level) and remained the same for large firms. Overall, information asymmetry has decreased after 2000 for both small and large firms, while the precision of information increased only for small firms.

Panel B presents slope coefficients obtained from estimating the following equation:

$$DEPVAR_{it} = \beta_0 + \beta_1 REGFD_{it} + \eta_{it} \qquad (5)$$

$$DEPVAR_{it} = \{NONANN_{it}, ANN_{it}, [NONANN_{it} + ANN_{it}], BAS_{it}\}.$$

REGFD is an indicator variable that equals 1 for years after 2000, and 0 otherwise. The set of dependent variables ($DEPVAR_{it}$) contains the precision measures NONANN, ANN, and NONANN+ANN, and the bid-ask spread (BAS) as a measure of information asymmetry. Each model is estimated with firm fixed effects. The results are virtually identical to those in panel A: the precision measures improved for small firms after 2000 but are basically unchanged for large firms. The bid-ask spreads decreased for both small and large firms.

(Table 4 about here)

4.2. Cross-sectional analysis of precision

Table 5 presents results of estimating eq. (2), with year and firm fixed effects and with standard errors clustered based on year and firm. The coefficient on firm size (MV) in the full model (column 3) is unexpectedly negative and significant at the 0.01 level (-0.068, t = -6.24). Also, the coefficient on the book-to-market ratio is positive (0.047, t = 3.55) and significant at the 0.01 level. The magnitude of earnings news (NEWS) is positively associated with the precision of information in returns during the quarter (0.017, t=2.79, in column 3), but it is not associated with the precision of information on announcement days (-

0.012, t=-0.59, in column 6). These results suggest the precision of information on announcement days is unrelated to the magnitude of news.

We also estimate eq. (2) without the bid-ask variable and without firm fixed effects (column 1). The coefficients on MV and on earnings news become positive and significant at the 0.01 level, and the coefficient on BM is statistically insignificantly different from 0.

The coefficient on earnings guidance is positive (0.029, t = 3.15), as expected, and significant at the 0.01 level. This result means that releasing earnings guidance increases the precision of information on nonannouncement days. In addition, the coefficient on BAS is negative and significant at the 0.01 level, suggesting that companies with larger information asymmetry, as measured by the bid-ask spread, release less precise information outside earnings announcement.

Column (6) presents results for estimating eq. (3) with NONANN+ANN as the dependent variable (the precision of information released during earnings announcements). The results suggest that the precision of information during earnings announcement days is smaller in large firms, as the negative coefficient on MV reflects (-0.087, t = -4.85). Also, the coefficient on BM is positive (0.053, t = 2.80) and significant at the 0.01 level, suggesting companies with larger book-to-market ratios provide more precise information in stock prices during earnings announcements. In addition, the magnitude to earnings news is not associated with the precision of information released during earnings announcements. Management guidance is not associated with the precision of information released during earnings announcements, probably because management forecasts are provided outside the earnings announcement windows.

Column (7) provides results of estimating eq. (3), but the dependent variable is ANN—the *incremental* precision of information released during earnings announcements. Note that positive (negative) coefficients on the independent variables indicate higher (lower) precision relative to nonannouncement days. We also added NONANN as an additional independent variable. The purpose of this column is to highlight the substitution between precision of information released outside and within earnings announcements. The coefficient on NONANN is negative and significant at the 0.01 level (-0.551, t = -15.16), suggesting that higher precision during nonannouncement days is associated with lower incremental precision of information released during earnings announcements. Also, the results are consistent with those reported in column (3); that is, the coefficient on firm size is negative (at the 0.01 level), the coefficient on BM is positive (at the 0.10 level), and the coefficient on BAS is negative (at the 0.01 level).

(Table 5 about here)

4.3 Precision and the cost of capital

Table 6 presents abnormal returns for quintile portfolios formed based on precision measures and bid-ask spreads. We use a time-calendar portfolio approach to accumulate returns. In each year t, stocks are sorted into quintile portfolios based on the precision of information released during nonannouncement days (NONANN). In each quintile portfolio, stocks are held from February of year t+1 to January of year t+2. For each of the five portfolios, we compute average returns for each month, and regress the time series of monthly returns on Fama and French's (1993) three factors (MRKT, SMB, HML). We also create similar quintile time-calendar portfolios for the incremental precision of information released during earnings announcements (ANN), the precision of information released during earnings announcements (NONANN+ANN), and effective bid-ask spreads (BAS).

As the table shows, firms with larger information precision outside earnings announcements earn lower subsequent abnormal returns, consistent with the argument that larger precision translates to lower cost of capital. We do not find any association between the precision of information released during earnings announcements and subsequent abnormal stock returns. Firms with larger effective bid-ask spreads earn larger subsequent abnormal returns, consistent with the argument that more information asymmetry increases the cost of capital.

The effect of precision on stock returns in this univariate portfolio analysis is quite large. The quintile portfolio of firms with low NONANN earns a monthly abnormal return of 0.60%, whereas the quintile portfolio of firms with high NONANN earns only 0.15%. In annual terms, the difference between the high and low quintiles is 5.4%. Next, we use a multivariate analysis that controls for information asymmetry and firm fixed effects. The effect of precision on subsequent abnormal returns is more modest.

(Table 6 about here)

Table 7 presents results for estimating eq. (5)—the association between information precision and expected stock returns. We estimate the equation with firm and year fixed effects, and with double-clustered standard errors. As the table shows, higher precision of information, both during and outside earnings announcements, is associated with a lower cost of capital, whereas information asymmetry, measured by the bid-ask spread, is associated with a higher cost of capital. These results are consistent with Lambert et al. (2012), who argue that the precision of average information should be priced. We find that the effect of precision on expected returns exists after controlling for information asymmetry.

