Distress Risk Puzzle and Analyst Forecast Optimism

Abstract

A general consensus in the literature is that financial analysts make optimistic forecasts: they tend to underreact to negative but overreact to positive information. In this study, we invoke this idea to provide an explanation for distress risk puzzle, the phenomenon that high distress risk firms deliver anomalously low subsequent returns. We find that analysts underestimate the implication of the poor performance of higher distress risk firms, and thus make EPS and sales forecasts that are generally more optimistic than the forecasts for the lower distress risk firms. Because market respond to the analyst forecasts, investors initially overvalue the high distress risk firms; later on, when those firms report less than expected performance, analysts revise their forecasts downwards and cause the high distress risk firms to earn low future returns composing of both immediate-forecast-revision responses and post-forecast-revision price drifts. We further document that (quarter) earnings announcements convey substantial amount of information that roughly drive more than 60% of the analyst forecast revisions and 30% of the revision-related market responses.

1. Introduction

Dichev (1998) document that firms with high distress risk tend to earn anomalously lower returns. In this study, we try to provide an explanation for this anomaly (the distress risk puzzle) from the perspective of analyst forecasts. The intuition is that financial analysts tend to underreact to negative information but overreact to positive information (e.g. Easterwood and Nutt 1999), and hence make too optimistic forecasts, such as the earnings per share (EPS) and sales forecasts, for the high distress risk firms. Since investors generally base analyst forecasts to form their expectation about the firms (e.g. Fried and Givoly, 1982; O'Brien, 1988), it will become likely that investors will be initially guided to overvalue the high distress risk firms. Later on, when more information about the firms' poor performance is observed (e.g. from the quarterly earnings reports or press releases), analysts will revise their forecasts downwards that subsequently causes stock prices to drop. Another possible cause of lower returns earned by high distress risk firms is that although analysts revise their forecasts downwards upon receiving of new information, the market does not respond to the forecast revisions timely and fully, but takes few more months to finish the response. This so-called post-forecast-revision price drifts as documented by the literature (e.g. Givoly and Lakonishok 1980) thus suggests that high distress risk firms may earn lower returns, not only around the forecast revision dates but also the period in-between. The purpose of this paper is to provide empirical evidence for these two explanations for the distress risk puzzle.

We follow common practice to use O-Score, probability of default, and credit rating to measure distress risks of the firms (e.g. Dichev 1998; Vassalou and Xing 2004; Avramov et al. 2013). Prior studies generally focus on the EPS forecasts made by the analysts. We also examine the analysts' consensus sales forecasts from I/B/E/S because prior studies document that analysts make less optimistic sales forecasts than the earnings forecasts (e.g. Cheng et al. 2019). We study how analysts make the sales forecasts for the firms with different distress risk levels; and how the revisions of the two forecasts contribute to the low stock returns in the subsequent periods. EPS and sales forecast errors are defined as the (scaled) actual realizations minus the analyst forecasts for the variables at t+1. We find significant negative relations between EPS (sales) forecast errors and the distress risk measures, suggesting that analysts make over-optimistic EPS and sales forecasts for higher distress risk firms.

Presumably, analysts observe the (distress risk) information of firms since the disclosure of the firms' financial reports. Later on when more information is publicly available (e.g. the quarter earnings announcement), analysts will revise their previous forecasts (forecast revision) for the firms. In the current paper's context, we hypothesize and find that analysts *gradually* revise their EPS and sales forecasts for high distress risk firms downwards, when they receive more information about the firms' poor performance. The revised forecasts trigger market to respond downwards that gives rise to the lower returns by the high distress risk firms. We also observe abnormally low stock returns for higher distress risk firms in the periods between forecast revision dates, consistent with the post-forecast-revision price drifts phenomenon. Overall, the empirical evidences suggest that both EPS and sales forecast revisions and the post-forecast-revision price drifts contribute to the lower stock returns earned by high distress risk firms.

Our paper contributes to the analyst forecast and mispricing literature. First, although evidence indicates that analysts underreact to the negative information of firms, it is not clear if this relation exists in firms with high distress risk. This study will first provide such evidence. Second, comparing to prior studies that focus mainly on earnings forecasts, we consider also the sales forecasts. This helps us to understand how analysts behave when they analyze firms in extreme conditions, and hence the potential source of forecast bias for the distressed firms. Third, we show empirically how the distress risk puzzle is contributed by the market's immediate- and post-forecast-revision responses. Finally, prior studies explore factors that explain the cross-sectional variations in forecast revisions and the subsequent market responses (e.g. Clement and Tse, 2003; Gleason and Lee, 2003); however, little is known about how firms' distress status will affect forecast revisions and the associated price drifts. We fill this void by providing evidences for whether firms with high distress risk will incur more pronounced downward forecast revisions, revision price responses, and post-forecast-revision price drifts.

The remainder of this paper proceeds as follows. Section 2 reviews prior research related to our topic and present the main hypotheses. Section 3 describes the sample data and definitions of the major variables. Section 4 provides the empirical results and section 5 concludes.

2. Literature Review and Hypotheses Development

Why are high distress risk firms not rewarded by higher stock returns? To answer this question, a number of studies attempt to provide the so-called risk-based explanations. For example, Garlappi et al. (2008) and Garlappi and Yan (2011) propose that general hump-shaped relations between default probability and equity returns can be obtained when shareholders can extract more value from renegotiation and when there exists shareholder recovery upon financial distress. In other words, the distress risk puzzle is just a manifestation of the 'low risk-low return' phenomenon. In a similar vein, George and Hwang (2010) suggest that firms with high distress cost will optimally choose low leverage to achieve a lower probability of financial distress; but because distress costs heighten a firm's exposure to systematic risk, expected returns are negatively related to the distress probability. Using the Distance-to-Default to measure distress risk, Vassalou and Xings (2004) show that default risk is systematic risk that small caps and firms with high book-to-market ratios earn higher returns when they are with high distress risk. However, they find no significant difference in returns between stocks with high and low default risk in other cases. Indeed, Da and Gao (2010) claim that the abnormally high returns on stocks with high distress risk documented by Vassalou and Xing (2004) are driven by short-term return reversals arising from a liquidity shock triggered by a clientele change.

The risk-based explanations for the negative relation between stock returns and distress risk seem to be setting-specific and incomplete. Another line of research suggests that it is the market imperfection that causes the anomaly. For example, empirical evidence by Campbell et al. (2008) shows that firms with high distress risk are no less risky, as they have much higher return volatilities, market betas and loadings on value and size risk factors than firms with low distress risk. Furthermore, as they use broader measures for distress probability (logit models based on accounting and market variables, and the Distance-to-Default), their results do not seem sensitive to how distress risk is measured. Griffin and Lemmno (2002) show that the low average returns of firms with high distress risk are driven by the poor performance of firms with low book-to-market ratios. Most importantly, they document return reversals around earnings announcement dates, suggesting that firms with high distress risk are mispriced by investors, who are subsequently disappointed by the poor performance of the firms. A recent paper by Kim (2013) provides evidence

and claims that the distress risk anomaly is a manifestation of investors' underpricing (overpricing) of cash flows (accrual) component of earnings, i.e., the accrual anomaly (Sloan, 1996).

Being important participants of financial markets, financial analysts interpret and convey firms' disclosed information to investors (Livnat and Zhang 2012). Their earnings forecasts are believed to be and commonly-used as proxies for the market's expectations about the firms' future earnings (e.g. Fried and Givoly, 1982; O'Brien, 1988); and also stock prices response to analyst forecast revisions (e.g. Givoly and Lakonishok 1980; Imhoff and Lobo 1984; Stickel 1991). Elton et al. (1981) provide further evidence that analyst revisions are more value-relevant than reported earnings per share. Clement and Tse (2003) find that investors react stronger to forecast revisions released earlier in the year.