The coefficients on NONANN are negative and significant at the 0.01 level, in all specifications, suggesting that precision of information released during nonannouncement days reduces the cost of capital. In particular, the coefficient on NONANN in the first specification is -0.513, which means that an increase in precision from the first to the third quartile, from 0.180 to 0.796 according to Table 3, decreases monthly abnormal returns by

0.316%, or about 3.8% annually. After controlling for bid-ask spreads (BAS) in specification 5, the coefficient on NONANN is -0.406, which means that an increase in precision from the first to the third quartile decreases monthly abnormal returns by 0.25%, or about 3% annually.

Furthermore, the *incremental* precision of information released during earnings announcements further decreases the cost of capital, as the negative coefficient on ANN reflects (-0.009, significant at the 0.05 level). The precision of information released during earnings announcements (NONANN+ANN) has the strongest negative effect on the cost of capital per unit of precision; the coefficient on NONANN+ANN is -0.15 (significant at the 0.01 level). Finally, the coefficient on BAS is positive and significant at the 0.01 level (11.73, t = 4.13), suggesting information asymmetry increases the cost of capital.

(Table 7 about here)

Lambert et al. (2012) also argue that competition between investors will reduce the effect of information asymmetry on expected returns, and precision will be priced even in competitive markets. Armstrong et al. (2011) find results consistent with the first prediction, regarding the effect of competition on the pricing of information asymmetry, and we test its effect on the pricing of precision below. We use the following regression:

$$\begin{aligned} ABRET_{it+1} &= \theta_0 + \theta_1 NONANN_{it} + \theta_2 ANN_{it} + \theta_3 BAS_{it} + \theta_4 CMPT_{it} + \\ &\theta_5 CMPT_{it} \times NONANN_{it} + \theta_6 CMPT_{it} \times ANN_{it} + \theta_7 CMPT_{it} \times BAS_{it} + \omega_{it} \,. \end{aligned} \quad (6)$$

We follow Armstrong et al. (2011) in using CMPT, which is a measure of competition between investors and is based on the number of shareholders reported by Compustat. Specifically, $CMPT_{it} = \frac{LSH_{it}}{LMV_{it} \times LTR_{it}}$, where LSH is the natural logarithm of the number of shareholders reported for the fiscal year, divided by the natural logarithm of market value of equity (LMV) multiplied by the natural logarithm of trading turnover (LTR), where trading turnover is the average number of shares traded daily during the year divided by shares outstanding. CMPT is the inverse of the market share of the average investor in trading. When the market share of investors is lower, competition between investors is expected to be higher. Higher competition will diminish the effect of information asymmetry on expected returns, and θ_7 is expected to be negative.

Table 8 presents results for estimating eq. (6), and shows that θ_7 is indeed negative and significant at the 0.01 level (-45.34, t=-3.07). However, competition does not affect the pricing of precision, as predicted by Lambert et al. (2012), and the coefficients on θ_5 and θ_6 reported in Table 8 are not statistically different from 0.

(Table 8 about here)

4.4. Robustness tests

We conducted several sensitivity analyses to check whether our results are sensitive to estimation methods, variable definitions, or sample selection. For each setting, we replicated the entire analysis; however, to save space, we report in Table 9 only the results of estimating eq. (5) for each setting.

The main analysis uses the bid-ask spread (BAS) as a measure of information asymmetry. However, bid-ask spreads may also capture other components of transaction costs, such as inventory risk. We performed our tests using the price impact (PI) instead of the bid-ask spread. PI measures the adverse-selection component of trading costs, and it may be a more accurate measure of information asymmetry. Following Huang and Stoll (1996), we define price impact as $PI_{it} = 100 \times D_{it} \times \{[(V_{it} + 30) - V_{it}]/V_{it}\}$, where V_{it} is the security's bid-ask midpoint at the time of the transaction, and (Vit+30) is the bid-ask midpoint 30 minutes after the transaction, or at 4 p.m. for transactions completed during the last half hour of trading. D_{it} is equal to 1 when a buyer initiated the transaction, and is equal to -1 when a seller initiated it. We use the Lee and Ready (1991) algorithm to determine the direction of the trade. We use TAQ data to estimate the price impact of each transaction.[14] We calculate the daily price impact by averaging the price impact of all transactions during that day, and use the average daily price impact for the year (PI_{it}) as a measure of information asymmetry.

Specification (1) of Table 9 reports the results of estimating eq. (5) with PI instead of BAS. The coefficient on PI is positive and significant at the 0.01 level, suggesting information asymmetry is positively associated with the cost of capital. Also, after we control for PI, the precision of information released during nonannouncement days and the incremental precision of information released during earnings announcement days are both negatively associated with expected stock returns (the coefficient on NONANN is -0.512 and the coefficient on ANN is -0.031, both significant at the 0.05 level or better). Hence, using bid-ask spreads as a measure of information asymmetry does not drive the results.

In estimating the precision measures in eq. (1), we assume daily stock returns are serially independent, because dependence in daily stock returns might lead to a biased slope coefficient. We computed the autocorrelation in daily stock returns for each firm/year and find that the autocorrelation is not significantly different from 0 at the 0.05 level for 31,208 firm/year observations (62% of the sample). We re-estimated eq. (5) using only the 31,208 firm/year observations for which the autocorrelation in daily stock returns is close to 0. The results are reported in specification (2). As before, the coefficients on NONANN are

[14] We delete from the sample trades and quotes with time stamps outside regular trading hours (9:30 a.m. to 4:00 p.m.), as well as a small number of trades and quotes representing possible data errors or with unusual characteristics (Bessembinder, 1999). Specifically, we omit trades if they are indicated in the TAQ database to be coded out of time sequence, or coded as involving an error or a correction. We also omit trades indicated to be exchange acquisitions or distributions, or that involve nonstandard settlements (TAQ Sale Condition codes A, C, D, N, O, R, and Z), as well as trades that are not preceded by a valid same-day quote. We omit quotes if either the ask or bid price is non-positive, or if the differential between the ask and bid prices exceeds $5 or is non-positive. We also omit quotes associated with trading halts or designated order imbalances, or that are non-firm (TAQ quote condition codes 4, 7, 9, 11, 13, 14, 15, 19, 20, 27, and 28).

negative and significant at the 0.01 level, and the coefficients on BAS and PI are positive and significant at the 0.01 level. The coefficient on ANN is negative but not significant at the 0.10 level, suggesting the *incremental* impact of precision of information released during earnings announcements is *similar* to that released during nonannouncement days.

We obtain the precision measures by estimating eq. (1) with raw daily stock returns. We use raw returns because we aim to capture all information in stock returns, both market-wide and firm specific. Changes in the information environment can affect the risk loadings and the interaction between the returns of individual stocks and the market (Hughes et al. 2007, Patton and Verardo 2012). We construct precision measures using abnormal daily returns (based on size, book-to-market, and momentum factors), and estimate eq. (4) using the new precision measures (specification 3). The results are similar to those reported in Table 7, suggesting that using raw daily stock returns in constructing the precision measure does not drive our results.

To construct our precision measures, we estimate eq. (1) using symmetric windows around the month containing the daily return. For instance, the three-month window used in eq. (1), as well as the other windows reported in Table 2, includes the same number of months before and after the month containing the daily return. As a robustness check, we constructed the precision measures using a forward-looking window—a three-month window that includes the month containing the daily returns and the subsequent two months. Using these forward-looking precision measures, we re-estimate eq. (4) and report the results in specification (4) of Table 9. The results are similar to those reported in Table 7, suggesting that using symmetric return windows does not drive the results.

To alleviate concerns of endogeneity or spurious correlation between the precision measures and expected stock returns, we compute the fitted values from eq. (2) and eq. (3), and use those values as our new precision measures in estimating eq. (4). The results, which are reported in specification (5) of Table 9, are consistent with those in Table 7. Overall, results in Table 9 provide support for our main finding: information precision is negatively associated with the cost of capital, whereas information asymmetry is positively associated with the cost of capital.

(Table 9 about here)

We also examine whether precision is priced, using the two-stage cross-sectional regression technique used, for example, by Core et al. (2008). In the first stage, we estimate factor betas, and in the second stage, we estimate factor risk premia. This way, we test whether a proposed risk factor is priced.

In the first stage, we estimate multivariate betas from a single time-series regression of excess returns for a firm (R_q-R_F) on the contemporaneous returns. We include the three Fama-French factors (market, size, book-to-market) and a precision factor. To construct the precision factor, we sort stocks based on the precision of their daily returns; the precision factor is the difference between returns of the stocks in the upper three deciles of precision and the returns of the stocks in the lower three deciles of precision. We use the precision on nonannouncement days, NONANN, because this precision encompasses the majority of trading days during the year. The portfolio is rebalanced every June of year t, based on the precision estimated during year t-1, and returns are value-weighted. We add the precision factor to the Fama–French model, and estimate the multivariate betas using the following time-series regression:

$$R_{q,t} - R_{F,t} = b_0 + b_{q,R_M-R_F}\left(R_{M,t} - R_{F,t}\right) + b_{q,SMB}SMB_t + b_{q,HML}HML_t + b_{q,Precision}Precision_t + \varepsilon_{q,t}. \quad (7)$$

In the second stage, we estimate a cross-sectional regression of excess returns on the factor betas estimated using eq. (7) as follows:

$$\bar{R}_{q,t} - \bar{R}_{F,t} = \lambda_0 + \lambda_1 b_{q,R_M-R_F} + \lambda_2 b_{q,SMB} + \lambda_3 b_{q,HML} + \lambda_4 b_{q,precision} + \varepsilon_q, \quad (8)$$

where $\overline{R}_{q,t} - \overline{R}_{F,t}$ is the mean excess return for asset q.

If the precision factor carries a positive risk premium, the coefficient (λ_4) on the precision factor beta will be positive. We compute standard errors from monthly cross-sectional regressions using the Fama and MacBeth (1973) procedure to mitigate concerns about cross-sectional dependence in the data. Also, because betas in the second-stage regressions are not true betas, they may be measured with error. To mitigate this problem, we estimate eqs. (7) and (8) using 25 size and book-to-market portfolios, as in Fama and French (1993).