However, professional as financial analysts are, their forecasts are well-known to be over-optimistic for different reasons. For instance, analysts may have incentives issuing optimistic forecasts to please the firm's management (e.g. Das et al. 1998; Francis and Philbrick 1993; Dugar and Nathan 1995; Dechow et al. 2000; Lim 2001; Cowen et al. 2006; Bradshaw et al. 2006). From psychological point of view, analyst optimism may also be driven by e.g. self-selection bias (e.g. McNichols and O'Brien 1997), firm and analyst characteristics (e.g. Teoh et al. 1998; Bradshaw et al 2001; Drake and Myers 2011; Cheng et al. 2019). Some studies suggest that analysts misinterpret information systematically and make biased forecasts (e.g. DeBondt and Thaler 1990; Abarbanell 1991; Abarbanell and Bernard 1992). Related to our study, and Hwang et al. (1996) and Easterwood and Nutt (1999) provide evidence that poor firm performance correlates with excess forecast optimism.

Following the mispricing argument, our research aims to provide an explanation for the distress risk puzzle from the perspective of analyst forecast optimism. Motivated by the stylized fact that analysts tend to underreact to negative news, we generate the first hypothesis:

H1: Analysts make over-optimistic one-year-ahead forecasts for higher distress risk firms – Forecast errors are negatively related to the distress risk levels of the firm.

Previous studies also document that over-optimistic analyst forecasts relate to subsequent poor firm performance after, e.g., initial public offerings (e.g. Rajan and Servaes 1997; Chahine 2004), equity offerings (e.g. Dechow et al. 2000; Teoh and Wong 2002; Paleari et al. 2007; Lin et

al 2013), corporate external financing activities (Bradshaw et al. 2006). Hughes et al. (2008) document that the predictable component of abnormal returns is significantly associated with future forecast errors and suggest that pricing anomalies are not merely an artifact of inadequately controlled risk. The intuition is that after making the initial forecasts, analysts revise their forecasts (forecast revision) downwards when more information is publicly available. Later on, stock prices drop. We hypothesize that similar argument will apply to distressed firms. That is, the revised downward forecasts trigger market to respond negatively that gives rise to the lower returns by higher distress risk firms.

H2: Analysts revise their one-year-ahead forecasts downwards for higher distress risk firms – Forecast revisions are negatively related to the distress risk levels of the firm.

H3: Market respond downwards around the forecast revision dates for higher distress risk firms – The 3-day cumulative abnormal returns (CAR) around forecast revision dates are positively related to the forecast revisions.

Although market reacts to the forecast revisions, the immediate responses are well-known to be incomplete–Prices continue to drift in the same direction for certain period of time after the revisions (e.g. Givoly and Lakonishok 1980; Stickel 1991; Elgers et al. 2001; Gleason and Lee 2003; Hui and Yeung 2013). Givoly and Lakonishok (1980) is among the earliest studies that document this so-called post-forecast-revision price drifts phenomenon. Stickel (1991) shows that firms having recent upward revisions in consensus forecasts earn higher abnormal returns for a period of up to 12 months than firms having recent downward revised consensus forecasts. In their cross-sectional analysis, Gleason and Lee (2003) provide evidence that post-forecast-revision price drifts are more pronounced for revisions with higher innovation, for revisions made by celebrity analysts, and for firms with lower analyst coverage. In this paper, we hypothesize that (downwards) post-forecast-revision price drift is another channel that contributes to the lower returns earned by high distress risk firms. The intuition is that as follows. Even if analysts become aware that they have underreacted the distress risk information of the firms and make corrections in the new forecasts, investors may still not fully and timely respond to these distress-risk-related corrections by the analysts. (Analysts are supposed more professional market participant than ordinary investors; yet analysts still underreact to the distress risk information of the firms.) If this is the case, the post-forecast-revision price drifts should be explainable by the distress risk levels of the firms.

H4: Low abnormal stock returns for high distress risk firms persist between forecast revision dates – The cumulative abnormal returns between forecast revision dates (price drifts) are negatively related to the distress risk levels of the firms.

To sum up, the four hypotheses are logically-connected to help explain the distress risk puzzle. First, analysts make over-optimistic forecasts for firms with higher distress risk (possibly because analysts underreact the bad (distressed) status of the firms). Then analysts revise their forecasts more downwards for the higher distress risk firms to drive down the stock prices (the low abnormal returns around forecast revision dates). However, market respond to the revisions incompletely and prices continue to drift downwards after the forecast revisions.

3. Data and Variable Definition

We obtain from I/B/E/S the consensus (median) one-year-ahead forecasts and actual values for annual (FPI = 1) sales (the "SAL" variable) and EPS for non-financial firms (SIC codes are <6000 or >6999) from 1997 to 2016 (a total of 20 years). Financial and monthly stock returns data are from Compustat and CRSP respectively. To study the effects of distress risk on analyst forecasting behaviors, analyses are performed on 10 evenly-sized groups of firms ranked according to their distress risk levels at the beginning of each fiscal year such that firms in group 1 (10) have the lowest (highest) distress risk levels. All variables are winsorized at the top/bottom 1 percent level.

3.1 Distress Risk Measures

Sample firms are ranked into ten groups at the beginning of each fiscal year according to their distress risk (DR) measures constructed by their last year's financial or market-related data. Three commonly-used metrics are used to measure the DR levels, namely, O-SCORE (Ohlson 1980), probability of default (PD) (e.g. Merton 1974; Crosbie and Bohn 2003; Vassalou and Xing 2004; Bharath and Shumway 2008), and credit ratings (RATING) (e.g. Vazza et al. 2005; Avramov 2013). By convention, the larger the O-SCORE, PD, and RATING, the higher the distress risk levels of the firms.

O-SCORE is widely used in the literature and we consider it as our benchmark DR measure so that our results are comparable to the findings of earlier studies (e.g. Dichev 1998). However, since O-Score is calculated solely by *historical* accounting data that may not perfectly predict future corporate failure, we use also the probability of default and firms' credit ratings (from the Compustat) as the secondary and tertiary measures for firms' distress risk.[1] Because the latter two measures involve market information and judgements by the market professionals for the firms, using them together with O-Score act as robustness check for our results. Appendix provides the details of how to construct the three DR measures.

3.2 Forecast Errors and Forecast Revisions

We obtain from I/B/E/S one-year-ahead (FY1) consensus (median) forecasts and actual values for annual (FPI = 1) sales (the "SAL" variable) and earnings per share (EPS, adjusted for stock splits and dividends). Assume that it is at the beginning of fiscal year t. We define the one-year-ahead EPS and sales forecast errors as the actual (realized) minus the forecasted values:

$$FE\_EPS_{(j,\,t,\,m)} = [\text{Actual } EPS_{(j,\,t)} - \text{consensus EPS forecast}_{(j,\,t,\,m)}]/Price_{(j,\,m-2d)}$$

$$FE\_S_{(j,\,t,\,m)} = [\text{Actual sales}_{(j,\,t)} - \text{consensus sales forecast}_{(j,\,t,\,m)}]/\text{Actual sales}_{(j,\,t)}$$

where (j, t, m) indicate firm j, fiscal year t and m^{th} fiscal month. Consensus forecast with subscript (j, t, m) thus refers to the forecasted value for the end of fiscal year t, announced at the m^{th} months of fiscal year t.

Analysts revise their forecasts when they observe more information. We define the month-by-month revisions of the one-year-ahead consensus EPS and sales forecasts as:

$$FR\_EPS_{(j,\,t,\,m)} = [\text{Consensus forecast for } EPS_{(j,\,t,\,m)} - \text{consensus EPS forecast}_{(j,\,t,\,m-1)}]/Price_{(j,\,m-2d)}$$

$$FR\_S_{(j,\,t,\,m)} = [\text{Consensus forecast for sales}_{(j,\,t,\,m)} - \text{consensus sales forecast}_{(j,\,t,\,m-1)}]/\text{Actual sales}_{(j,\,t)}$$

[1] Another criticism of using O-SCORE as distress risk measure is that O-SCORE is highly correlated with the firm's accruals (Kim 2013). In other words, the distress risk puzzle may be just a manifesto of the accrual anomaly (Sloan 1996). This motives our study using also probability of default and credit rating as extra measures of distress risk to provide evidence that the distress risk puzzle is not simply equivalent to the accrual.