Table 10 presents results for estimating eq. (8). The coefficient on the precision factor beta, λ_4, is positive and significant at the 0.10 level, suggesting that precision is priced as a risk factor. The risk premium on the precision factor is 0.513 (0.53% a month). When the model is estimated only with the market and precision factors, the premium on the precision factor is 0.77% a month, and the coefficient is significant at the 0.05 level (t-statistics of 2.47). Our pricing results for the Fama-French three factors are comparable, for example, to those presented by Core et al. (2008).[15]

(Table 10 about here)

7. Summary and Conclusions

This study examines the precision of information impounded in daily prices, its relation to corporate disclosures, and its association with the cost of equity capital. We estimate the precision of information using a methodology similar to that used by Hodrick (1987) and Biais et al. (1999). In particular, we regress long-window stock returns on daily returns. The long-term returns serve as a proxy for the fundamental change in the value of the firm, and the slope coefficient on daily returns is our measure of precision. Less precise

[15] See, for example, Table 4 in Core et al. (2008).

information in daily returns will result in a slope coefficient closer to 0, whereas more precise information in daily stock returns will yield a slope coefficient closer to 1. We use this measure to examine the effect of disclosure on the precision of information reflected in prices, and the association of precision on the cost of equity capital.

We find that precision of information is negatively associated with the cost of equity. The literature debates whether and when information risk is priced. We find that although competition between investors lowers the effect of information asymmetry on expected returns, it does not change the effect of information precision on expected returns, as predicted by theory.

These results may have policy implications. Information asymmetry among investors has been a long-standing concern to securities regulators (e.g., Loss and Seligman, 2001). Regulations aimed at reducing information asymmetry, such as REG FD, which prevents companies from making selective disclosures, can also lower the precision of total information. We indeed find a decrease in the average precision of information in daily stock returns after 2000, when REG FD came into effect. If, as we show empirically, precision of information decreases the cost of equity, regulators should consider the effect of new regulation on precision and not just on information asymmetry.

The precision of information in prices is of importance, regardless of its cost of capital implications. More precise and less noisy stock prices will reduce investor risk in trading individual stocks, and particularly benefit small, undiversified investors. Disclosure should serve the investing decisions of the public, not only of large and institutional investors (U.S. Securities and Exchange Commission 2014). Therefore, the effect of disclosure on precision of information in prices is of interest by itself.

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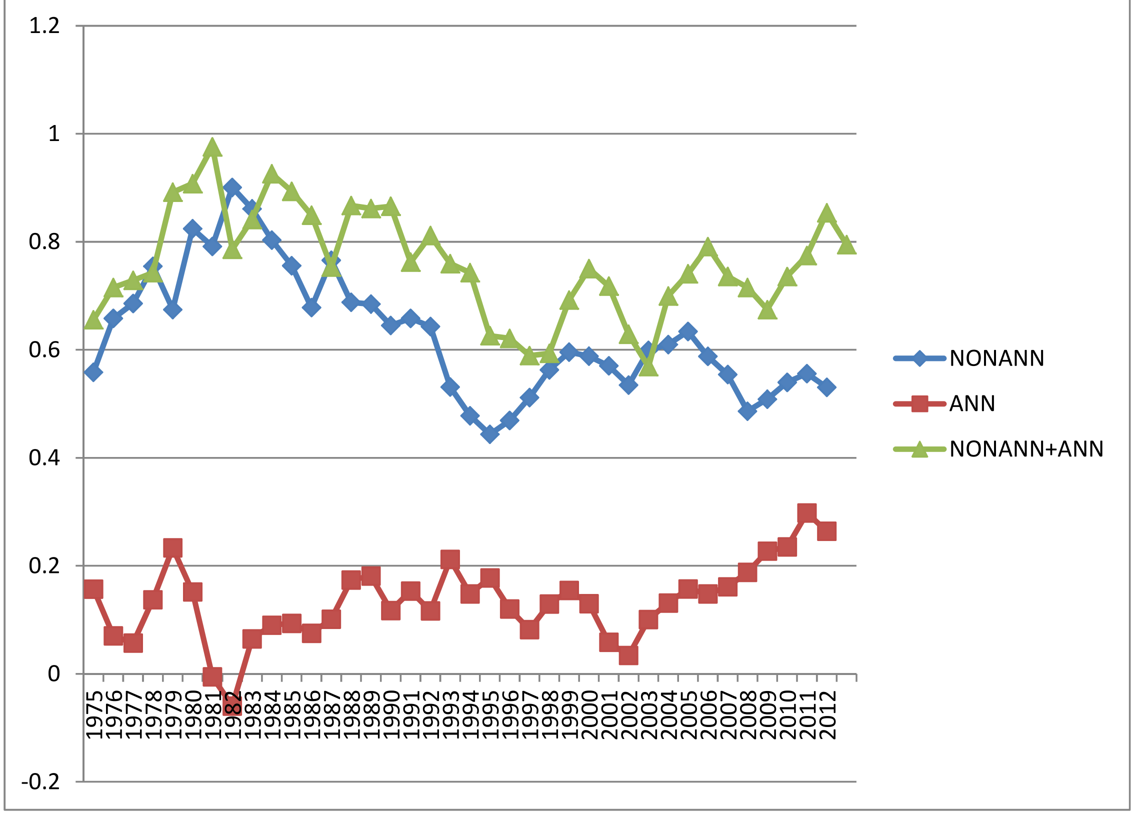
Figure 1 - Precision of Information on Announcement and Nonannouncement Days

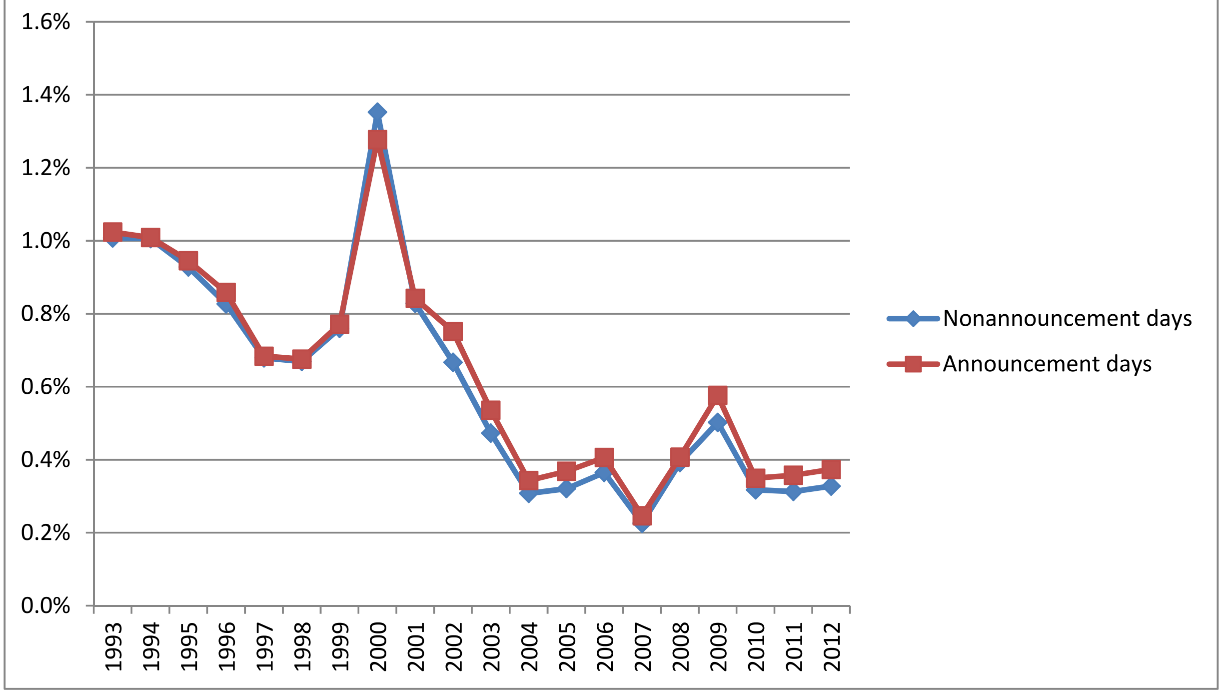


Note: The figure presents annual precision measures for announcement and nonannouncement days. For each stock and calendar year, we estimate eq. (1) using the 252 or so trading days:

$$RET3M(T)_{it} = \gamma_{0t} + \gamma_{1t} ANND_{it} + \gamma_{2t} RET(T)_{it} + \gamma_{3t} ANND_{it} RET(T)_{it} + \varepsilon_{it}, \qquad (1)$$

where $RET(T)_{it}$ is firm 's daily stock return during calendar year T; $RET3M(T)_{it}$ is the return in the three months surrounding the month containing day t; and $ANND_{it}$ is an indicator variable that equals 1 in the 12 days around quarterly earnings announcements during calendar year T, and 0 otherwise. The coefficient γ_2 captures the average precision of information released in non-announcement days (labeled NONANN), and the coefficient γ_3 captures the *incremental* precision of information released in earnings announcement days (labeled, ANN). The sum NONANN+ANN represents the precision of information released during earnings announcement days. Then we compute average annual NONANN and ANN, and plot the three-year moving average in the graph. The sample includes 126,762 firm/year observations.

Figure 2 - Bid-Ask Spreads on Announcement and Nonannouncement Days



Note: The figure presents average effective bid-ask spreads during announcement and nonannouncement days for each year between 1993 and 2012, for NYSE firms.

Table 1
Sample Selection

Criterion	**Obs.**
Firm-years with four quarterly earnings announcement dates on COMPUSTAT and at least 200 trading days on CRSP between 1972 and 2012	126,762
Observations with available risk-adjustment data based on Daniel et al. (1997) for year t+1. Assignment of stocks into benchmark portfolios with data available on R. Russ Wermers' website: http://www.smith.umd.edu/faculty/rwermers/ftpsite/Dgtw/coverpage.htm	98,896
Observations between 1993 and 2012	64,699
Observations with bid-ask spread data from TAQ	50,490

Table 2
Precision Measures for Different Time Horizons

	γ_1	γ_2 NOANN	γ_3 ANN	R-Square	$\gamma_2 + \gamma_3$ NOANN+ANN
RET3M (3 months)	-0.007***	0.674***	0.210***	3.7%	0.884
RET5M (5 months)	-0.000	0.669***	0.275***	4.7%	0.944
RET7M (7 months)	0.004***	0.672***	0.330***	6.0%	1.002
RET9M (9 months)	0.005***	0.649***	0.373***	7.0%	1.022
RET11M (11 months)	-0.001	0.628***	0.356***	7.8%	0.984
RET13M (13 months)	0.001**	0.631***	0.379***	8.7%	1.010

Note: The table presents precision coefficients for nonannouncement and announcement days for return windows ranging from 3 to 13 months. We estimate eq. (1) using different return windows, for the entire sample, and with firm fixed effects:

$$RETXM(T)_{it} = \gamma_{0t} + \gamma_{1t} ANND_{it} + \gamma_{2t} RET(T)_{it} + \gamma_{3t} ANND_{it} RET(T)_{it} + \varepsilon_{it},$$

where $RETXM(T)_{it}$ is the return in the X months surrounding the month containing day t, where X ranges from 3 to 13 months. For example, for the daily returns in June, RET5M is the cumulative return from April 1 to August 31; $RET(T)_{it}$ is firm i's daily stock return; and $ANND_{it}$ is an indicator variable that equals 1 for the 12 days around quarterly earnings announcements during calendar year T, and 0 otherwise. The coefficient γ_2 captures the average precision of information released in non-announcement days (labeled NONANN), and the coefficient γ_3 captures the incremental precision of information released in earnings announcement days (labeled, ANN). The sample includes 126,762 firm/year observations between 1972 and 2012. *, ** and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table 3
Determinants of Precision - Descriptive Statistics and Correlations