Again, (j, t, m) indicate firm j, fiscal year t and m^{th} fiscal month. Revision with subscript (j, t, m) thus refers to the change in forecasted value for the end of fiscal year t, announced at the m^{th} months of fiscal year t. Following common practice, EPS forecast errors (revisions) are scaled by $price_{(j, m-2d)}$, stock price two days before the current forecast announcement (revision) date (month). For sales forecast errors and revisions, we use total sales at the end of fiscal year t as the deflators.

3.3 Revision Returns and Post-Forecast-Revision Price Drifts

Stock returns obtained from CRSP are size-adjusted to measure the market responds to a forecast revision and post-forecast-revision price drifts. In each year stocks are ranked into 10 groups based on their market caps. Abnormal returns are then equal to the stock returns minus the value-weighted returns of the size group (portfolio) the stock belongs to. To measure the market response to a forecast revision, we use CAR(-1, 1), 3-day cumulative abnormal returns center on the forecast revision (announcement) date. Post-forecast-revision price drifts between two consecutive forecasts are measured by CAR(2, -2), cumulative abnormal returns from two days after one forecast to two days before the next one. Cumulative (buy-and-hold) abnormal returns is calculated by standard formula: $CAR(-t, t) = \prod_{k=-t}^{+t}(1 + r_k) - \prod_{k=-t}^{+t}(1 + B_k)$, where r_k and B_k are the daily stock and size portfolio returns k^{th} days after the forecast revision date.

4. Empirical Results

4.1 Bivariate Analysis

For a single firm within any fiscal (sample) year, CRET is defined as the 12-month cumulative (buy-and-hold) returns of the firm starting from the 4^{th} month after the last fiscal year end. Within the same fiscal year, AFE_EPS and AFE_S are the averages of all monthly EPS and sales forecast errors; AFR_EPS and AFR_S are the averages of all monthly EPS and sales forecast revisions; ACAR(-1, 1) and ACAR(2, -2) are the averages of all 3-day revision returns and post-forecast-revision price drifts between two consecutive forecasts. (To ease the notation, firm and fiscal year subscripts are not included for the variables.) Table 1 Panel A-C report their median values (by pooling all firm-years belonging to the same distress risk group) for the ten distress risk (DR) groups ranked by O-SCORE, PD and RATING respectively: osgrp, pdgrp and ratgrp 1 (10)

represent lowest (highest) distress firms: the median O-SCORE from -5.71 to 4.48, median PD from 0 to 28.15%, and median RATING from 5 to 16.

<< Insert Table 1 here>>

For all three DR measures, CRET show generally decreasing trends along the corresponding DR groups (except for the very low risk groups): from 6.02% to -16.73% for osgrp; from 9.23% to -3.72% for pdgrp; and from 10.64% to -8.51% for ratgrp.[2] In other words, firms with higher distress risk earn lower stock returns, consistent with the distress risk puzzled as documented by prior literature (e.g. Dichev 1998).

Turning to the two forecast errors and forecast revisions, again obvious decreasing trends are observed for all ten DR groups sorted by the three DR measures. For osgrp, AFE_EPS (AFE_S) decrease from -0.07% (-0.86%) to -0.58% (-20.96%); for pdgrp, from 0.05% (0.34%) to -2.90% (-6.60%); and for ratgrp, from 0.02% (0.64%) to -2.40% (-6.52%). For AFR_EPS (AFR_S), values decrease from -0.02% (-0.04%) to -0.12% (-0.19%) for osgrp; from 0.00% (0.00%) to -0.40% (-1.21%) for pdgrp; and from -0.00% (0.00%) to -0.47% (-1.20%) for ratgrp. Differences between median values of the lowest (1) and highest (10) DR groups are all significant by the two way Wilcoxon test. Overall, the results support Hypothesis 1 and 2 that analysts make both over-optimistic EPS and sales forecasts for higher distress risk firms; and revise their forecasts more downwards for higher distress risk firms.

Note that AFE_EPS (AFE_S) and AFR_EPS (AFR_S) are on an annual basis in the senses that they are constructed by aggregating the monthly forecast errors and forecast revisions. To provide more evidence that analysts revises their forecasts downwards throughout the fiscal year when more information is received, especially for higher distress risk firms, we can look at the trends by monthly $FE\_EPS_{(j, t, m)}$, $FE\_EPS_{(j, t, m)}$, $FE\_EPS_{(j, t, m)}$, $FE\_EPS_{(j, t, m)}$ within the fiscal year. Because there are EPS, sales, forecast errors, forecast revisions, and 3×10 DR groups combinations, to not sidetracking the readers, we put the results into Appendix C and just highlight the main observations in the text. It is shown that both EPS and sales forecast errors generally increase from most negative to least negative values (i.e., increasing trends) from the 1st month (M1) to the last

[2] We also measure the size-adjusted CRET that show similar decreasing trends along the three sets of DR groups: from -10.91% to -26.57% for osgrp, from -11.24% to -15.65% for pdgrp, and from -7.96% to -24.81% for ratgrp.

month (M10) of the fiscal year for the 3×10 DR groups.[3] Furthermore, the increasing trends (forecast errors) are more pronounced (negative) for high distress risk firms low distress risk firms, supporting Hypothesis 1 that analysts tend to make more optimistic forecasts for higher distress risk firms. For the EPS and sales forecast revisions, results show that they are obviously more negative for the higher distress risk firms than the lower distress risk firms, i.e., analysts revise more downwards their forecasts for higher distress risk firms (Hypothesis 2). However, clear trend patterns along the fiscal months are not observed for different distress groups. We take it as reasonable because the magnitude of revisions depends on how much incremental information analysts receive when they make the revisions. There is no theory suggesting that analysts will receive more incremental information when it is closer to the forecast end dates (fiscal year end).

Finally, look at the averages of all 3-day abnormal returns and post-forecast-revision price drifts within the same fiscal year, ACAR(-1, 1) and ACAR(2, -2). For osgrp, ACAR(-1, 1) decrease from -0.16% to –0.22%; for pdgrp, from -0.05% to -0.31%; for ratgrp, -0.01% to -0.35%. Decreasing trends are generally observed, except for the DR groups sorted by O-SCORE and RATING. But still, ACAR(-1, 1) are monotonic decreasing starting from ~DR groups 3-5. For the average price drifts, decreasing trends are far more evident, no exception for the three sets of DR groups. For osgrp, ACAR(2, -2) decrease from -0.94% to -2.13%; for pdgrp, from -0.62% to -1.85%; for ratgrp, -0.72% to -1.86%. The findings that 3-day abnormal returns (center on the forecast revision date) are generally more negative for higher distress risk firms are supportive to Hypothesis 3 that downwards revisions of analyst forecasts contribute to the abnormally low returns earned by high distress risk firms. Whereas price drifts are more negative for higher distress risk firms, this indicates that market responses to forecast revisions are incomplete especially for firms with higher distress risk (Hypothesis 4).

Table 2 reports the rank correlations among major variables that provide extra evidence supporting the four hypotheses. First, EPS and sales forecast errors and forecast revisions are negatively and significantly correlated with all three DR measures. Second, EPS and sales forecasts errors and revisions are positively and significantly correlated with the 12-month cumulative (abnormal) returns, 3-day abnormal returns and post-forecast-revision price drifts. Finally, DR measures are also negatively correlated with the 12-month cumulative (abnormal) returns, 3-day

[3] We do not consider the forecast errors and revisions announced in the 11th month and 12th fiscal month because the number of observations in these two months normally decrease to less than 10% the observations of other fiscal months.

abnormal returns and post-forecast-revision. To further investigate the explicit contribution of forecast revisions on the low returns of higher distress risk firms, we resort to multiple regression analysis in the next section.