Panel A: Descriptive Statistics

Variable	Mean	Std. Dev.	5th Pctl.	25th Pctl.	50th Pctl.	75th Pctl.	95th Pctl.
ANN	0.164	1.637	-2.442	-0.637	0.122	0.950	2.929
NONANN	0.556	0.532	-0.051	0.178	0.437	0.805	1.595
NONANN+ANN	0.721	1.642	-1.652	-0.149	0.534	1.451	3.672
NEWS	1.439	0.528	0.725	1.061	1.351	1.731	2.461
GUID	0.341	0.474	0	0	0	1	1
BAS	0.021	0.026	0.001	0.004	0.011	0.027	0.072
MV	12.38	1.92	9.44	11.00	12.29	13.64	15.71
BM	0.707	0.644	0.135	0.333	0.552	0.865	1.779

Panel B: Correlation Matrix

	ANN	NONANN	NONANN +ANN	NEWS	GUID	BAS	MV	BV
ANN		-0.15***	0.95***	0.00	0.00	-0.02***	0.02***	0.01*
NONANN	-0.16***		0.17***	0.08***	0.09***	-0.18***	0.09***	-0.01***
NONANN+ANN	0.92***	0.15***		0.03***	0.03***	-0.08***	0.05***	0.01
NEWS	0.02***	0.09***	0.07***		0.20***	-0.18***	0.18***	-0.07***
GUID	0.01	0.12***	0.05***	0.2***		-0.27***	0.34***	-0.13***
BAS	-0.03***	-0.21***	-0.11***	-0.27***	-0.36***		-0.69***	0.35***
MV	0.03***	0.16***	0.08***	0.21***	0.35***	-0.89***		-0.40***
BV	0.01**	-0.07***	-0.01***	-0.10***	-0.17***	0.33***	-0.44***	

Note: Panel A presents descriptive statistics for the main variables. Panel B presents a Pearson (above diagonal) and Spearman (below diagonal) correlation matrix for the main variables. The sample includes 50,490 firm-year observations between 1993 and 2012 (the period over which data on bid-ask spreads and management earnings guidance are available). For details on the estimation of NONANN and ANN, see Table 2. *NEWS* is average absolute daily returns on announcement days divided by average daily returns on nonannouncement days. *GUID* is an indicator variable that equals 1 for firms that issued management earnings forecasts, and 0 otherwise. *BAS* is the average effective bid-ask spread during the year. *MV* is the natural logarithm market value of equity at the beginning of the year. *BM* is the book-to-market ratio (book value of equity divided by market value of equity) at the beginning of the year. *, ** and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table 4
The Change in Information Asymmetry and Information Precision after Regulation Fair Disclosure (REGFD)

Panel A	Small Firms			Large Firms		
	before REGFD 1993-2000	**After REGFD 2001-2012**	**T-test Diff**	**before REGFD 1993-2000**	**After REGFD 2001-2012**	**T-test Diff**
# Observations	12,661	19,800		13,242	21,401	
NONANN	0.450	0.526	12.57	0.605	0.580	-4.49
ANN	0.058	0.177	6.41	0.190	0.210	1.12
NONANN+ANN	0.507	0.703	10.48	0.795	0.790	-0.28
BAS	0.040	0.034	-14.30	0.011	0.004	-92.33

Panel B:

Time Period	Small Firms	Large Firms
NONANN	0.047 (5.21)***	-0.029 (-3.99)***
ANN	0.120 (4.21)***	0.008 (0.34)
NONANN + ANN	0.167 (5.77)***	-0.021 (-0.87)
BAS	-0.002 (-4.41)***	-0.005 (-76.97)***

Note: This table presents results of estimating whether the bid-ask spread and the precision of information released during announcement and nonannouncement days have changed since 2000. NONANN denotes precision of information released during nonannouncement days; ANN denotes precision of information released during earnings announcements (see Table 2 for details). BAS is the average effective bid-ask spread during the year. Panel A presents averages for small (below median market value of equity) and large (above median market value of equity) firms both before and after 2000 (t-tests for differences are included). Panel B estimates the following regression with firm fixed effects and reports slope coefficients (t-tests in parentheses). REGFD is an indicator variable that equals 1 for years after 2000 (2001-2012), and 0 otherwise:

$$DEPVAR_{it} = \beta_0 + \beta_1 REGFD_{it} + \eta_{it}$$
$$DEPVAR_{it} = \{NONANN_{it}, ANN_{it}, (NONANN_{it} + ANN_{it}), BAS_{it}\}.$$

The sample includes 67,104 firm-year observations between 1993 and 2012. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table 5
Determinants of Precision – Regression Results