<< Insert Table 2 here>>

4.2 Multiple Regression Analysis

Results in the previous section suggest that analysts make over-optimistic EPS and sales forecasts for higher distress risk firm; but later on revise their forecast downwards (Hypotheses 1 and 2). The downwards forecast revisions in turn drive the low abnormal returns of the higher distress risk firms (Hypotheses 3 and 4). In this section, we perform formal regression analysis for the four hypothesis. In the first sets of analysis, averages of all EPS (sales) forecast errors and forecast revisions within the same fiscal year, i.e. AFE_EPS (AFE_S) and AFR_EPS (AFR_S), are regressed on the DR measures, plus the control variables:

$$AFE\_X = \alpha + \beta * DR\_I + \gamma * CTRL + Err \qquad \text{(FER)}$$

$$AFR\_X = \alpha + \beta * DR\_I + \gamma * CTRL + Err \qquad \text{(FRR)}$$

where X = {EPS, S} specifies whether it is the EPS or sales model; DR_I = {O-SCORE_I, PD_I, RATING_I} are the distress risk indicators equal to the firms' belonging DR groups (by the three DR measures) scaled by 10. For convenience, equations with the corresponding DR_I are labeled as the O-SCORE, PD or RATING model; CTRL are the standard control variables including firm size, book-to-market, accruals, dispersion of analyst EPS forecasts, analyst coverage, momentum, trading volume. (See Appendix for their formal definitions). Err is the error terms.

The purposes of the forecast error regressions (FER) and forecast revision regressions (FRR) are to provide evidence that forecast errors and forecast revisions are bigger and stronger for firms with higher distress risk. Thus the variable of interest is the distress risk indicators, i.e. DR_I, and it is expected that $\beta < 0$, i.e., forecast errors and forecast revisions are more negative for higher distress risk firms.

Table 3 reports the pooled yearly regression results: Panel A shows the results for (FER) for the three DR models, and Panel B the results for (FRR) for the three DR models. For (FER), β are

negative for all three DR indicators (namely, O-SCORE_I, PD_I, and RATING_I) for both EPS and sales models. Furthermore, except for O-SCORE_I in EPS model, PD_I and RATING_I in the EPS and sales models are all significant, consistent with Hypothesis 1 that forecast errors are negatively related to the distress risk levels of the firms. Similar results are observed for (FRR). That is, all three DR indicators negatively and significantly explain the EPS and sales forecast revisions, except for the O-SCORE_I in the EPS model. In other words, analysts revise their EPS and sales forecasts more downwards for firms with higher distress risks, as predicted by Hypothesis 2.

<< Insert Table 3 here>>

Why O-SCORE_I is insignificant in the EPS model? We investigate this question by excluding firm size in the models (because coefficients of firm size are all significant in the three EPS models, and firm size is commonly considered as a proxy for distress risk, e.g., Fama and French 1992). Un-tabulated results show that t-values of all three DR indicators in the "no-size" EPS models largely increase, suggesting that O-SCORE and size may share considerable amount of distress risk information to explain EPS forecast errors while PD and RATING embed extra information not pertaining to firm size. Another observation is that firm size has little effect to explain sales forecast errors, suggesting that size has quite different implications to the two forecasts (errors). We leave further investigation to future research.

In the second sets of analysis, averages of all 3-day cumulative abnormal returns within the same fiscal year, i.e. ACAR(-1, 1), are regressed on the EPS and sales forecast revisions, plus the control variables:

$$ACAR(-1, 1) = \alpha + \gamma * AFR\_EPS + \delta * AFR\_S + CTRL + Err \qquad (CARR)$$

where CTRL are the same control variables as before. Err is the error terms.

The purpose of (CARR) is to provide evidence for Hypothesis 3 that EPS and/or sales forecast revisions drive the 3-day abnormal center on the forecast revision dates, i.e. it is expected that $\gamma, \delta > 0$. Table 4 column (1) reports the pool regression results for (CARR). The coefficients of AFR_EPS, i.e. γ, is positively significant. For the sales forecast revisions, δ is positive but not significant. The results suggest that it is mainly the EPS forecast revisions that drive the 3-day cumulative abnormal returns.

<< Insert Table 4 here>>

We need to caution readers that Hypotheses 3 alone is not sufficient to explain the distress risk puzzle because market's immediate responses (e.g. the 3-day CAR) to forecast revisions is well-documented phenomena in the literature (see the Introduction and Literature Review Sections). That is why we also need Hypotheses 1 and 2 as starters to complete the argument for explaining the distress risk puzzle. First, analysts make over-optimistic forecasts for firms with higher distress risk (possibly because analysts underreact the bad (distressed) status of the firms). Later on the analysts revise their forecasts more downwards for the higher distress risk firms. The *more pronounced* downward forecast revisions then induce more negative market responses (the 3-day abnormal returns) of the firms.

To provide more supports for the above argument. We conduct an extra test for whether investors' over-pricings of the higher distress risk firms are (or partially) due to analysts' underreaction to the distress risk information of the firms. Specifically, we investigate how forecast revisions and distress risk information as confounding variables affect the 3-day abnormal returns by including the distress risk indicators, DR_I = {O-SCORE_I, PD_I, RATING_I}, to (CARR). The idea is that if the lower returns of the higher distress risk firms are (or partially) due to the stronger distress-risk-related forecast revisions for the firms, including the distress risk indicators in the regressions should weaken the explanatory powers (significance, in terms of t-values) of the EPS and sales forecast revisions, i.e. AFR_EPS and AFR_S.[4] For completeness, we also include the interaction terms of distress risk indicators and forecast revisions (namely, DR_I×AFR_EPS and DR_I×AFR_EPS) as extra control variables to detect whether the forecast revisions have differential effects on the stock returns with respective to different distress risk levels. The modified model is as follows:

$$\text{ACAR}(-1, 1) = \alpha + \beta * \text{DR\_I} + \gamma * \text{AFR\_EPS} + \delta * \text{AFR\_S} + \varepsilon * \text{DR\_I} \times \text{AFR\_EPS} + \zeta * \text{DR\_I} \times \text{AFR\_S} + \text{CTRL} + \text{Err} \qquad \text{(CARR')}$$

[4] An alternate argument is that if investors do not fully consider the distress risk information of the firms when pricing the stocks, the distress risk information in the forecast revisions should explain the 3-day abnormal returns. Teoh and Wong (2002) invoke similar argument for explaining whether analysts misinterpret the information of accruals when pricing IPO stocks. Teoh and Wong (2002) use predicted forecast errors (by the issue-year accruals) to explain the future returns of the IPO firms.

Table 4 columns (2), (3) and (4) report the pool regression results for (CARR') for the three DR models. The coefficients of DR_I, i.e. β, are negatively significant in all except for the O-SCORE model. Most importantly, the significances of AFR_EPS and AFR_S in all three DR models reduce substantially. Now, AFR_EPS is only barely significant in the O-SCORE model, and AFR_EPS is only barely significant in the RATING model. In other words, the EPS and sales forecast revisions are indeed reflecting the distress risk information of firms to affect their 3-day abnormal stock returns. For the two interaction terms, only the RATING indicator and sales forecast revisions interaction, i.e. RATING_I×AFR_S, is significant in the RATING model. All other interaction terms are insignificant. The result suggests that it is not the differential sensitivities of forecast revisions to distress risk levels that explain the *immediate* low abnormal returns; rather it is the larger magnitudes of the downward forecast revisions that drive the low abnormal returns of the higher distress risks firms.

In the last sets of analysis, averages of all post-forecast-revision price drifts within the same fiscal year, i.e. ACAR(2, -2), are regressed on the DR measures, EPS and sales forecast revisions, their interaction terms with the distress risk indicators, plus the other control variables:

$$\text{ACAR}(2,-2) = \alpha + \beta*\text{DR\_I} + \gamma*\text{AFR\_EPS} + \delta*\text{AFR\_S} + \varepsilon*\text{DR\_I}\times\text{AFR\_EPS} + \zeta*\text{DR\_I}\times\text{AFR\_S} + \text{ACAR}(-1,1) + \text{CTRL} + \text{Err} \qquad \text{(DRR)}$$

where DR_I = {O-SCORE_I, PD_I, RATING_I} are the distress risk indicators equal to the firms' belonging DR groups (by the three DR measures) scaled by 10. For convenience, equation with the corresponding DR_I are labeled as the O-SCORE, PD or RATING model; CTRL are the same control variables as before. Err is the error terms. We follow Gleason and Lee (2003) to also include the 3-day cumulative abnormal returns, i.e. ACAR(-1, 1), as an extra control variable for the information content of the forecast revisions.

The purpose of the drift regression (DRR) is to provide evidence for Hypothesis 4 that post-forecast-revision price drifts are more pronounced for higher distress risk firms, i.e. it is expected that $\beta > 0$. The intuition is that even if analysts become aware that they have underreacted the distress risk information of the firms and make corrections in the new forecasts, investors may still not fully and timely respond to these distress-risk-related revisions by the analysts. In other words, the post-forecast-revision price drifts should still be explainable by the distress risk levels of the firms after controlling for the revision contents by including the EPS and sales forecast revisions and ACAR(-

1, 1).[5] For completeness, we also include the interaction terms between distress risk levels and forecast revisions to the regressions.

Table 5 reports the pool regression results for (DRR) for the three models. DR_I are negatively significant for all three DR models, as predicted by Hypothesis 4. For the two forecast revisions, it is only the sales forecast revisions, i.e. AFR_S, that reduce their explanatory powers (in terms of t-values) in the three DR models; for the EPS forecast revisions, i.e. AFR_EPS, their significances remain (even slightly increase) in the three models, consistent with the findings of the literature (e.g. Gleason and Lee 2003). Overall, evidences suggest that market underreact to the distress risk information embedded in both EPS and sales forecast revisions.

Turning to the interaction terms, the (distress risk indicators)×(sales forecast revisions) terms, i.e. DR_I×AFR_S, are all positive (but only significant in the O-SCORE model). That is, sales forecast revisions have (slightly) stronger effect on the price drifts by higher distress risk firms, suggesting that market had underreacted to the sales forecast revisions more for the higher distress risk firms, and as a result their subsequent price drifts are more pronounced. In contrast to the sales forecast revisions, the (distress risk indicators)×(EPS forecast revisions) terms, i.e. DR_I×AFR_EPS, are negative for all three models, indicating that EPS forecast revisions have actually weaker effects on the price drifts by higher distress risk firms. Or equivalently, market had already responded to the EPS forecast revisions *sufficiently* for the higher distress risk firms than for the lower distress firms, and thus the drifts for the higher distress firms become *relatively* weaker.[6]

<< Insert Table 5 here>>

4.3 Further Analysis

In this section we investigate the effect of earnings information on the returns behaviors of the firms. The idea is that analysts revises their forecast when they receive more information about the firms, including surely the earnings information (e.g. from quarter earnings announcements) and

[5] By including both revisions as the control variables, we can see whether sales forecast revisions also contribute to the price drifts, as well as the EPS forecast revisions. To the best of our knowledge, the post-sales-forecast-revision price drifts are not studied in the literature before.

[6] If the 3-day abnormal returns (the immediate responses) and the post-forecast-revision price drifts are somewhat balance on both sides. The non-trivial interaction terms in the DRR can explain why the interaction terms in the CARR are insignificant.

other information. We want to know how much portion of the (low) abnormal returns of the (high distress risk) firms are contributed by the earnings information. Specifically, we exclude all 1st analyst forecasts (revisions) after the quarter earnings announcements and then calculate the sum of all EPS and sales forecast revisions (i.e. SFR_EPS and SFR_S), 3-day abnormal returns around revisions, i.e. SCAR(-1, 1), and post-forecast-revision price drifts, i.e. SCAR(2, -2) within the same fiscal years.

Table 6 Panel A-C report their median values (by pooling all firm-years belonging to the same distress risk group) for the ten distress risk (DR) groups ranked by O-SCORE, PD and RATING respectively: osgrp, pdgrp and ratgrp 1 (10) represent lowest (highest) distress firms. First look at the EPS and sales forecast revisions, comparing before and after excluding the 1st forecast revisions after the quarter earnings announcements, SFR_EPS and SFR_S drop substantially by an average percentages of about 70% and 60% for the three sets of DR groups. The drop percentages are distinctly bigger for higher distress risk firms than lower distress risk firms; but SFR_EPS and SFR_S (excluding the 1st forecast revisions after earnings announcements) still show clear decreasing trends along the DR groups, i.e. larger EPS and sales forecast revisions for higher distress firms. Turning to the 3-day abnormal returns and price drifts, comparing before and after excluding the 1st revisions after the quarter earnings announcements, SCAR(-1, 1) and SCAR(2, -2) drop by an average percentages of about 35% and 30% for the three sets of DR groups. The drop percentages are, however, more or less the same within each set of DR groups. As before, SCAR(-1, 1) and SCAR(2, -2) are more negative for higher distress risk firms, after excluding the 1st forecast revisions after earnings announcements, and clear decreasing trends remain. Overall, the results indicate that (quarter) earnings announcements convey important information that non-trivially affect the analyst forecast revisions and the subsequent market responses.

<< Insert Table 6 here>>

5. Conclusion

This study provides an explanation for the high distress risk but low stock returns puzzle from the analysts forecast perspective. We use O-SCORE, probability of default, and credit rating as proxy for distress risk, and examine the analyst earnings per share (EPS) and sales forecasts for

the sample firms. Generally consistent results are obtained when firms are ranked by the three independent distress risk measures. This provides extra evidence for the debate that the distress risk puzzle may be merely special case results due to the use of a particular measure such as the O-SCORE (e.g. Kim 2013).

Four logically-linked hypotheses are proposed that lay out the whole argument for explaining the distress risk puzzle. First, analysts make over-optimistic forecasts for firms with higher distress risk. Then the analysts revise their forecasts more downwards for the higher distress risk firms to drive down the stock prices. Finally, market respond to the forecast revisions incompletely and prices continue to drift downwards after the forecast revisions.

Empirical evidences are generally supportive for the four hypotheses, namely, we observed significant negative relations between (EPS and sales) forecast errors (revisions) and distress risk levels of the firms. The within-fiscal-year averages of 3-day abnormal returns (CAR) are positively related to the EPS forecast revisions. Finally, the within-fiscal-year averages of post-forecast-revision price drifts are more pronounced for higher distress risks firms. The 3-day immediate market responses and the post-forecast-revision price drifts constitute the low abnormal returns of higher distress risk firms.

Our paper contributes to the analyst forecast and mispricing literature. We provide evidences that analysts underreact to the distress risk status of firms, and that analyst EPS and sales forecasts are more biased for the higher distress risk firms. We show that both EPS and sales forecast revisions explain the 3-day abnormal returns around forecast revisions and the post-forecast-revision price drifts; and most importantly distress risk information is a determinant of the cross-sectional variations in the post-forecast-revision price drifts associated with analyst (EPS and sales) forecast revisions. Finally, we document that (quarter) earnings announcements convey substantial amount of information that roughly drive more than 60% of the analyst forecast revisions and 30% of the revision-related market responses.

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Table 1: Bivariate Analysis

Panel A: Sample firms are ranked by the O-SCORE into ten DR groups (osgrp) each year

osgrp	N	O-Score	AFE_EPS	AFE_S	AFR_EPS	AFR_S	CRET	ACAR(-1,1)	ACAR(2,-2)
1	5427	-5.71	-0.07%	-0.86%	-0.02%	-0.04%	6.02%	-0.16%	-0.94%
2	5410	-3.92	-0.08%	-0.89%	-0.03%	-0.04%	7.64%	-0.16%	-0.92%
3	5428	-2.97	-0.11%	-0.65%	-0.03%	-0.05%	7.70%	-0.12%	-0.83%
4	5423	-2.31	-0.16%	-0.75%	-0.03%	-0.06%	7.46%	-0.10%	-0.94%
5	5424	-1.75	-0.13%	-1.03%	-0.03%	-0.08%	7.90%	-0.08%	-0.84%
6	5442	-1.21	-0.13%	-1.48%	-0.04%	-0.09%	8.19%	-0.10%	-0.97%
7	5504	-0.67	-0.20%	-1.98%	-0.04%	-0.17%	7.42%	-0.10%	-0.88%
8	5623	0.01	-0.39%	-3.10%	-0.07%	-0.24%	4.50%	-0.13%	-1.04%
9	5815	1.10	-0.68%	-5.38%	-0.13%	-0.33%	-0.14%	-0.16%	-1.20%
10	6288	4.48	-0.58%	-20.96%	-0.12%	-0.19%	-16.73%	-0.22%	-2.13%
(10-1)			-0.51%***	-20.09%***	-0.09%***	-0.15%***	-22.75%***	-0.06%***	-1.19%***