	NONANN	NONANN	NONANN	NONANN +ANN	NONANN +ANN	NONANN +ANN	ANN
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
NONANN							-0.551 (-15.16)***
NEWS	0.054 (7.54)***	0.043 (6.46)***	0.017 (2.79)***	0.039 (2.00)**	0.027 (1.36)	-0.012 (-0.59)	-0.020 (-1.03)
GUID	0.056 (5.46)***	0.049 (4.72)***	0.029 (3.15)***	0.039 (1.93)*	0.030 (1.54)	0.030 (1.21)	0.018 (0.71)
BAS		-4.567 (-8.24)***	-4.812 (-10.12)***		-5.508 (-7.89)***	-6.604 (-9.33)***	-4.438 (-7.59)***
MV	0.020 (4.26)***	-0.020 (-4.64)***	-0.068 (-6.24)***	0.046 (4.92)***	-0.024 (-0.27)	-0.087 (-4.85)***	-0.057 (-3.55)***
BM	0.008 (0.72)	0.020 (1.56)	0.047 (3.55)***	0.065 (3.66)***	0.079 (3.98)***	0.053 (2.81)***	0.032 (1.80)*
Firm effects	NO	NO	YES	NO	NO	YES	YES
Year effects	YES	YES	YES	YES	YES	YES	YES
Observations	50,490	50,490	50,490	50,490	50,490	50,490	50,490
Adj. R^2	3.64%	6.13%	27.39%	0.92%	1.30%	18.61%	19.64%

Note: The dependent variables are NONANN (precision of nonannouncement days), ANN (incremental precision of earnings announcement days), and NONANN+ANN (precision of earnings announcement days). All regressions except column (2) include firm and year fixed-effects and errors that are clustered by firm and year. The sample includes 50,490 firm-year observations between 1993 and 2012. For details on the estimation of NONANN and ANN, see Table 2. *NEWS* is average absolute daily returns on announcement days divided by average absolute daily returns on nonannouncement days. *GUID* is an indicator variable that equals 1 for firms that issued management earnings forecasts, and 0 otherwise. *BAS* is the average effective bid-ask spread during the year. *MV* is the natural logarithm market value of equity at the beginning of the year. *BM* is the book-to-market ratio (book value of equity divided by market value of equity) at the beginning of the year. *, ** and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table 6
Association between Precision and Expected Stock Returns
Univariate Portfolio Analysis

Quintile Portfolios	**NONANN 1993-2012 (N = 50,490)**	**ANN 1993-2012 (N = 50,490)**	**NONANN+ANN 1993-2012 (N = 50,490)**	**BAS 1993-2012 (N = 50,490)**
Low	0.60% (4.48)***	0.29% (2.18)**	0.33% (2.51)***	0.11% (0.91)
2	0.49% (3.89)***	0.30% (2.45)**	0.50% (4.00)***	0.16% (1.45)
3	0.32% (2.76)***	0.50% (4.00)***	0.41% (3.25)***	0.17% (1.29)
4	0.21% (1.68)	0.42% (3.50)***	0.28% (2.42)**	0.40% (2.38)**
High	0.15% (0.99)	0.27% (2.13)**	0.26% (1.96)**	0.95% (3.63)***

Note: The table presents future abnormal stock returns for portfolios formed based on precision measures and bid-ask spreads. In each year t, stocks are sorted into quintile portfolios based on the precision of information released during nonannouncement days (NONANN), the incremental precision of information released during earnings announcements (ANN), the precision of information released during earnings announcements (NONANN+ANN), and effective bid-ask spreads (BAS). Stocks are held from February of year t+1 to January of year t+2. For each of the five portfolios, average returns are computed for each month, and the time series of daily returns are regressed on Fama and French's (1993) three factors (MRKT, SMB, HML).

Table 7
Association between Precision and Expected Stock Returns

		Independent Variables				
Model	**Dependent Variable**	**NONANN**	**ANN**	**NONANN +ANN**	**BAS**	**Obs. Adj-R^2**
1	$\boldsymbol{ABRET_{it+1}}$	-0.513 (-4.83)***				50,490 25.92%
2	$\boldsymbol{ABRET_{it+1}}$		-0.006 (-0.53)			50,490 25.68%
3	$\boldsymbol{ABRET_{it+1}}$			-0.055 (-3.67)***		50,490 25.71%
4	$\boldsymbol{ABRET_{it+1}}$	-0.530 (-4.87)***	-0.033 (-2.39)**			50,490 25.93%
5	$\boldsymbol{ABRET_{it+1}}$	-0.406 (-4.31)***	-0.022 (-1.70)*		41.77 (5.71)***	50,490 27.31%

Note: This table presents results of estimating eq. (5) with year and firm fixed effects, and year and firm double-clustered errors:

$$ABRET_{it+1} = \theta_0 + \theta_1 NONANN_{it} + \theta_2 ANN_{it} + \theta_3 BAS_{it} + \omega_{it} \ . \qquad (4)$$

$ABRET_{it+1}$ is the average monthly risk-adjusted stock return for year t+1 (from February of year t+1 to January of year t+2) in percentage terms, so, for example, 1 is 1% average monthly returns. We adjust monthly returns for size, book-to-market, and momentum quintile portfolios. NONANN is the precision of information released during nonannouncement days; ANN is the incremental precision of information released during earnings announcements (see Table 2 for details); BAS is the average bid-ask spread during the year. The sample includes 50,490 firm-years between 1993 and 2012. *, ** and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table 8
The Effect of Competition on the Pricing of Precision and Information Asymmetry

	Dep. Var. = $ABRET_{it+1}$	
	(1)	(2)
NONANN	-0.389	-0.414
	(-3.75)***	(-3.46)***
ANN	-0.013	-0.010
	(-0.74)***	(-0.52)
BAS	49.69	51.96
	(6.68)***	(6.58)***
CMPT		2.054
		(2.27)**
NONANN*CMPT		0.947
		(1.29)
ANN*CMPT		-0.070
		(-0.41)
BAS*CMPT		-45.35
		(-3.07)***
Observations	41,064	41,064
Adj. R^2	27.93%	27.97%