Panel B: Sample firms are ranked by the PD into ten DR groups (pdgrp) each year

pdgrp	N	PD	AFE_EPS	AFE_S	AFR_EPS	AFR_S	CRET	ACAR(-1,1)	ACAR(2,-2)
1	4320	0.00%	0.05%	0.34%	0.00%	0.00%	9.23%	-0.05%	-0.62%
2	4303	0.00%	0.02%	-0.30%	0.00%	-0.01%	9.08%	-0.05%	-0.75%
3	4312	0.00%	0.00%	-0.50%	-0.01%	-0.02%	9.96%	-0.08%	-0.85%
4	4337	0.00%	-0.09%	-0.91%	-0.02%	-0.05%	7.84%	-0.08%	-0.83%
5	4359	0.00%	-0.19%	-1.60%	-0.04%	-0.10%	7.32%	-0.11%	-0.98%
6	4382	0.00%	-0.30%	-1.76%	-0.06%	-0.13%	6.79%	-0.12%	-1.01%
7	4396	0.00%	-0.58%	-3.11%	-0.10%	-0.25%	3.09%	-0.19%	-1.11%
8	4439	0.02%	-0.76%	-3.97%	-0.15%	-0.38%	1.35%	-0.19%	-1.33%
9	4503	0.85%	-1.37%	-5.34%	-0.23%	-0.61%	0.03%	-0.20%	-1.50%
10	4613	28.15%	-2.90%	-6.60%	-0.40%	-1.21%	-3.72%	-0.31%	-1.85%
(10-1)			-2.95%***	-6.94%***	-0.40%***	-1.21%***	-12.96%***	-0.27%***	-1.23%***

Panel C: Sample firms are ranked by the RATING into ten DR groups (ratgrp) each year

ratgrp	N	RATING	AFE_EPS	AFE_S	AFR_EPS	AFR_S	CRET	ACAR(-1,1)	ACAR(2,-2)
1	2116	5.00	0.02%	0.64%	0.00%	0.00%	10.64%	-0.01%	-0.72%
2	1955	7.00	0.03%	0.66%	0.00%	0.01%	11.77%	0.03%	-0.64%
3	2087	9.00	0.02%	0.24%	-0.01%	-0.02%	13.51%	-0.01%	-0.64%
4	1390	10.00	-0.04%	-0.24%	-0.02%	-0.02%	8.50%	-0.08%	-0.80%
5	1419	11.00	-0.06%	-0.12%	-0.02%	-0.05%	10.18%	-0.05%	-0.86%
6	1769	12.00	-0.11%	-0.56%	-0.03%	-0.04%	9.42%	-0.07%	-0.80%
7	2262	13.00	-0.21%	-1.35%	-0.05%	-0.19%	8.53%	-0.08%	-0.94%
8	1385	14.00	-0.34%	-2.26%	-0.07%	-0.25%	4.48%	-0.16%	-0.85%
9	1398	15.00	-1.09%	-4.35%	-0.20%	-0.71%	1.77%	-0.25%	-1.34%
10	1056	16.00	-2.40%	-6.52%	-0.47%	-1.20%	-8.51%	-0.35%	-1.86%
(10-1)			-2.41%***	-7.16%***	-0.46%***	-1.20%***	-19.16%***	-0.34%***	-1.14%***

This table presents the median values of CRET, defined as the 12-month cumulative (buy-and-hold) returns of the firm starting from the 4th month after the last fiscal year end; AFE_EPS and AFE_S, the averages of all monthly EPS and sales forecast errors within the same fiscal year; AFR_EPS and AFR_S, the averages of all monthly EPS and sales forecast revisions within the same fiscal year; and ACAR(-1, 1) and ACAR(2, -2), the averages of all 3-day revision returns and post-forecast-revision price drifts between two consecutive forecasts within the same fiscal year. Appendix A describes the detailed definitions of the variables. Median values are calculated by pooling all firm-years belonging to the same distress risk group, where the ten distress risk (DR) groups are ranked by O-SCORE, PD and RATING respectively: osgrp, pdgrp and ratgrp 1 (10) represent lowest (highest) distress firms. Results for the three sets of DR groups are reported in Panel A, B and C respectively. (10-1) report the differences between the median values of the highest (10) and lowest (1) DR groups. Significance are tested by the two way Wilcoxon test. *** Significant at the 1% level; ** Significant at the 5% level; * Significant at the 10% level.

Table 2: Rank Correlations Among Major Variables

	O-SCORE	PD	RATING	AFE_EPS	AFE_S	AFR_EPS	AFR_S	CRET	ACAR(-1, 1)
O-SCORE									
PD	0.39								
RATING	0.48	0.52							
AFE_EPS	-0.09	-0.22	-0.17						
AFE_S	-0.14	-0.23	-0.20	0.34					
AFR_EPS	-0.13	-0.36	-0.22	0.64	0.33				
AFR_S	-0.18	-0.31	-0.21	0.27	0.52	0.42			
CRET	-0.02	**-0.01**	-0.07	0.02	0.02	0.02	**0.01**		
ACAR(-1,1)	-0.02	-0.07	-0.07	0.11	0.06	0.11	0.03	**0.00**	
ACAR(2,-2)	-0.03	-0.13	-0.04	0.32	0.15	0.28	0.12	-0.03	**-0.01**

This table presents the Spearman rank correlations among major variables: O-SCORE, PD and RATING, the three DR measures; CRET, defined as the 12-month cumulative (buy-and-hold) returns of the firm starting from the 4th month after the last fiscal year end; AFE_EPS and AFE_S, the averages of all monthly EPS and sales forecast errors within the same fiscal year; AFR_EPS and AFR_S, the averages of all monthly EPS and sales forecast revisions within the same fiscal year; ACAR(-1, 1) and ACAR(2, -2), the averages of all 3-day cumulative (buy-and-hold) abnormal returns and post-forecast-revision price drifts between two consecutive forecasts within the same fiscal year. Appendix A describes the detailed definitions of the variables. Correlations are calculated by pooling all firm-years data. All correlations (except those bolded) are significant at the 1% level.

Table 3: Forecast Error Regression and Forecast Revision Regressions

Panel A: EPS and sales forecast error regressions for the three DR models

Variables	EPS models			Sales models		
O-SCORE_I	-0.002			-0.110***		
	(-0.859)			(-7.716)		
PD_I		-0.027***			-0.045***	
		(-11.974)			(-4.332)	
RATING_I			-0.043***			-0.099***
			(-5.047)			(-3.234)
SIZE	0.007***	0.005***	0.006***	-0.006	-0.001	0.002
	(7.225)	(4.143)	(3.051)	(-1.074)	(-0.199)	(0.438)
TACC	-0.007	-0.005	-0.029***	-0.002	0.022	-0.036
	(-1.016)	(-0.597)	(-2.659)	(-0.045)	(0.507)	(-0.825)
DISP	0.001*	0.001	0.001	-0.001	-0.002	-0.000
	(1.789)	(1.584)	(1.338)	(-0.816)	(-1.044)	(-0.354)
MOMEN	0.031***	0.031***	0.030***	0.051***	0.046***	0.030***
	(18.165)	(15.715)	(8.023)	(9.591)	(7.841)	(4.941)
ES	0.121***	0.097***	0.223***	0.214***	0.163**	0.194*
	(4.620)	(3.295)	(3.355)	(2.768)	(1.961)	(1.740)
L_VOL	-0.004***	-0.001	-0.004	-0.019***	-0.014***	-0.018***
	(-3.761)	(-0.693)	(-1.626)	(-4.062)	(-2.726)	(-2.863)
L_ANA	-0.004***	-0.005***	-0.011***	0.035***	0.031***	0.008
	(-3.110)	(-3.133)	(-4.417)	(4.315)	(3.303)	(0.798)
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
N	41084	33664	14576	37069	30256	13565
R^2	0.412	0.441	0.372	0.471	0.513	0.275