All regressions include firm and year fixed effects, and errors that are clustered by firm and year. The sample includes 41,064 firm-year observations between 1993 and 2012. For details on the estimation of NONANN and ANN, see Table 2. *BAS* is the average effective bid-ask spread during the year. *CMPT* is the natural logarithm of the number of shareholders deflated by the natural logarithm of market value of equity at the beginning of the year times the natural logarithm of daily trading turnover during the year. *, ** and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table 9
Association between Precision and Expected Stock Returns
Sensitivity Analysis

	Dependent Variable = $ABRET_{it+1}$				
Specification	**NONANN**	**ANN**	**BAS**	**PI**	**Obs. Adj-R^2**
(1) Using PI instead of BAS	-0.512 (-4.80)***	-0.031 (-2.26)**		0.632 (4.19)***	50,490 26.38%
(2) Autocorrelation in daily stock returns in close to zero	-0.248 (-2.94)***	-0.019 (-1.14)	56.67 (5.35)***		31,208 33.29%
	-0.263 (-3.04)***	-0.023 (-1.36)		1.050 (4.01)***	31,208 32.68%
(3) Precision measures are obtained using abnormal daily stock returns	-0.250 (-3.17)***	-0.047 (-2.64)***	38.33 (5.07)***		47,589 25.85%
	-0.339 (-4.36)***	-0.054 (-2.95)***		0.626 (3.22)***	47,589 24.83%
(4) Precision measures are obtained using forward looking return window	-1.016 (-4.97)***	-0.027 (-1.87)*	40.57 (5.78)***		50,490 27.83%
	-1.321 (-5.44)***	-0.038 (-2.69)***		0.621 (4.15)***	50,490 26.51%
(5) Precision measures are the fitted values from Eq. (2) and (3)	-0.317 (-3.88)***	-0.021 (-1.47)	42.92 (5.77)***		50,490 27.25%
	-0.323 (-3.86)***	-0.024 (-1.65)***		0.643 (4.18)**	50,490 26.23%

Note: The table presents results of estimating eq. (5) – the association between information precision and expected abnormal stock returns – for different specifications. All regressions include year and firm fixed effects, and year and firm double-clustered errors. See Table 2 for details on the measurement of precision and Table 5 for equation specification. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Specification (1): We use price impact (PI) instead of bid-ask spreads (BAS) as an explanatory variable. PI is defined as $PI_{it} = 100 * D_{it} * (V_{it}+30 - V_{it}) / V_{it}$, where V_{it} is the security's bid-ask midpoint at the time of the transaction, and Vit+30 is the bid-ask midpoint 30 minutes after the transaction (or at 4 p.m. for trades completed during the last half hour of trading). D_{it} is equal to 1 if the transaction was initiated by a buyer and -1 if it was initiated by a seller.

Specification (2): The analysis is conducted for firm/year observations for which the autocorrelation in daily stock returns is not significantly different from 0 at the 0.05 level (31,208 firm/year observations between 1993 and 2012).

Specification (3): The precision measures are obtained using abnormal stock returns instead of raw returns.

Specification (4): The precision measures are obtained using a forward-looking return window. Specifically, instead of using a symmetric three-month window, we use a window that starts at the first trading day of the month containing the daily return.

Specification (5): The precision measures NONANN and ANN are computed as the fitted values from eq. (2) and eq. (3), respectively.

Table 10
The Pricing of the Precision Factor

		Intercept	$b_{R_M-R_F}$	b_{SMB}	b_{HML}	$b_{precetion}$	Adj. R^2
1	Estimate	1.833	-1.198	0.269	0.370	0.513	77.8%
	FM t-stat	(4.18)***	(-3.17)***	(1.58)	(2.44)**	(1.86)*	
2	Estimate	1.683	-0.963	0.218	0.396		72.4%
	FM t-stat	(3.67)***	(-2.43)**	(1.25)	(2.61)***		
3	Estimate	1.226	-0.474			0.772	34.7%
	FM t-stat	(2.50)**	(-1.17)			(2.47)**	

In this table we estimate whether the precision factor is priced. We use a two-stage cross-sectional regression that estimates factor betas in the first stage and the factor risk premia in the second stage. The table presents the estimated coefficients of the second stage, the cross-sectional regression (8), using 25 size and book-to-market portfolios and using data from 1972 to 2012. The model is:

$$\bar{R}_{q,t} - \bar{R}_{F,t} = \lambda_0 + \lambda_1 b_{q,R_M-R_F} + \lambda_2 b_{q,SMB} + \lambda_3 b_{q,HML} + \lambda_4 b_{q,precision} + \varepsilon_q. \quad (8)$$

$\bar{R}_q - \bar{R}_F$ are the average monthly returns for portfolio q minus the average risk-free monthly rate over the entire sample period. The explanatory variables are full-period factor betas for the 25 size and book-to-market portfolios. $b_{R_M-R_M}$ is the portfolio beta related to the R_M-R_F factor. b_{SMB} is the portfolio beta related to the SMB factor. b_{HML} is the portfolio beta related to the HML factor. $b_{Precision}$ is the portfolio beta related to precision. Standard errors are computed using the Fama and MacBeth (1973) procedure. *, ** and *** denote significance at the 10%, 5%, and 1% levels, respectively.

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