Panel B: EPS and sales forecast revision regressions for the three DR models

Variables	EPS models			Sales models		
O-SCORE_I	-0.000			-0.008***		
	(-1.235)			(-6.556)		
PD_I		-0.004***			-0.015***	
		(-18.533)			(-12.151)	
RATING_I			-0.007***			-0.038***
			(-6.918)			(-6.523)
SIZE	0.001***	0.001***	0.001***	0.006***	0.005***	0.004***
	(11.452)	(5.407)	(3.523)	(14.823)	(10.287)	(3.901)
TACC	-0.002***	-0.002***	-0.004***	0.003	0.005	-0.008
	(-4.533)	(-3.678)	(-3.107)	(0.884)	(1.262)	(-0.981)
DISP	0.000***	0.000***	0.000**	-0.000	-0.000	-0.000
	(3.238)	(2.703)	(2.501)	(-0.550)	(-1.042)	(-0.380)
MOMEN	0.002***	0.002***	0.001***	-0.001	-0.004**	-0.013***
	(12.079)	(9.357)	(2.847)	(-0.799)	(-2.289)	(-3.849)
ES	0.027***	0.025***	0.041***	0.070***	0.066***	0.150***
	(12.505)	(10.116)	(6.837)	(6.065)	(4.938)	(3.945)
L_VOL	-0.001***	-0.000***	-0.001***	-0.005***	-0.004***	-0.005***
	(-9.779)	(-3.490)	(-4.451)	(-12.543)	(-7.139)	(-5.228)
L_ANA	-0.001***	-0.001***	-0.002***	-0.006***	-0.006***	-0.010***
	(-6.729)	(-5.406)	(-7.430)	(-8.095)	(-7.121)	(-6.331)
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
N	41222	33790	14626	37320	30354	13556
R^2	0.375	0.398	0.358	0.353	0.369	0.355

Table 3 (Continue)

This table presents the pooled yearly regression results for the three DR models. Panel A reports the results for the forecast error regressions (FER), where averages of all EPS (sales) forecast errors within a fiscal year, i.e. AFE_EPS (AFE_S), are regressed on the DR measures plus the control variables; Panel B reports the results for the forecast revision regressions (FRR), where averages of all EPS (sales) forecast revisions within a fiscal year, i.e. AFR_EPS (AFR_S), are regressed on the DR measures plus the control variables. Control variables include firm size, book-to-market, accruals, dispersion of analyst EPS forecasts, analyst coverage, momentum, trading volume. Appendix A describes the detailed definitions of the variables. *** Significant at the 1% level; ** Significant at the 5% level; * Significant at the 10% level.

Table 4: 3-Day Cumulative Abnormal Returns Regressions

Variables	(1)	(2)	(3)	(4)
AFR_EPS	0.105***	0.146*	0.120	0.098
	(3.027)	(1.859)	(1.239)	(0.889)
AFR_S	0.008	-0.012	-0.019	-0.022*
	(1.360)	(-0.764)	(-1.110)	(-1.829)
SIZE	-0.000***	-0.000***	-0.001***	-0.000
	(-2.588)	(-2.961)	(-2.684)	(-0.328)
TACC	0.001	0.001	-0.000	-0.002
	(0.734)	(0.538)	(-0.135)	(-0.733)
MOMEN	0.004***	0.004***	0.004***	0.004***
	(12.514)	(12.804)	(11.814)	(8.728)
ES	-0.005	-0.006	-0.006	-0.006
	(-1.377)	(-1.606)	(-1.588)	(-0.601)
L_ANA	-0.001**	-0.001*	-0.000	-0.001***
	(-2.005)	(-1.935)	(-0.654)	(-3.237)
DISP	-0.000***	-0.000***	-0.000***	-0.000**
	(-2.796)	(-2.657)	(-2.621)	(-2.418)
L_VOL	-0.000**	-0.000**	-0.000	-0.000*
	(-2.056)	(-2.023)	(-1.241)	(-1.708)
O-SCORE_I		-0.001		
		(-1.387)		
O-SCORE_I×AFR_EPS		-0.054		
		(-0.445)		
O-SCORE_I×AFR_S		0.027		
		(1.191)		
PD_I			-0.002***	
			(-3.154)	
PD_I ×AFR_EPS			-0.035	
			(-0.270)	
PD_I ×AFR_S			0.031	
			(1.493)	
RATING_I				-0.003***
				(-2.655)
RATING_I ×AFR_EPS				-0.049
				(-0.324)
RATING_I ×AFR_S				0.052**
				(2.486)
Year fixed effect	Yes	Yes	Yes	Yes
N	37320	37320	30354	13556
R^2	0.249	0.249	0.274	0.228

This table presents the pooled yearly regression results for the 3-day cumulative abnormal returns regressions. Column (1) reports the results for (CARR), where averages of all 3-day cumulative abnormal returns within the same fiscal year, i.e. ACAR(-1, 1), are regressed on the EPS and sales forecast revisions plus the control variables; Columns (2)-(4) report the results for (CARR') for the three DR models, where distress risk indicators, i.e. DR_I = {O-SCORE_I, PD_I, RATING_I}, and their interaction terms with the the EPS and sales forecast revisions (namely, DR_I×AFR_EPS and DR_I×AFR_EPS) are included as extra control variables. Control variables include firm size, book-to-market, accruals, dispersion of analyst EPS forecasts, analyst coverage, momentum, trading volume. Appendix A describes the detailed definitions of the variables. *** Significant at the 1% level; ** Significant at the 5% level; * Significant at the 10% level.

Table 5: Post-Forecast-Revision Price Drifts Regressions

Variables	O-SCORE model	PD model	RATING model
AFR_EPS	1.792***	1.193**	1.618***
	(4.723)	(2.462)	(5.394)
AFR_S	-0.134**	0.038	-0.009
	(-2.113)	(0.603)	(-0.314)
SIZE	-0.007***	-0.009***	-0.007***
	(-11.359)	(-11.819)	(-7.130)
TACC	-0.006	-0.004	-0.008
	(-1.439)	(-0.940)	(-1.403)
MOMEN	0.043***	0.042***	0.040***
	(36.045)	(32.742)	(25.145)
ES	-0.019	-0.018	-0.011
	(-1.229)	(-1.067)	(-0.376)
L_ANA	-0.001	-0.001	-0.001
	(-1.271)	(-1.143)	(-0.874)
DISP	0.000	0.000	0.000**
	(0.759)	(0.158)	(2.217)
L_VOL	-0.000	0.000	0.001
	(-0.451)	(0.373)	(1.487)
O-SCORE_I	-0.006***		
	(-3.167)		
O-SCORE_I×AFR_EPS	-1.612**		
	(-2.459)		
O-SCORE_I×AFR_S	0.288***		
	(3.023)		
PD_I		-0.007***	
		(-4.107)	
PD_I ×AFR_EPS		-0.738	
		(-1.004)	
PD_I ×AFR_S		0.045	
		(0.507)	
RATING_I			-0.022***
			(-6.224)
RATING_I ×AFR_EPS			-1.103***
			(-2.712)
RATING_I ×AFR_S			0.075
			(1.377)
ACAR(-1, 1)	-0.465***	-0.435***	-0.425***
	(-9.236)	(-8.640)	(-6.197)
Year fixed effect	Yes	Yes	Yes
N	37313	30351	13556
R^2	0.435	0.463	0.495

This table presents the pooled yearly regression results for the drift regression (DRR) for the three DR models, where averages of all post-forecast-revision price drifts within the same fiscal year, i.e. ACAR(2, -2), are regressed on the distress risk indicators i.e. DR_I = {O-SCORE_I, PD_I, RATING_I}, EPS and sales forecast revisions, their interaction terms, plus the other control variables. Control variables include firm size, book-to-market, accruals, dispersion of analyst EPS forecasts, analyst coverage, momentum, trading volume. 3-day cumulative abnormal returns, i.e. ACAR(-1, 1), is included to control for information content of the forecast revisions. Appendix A describes the detailed definitions of the variables. *** Significant at the 1% level; ** Significant at the 5% level; * Significant at the 10% level.

Table 6: The Effects of Earnings Information on Forecast Revisions and Abnormal Returns

	Before	After	After / Before	Before	After	After / Before	Before	After	After / Before	Before	After	After / Before
Panel A: Sample firms are ranked by the O-SCORE into ten DR groups (osgrp) each year												
osgrp	**SFR _EPS**	**SFR_EPS**		**SFR_S**	**SFR_S**		**SCAR (-1, 1)**	**SCAR (-1, 1)**		**SCAR (2, -2)**	**SCAR (2, -2)**	
1	-0.23%	-0.06%	25.09%	-0.35%	-0.15%	43.44%	-1.56%	-0.95%	61.13%	-8.68%	-6.21%	71.55%
2	-0.24%	-0.07%	27.21%	-0.33%	-0.13%	40.76%	-1.48%	-0.85%	57.60%	-8.52%	-5.88%	68.95%
3	-0.29%	-0.09%	30.66%	-0.44%	-0.18%	41.06%	-1.14%	-0.78%	68.06%	-7.67%	-5.80%	75.62%
4	-0.34%	-0.12%	36.09%	-0.50%	-0.19%	38.55%	-0.94%	-0.74%	78.87%	-8.58%	-6.40%	74.59%
5	-0.30%	-0.10%	32.07%	-0.67%	-0.19%	28.88%	-0.82%	-0.51%	61.77%	-7.86%	-5.69%	72.43%
6	-0.36%	-0.12%	33.01%	-0.71%	-0.32%	44.74%	-0.92%	-0.35%	38.40%	-9.06%	-5.97%	65.93%
7	-0.40%	-0.12%	31.08%	-1.39%	-0.56%	40.60%	-0.99%	-0.58%	58.76%	-8.03%	-6.06%	75.39%
8	-0.70%	-0.25%	36.19%	-2.02%	-0.83%	40.97%	-1.15%	-0.68%	59.45%	-9.35%	-6.05%	64.66%
9	-1.19%	-0.45%	37.98%	-2.86%	-1.17%	40.94%	-1.38%	-1.06%	76.68%	-9.87%	-7.00%	70.91%
10	-0.98%	-0.28%	28.75%	-1.42%	-0.51%	35.64%	-1.78%	-1.42%	79.55%	-15.58%	-10.62%	68.17%
Mean			31.81%			39.56%			64.03%			70.82%
Panel B: Sample firms are ranked by the PD into ten DR groups (pdgrp) each year												
pdgrp	**SFR _EPS**	**SFR_EPS**		**SFR_S**	**SFR_S**		**SCAR (-1, 1)**	**SCAR (-1, 1)**		**SCAR (2, -2)**	**SCAR (2, -2)**	
1	0.00%	0.01%	n.a.	0.00%	0.02%	n.a.	-0.45%	-0.34%	74.80%	-5.91%	-4.01%	67.75%
2	-0.03%	0.00%	0.00%	-0.07%	0.00%	5.68%	-0.50%	-0.35%	69.53%	-7.06%	-4.84%	68.61%
3	-0.09%	-0.01%	14.94%	-0.15%	-0.07%	44.30%	-0.77%	-0.42%	54.27%	-7.84%	-5.53%	70.53%
4	-0.20%	-0.06%	28.00%	-0.42%	-0.15%	35.00%	-0.75%	-0.57%	76.09%	-7.85%	-5.78%	73.61%
5	-0.43%	-0.16%	36.60%	-0.78%	-0.39%	50.54%	-1.07%	-0.50%	46.39%	-8.95%	-6.30%	70.41%
6	-0.58%	-0.23%	39.22%	-1.12%	-0.40%	36.05%	-1.12%	-0.63%	55.92%	-9.10%	-6.47%	71.10%
7	-1.02%	-0.39%	38.35%	-2.09%	-0.84%	39.93%	-1.72%	-1.13%	65.71%	-10.05%	-7.59%	75.52%
8	-1.43%	-0.61%	42.39%	-3.31%	-1.42%	42.96%	-1.68%	-1.21%	72.00%	-11.50%	-8.59%	74.64%
9	-2.21%	-0.95%	42.83%	-5.36%	-2.05%	38.34%	-1.71%	-1.11%	64.64%	-12.75%	-8.99%	70.57%
10	-3.75%	-1.89%	50.54%	-10.62%	-4.78%	45.04%	-2.73%	-1.91%	70.20%	-14.94%	-10.51%	70.36%
Mean			32.54%			37.54%			64.96%			71.31%
Panel C: Sample firms are ranked by the RATING into ten DR groups (ratgrp) each year												
ratgrp	**SFR _EPS**	**SFR_EPS**		**SFR_S**	**SFR_S**		**SCAR (-1, 1)**	**SCAR (-1, 1)**		**SCAR (2, -2)**	**SCAR (2, -2)**	
1	-0.03%	0.00%	1.18%	0.00%	0.17%	n.a.	-0.11%	-0.16%	144.61%	-6.91%	-5.15%	74.56%
2	-0.05%	0.00%	4.61%	0.07%	0.09%	122.53%	0.33%	0.05%	13.86%	-6.13%	-4.12%	67.27%
3	-0.11%	-0.04%	33.72%	-0.13%	-0.04%	32.90%	-0.10%	-0.20%	209.32%	-6.22%	-4.72%	75.80%
4	-0.23%	-0.08%	33.78%	-0.14%	-0.05%	35.42%	-0.84%	-0.67%	79.28%	-7.70%	-5.45%	70.83%
5	-0.22%	-0.07%	32.14%	-0.40%	-0.09%	21.66%	-0.54%	-0.16%	29.89%	-7.80%	-5.80%	74.38%
6	-0.34%	-0.10%	28.90%	-0.36%	-0.18%	51.22%	-0.67%	-0.25%	37.47%	-7.59%	-4.50%	59.27%
7	-0.50%	-0.20%	39.07%	-1.61%	-0.84%	52.48%	-0.77%	-0.76%	98.04%	-8.68%	-6.16%	70.98%
8	-0.72%	-0.31%	43.75%	-2.34%	-1.06%	45.17%	-1.49%	-1.18%	79.12%	-7.83%	-5.15%	65.85%
9	-1.85%	-0.88%	47.66%	-6.24%	-3.04%	48.82%	-2.23%	-1.19%	53.27%	-11.59%	-7.51%	64.80%
10	-4.33%	-2.58%	59.57%	-10.84%	-5.37%	49.51%	-2.99%	-1.73%	57.81%	-16.30%	-13.09%	80.27%
Mean			32.44%			51.08%			80.27%			70.40%

This table presents the median values of SFR_EPS and SFR_S, the sum of all monthly EPS and sales forecast revisions within the same fiscal year; and SCAR(-1, 1) and SCAR(2, -2), the sum of all 3-day revision returns and post-forecast-revision price drifts between two consecutive forecasts within the same fiscal year, before and after excluding the 1st forecast revisions after (quarter) earnings announcements. Appendix A describes the detailed definitions of the variables. Median values are calculated by pooling all firm-years belonging to the same distress risk group, where the ten distress risk (DR) groups are ranked by O-SCORE, PD and RATING respectively: osgrp, pdgrp and ratgrp 1 (10) represent lowest (highest) distress firms. Results for the three sets of DR groups are reported in Panel A, B and C respectively.

Appendix A. Definitions of the Major Variables

	Variables	Definitions
DR Measures	O-SCORE	Calculated by using the coefficients from Model 1 in Ohlson (1980).
	PD	The market value of the firm minus the face value of the firm's debt and then divided by the volatility of the firm using Merton DD model.
	RATING	The numeric rating is 1 = AAA, 2 = AA+, … If the rating is below B-, numeric rating is set to 17. Ratings are from Compustat.
	O-SCORE_I	Calculated by ranked O-SCORE and then scaled by 10.
	PD_I	Calculated by ranked probability of default and then scaled by 10.
	RATING_I	Calculated by ranked credit ratings and then scaled by 10.
Forecast Errors	$FE\_EPS_{(j, t, m)}$	Actual earnings per share at the end of current fiscal year t minus consensus (median) earnings per share forecast for firm j announced at the m^{th} month of the current fiscal year t scaled by stock price 2 days before the current forecast announcement date.
	$AFE\_EPS_{(j, t)}$	Average of all EPS forecast errors for firm j within the same fiscal year t.
	$SFE\_EPS_{(j, t)}$	Sum of all EPS forecast errors for firm j within the same fiscal year t.
	$FE\_S_{(j, t, m)}$	Actual sales at the end of current fiscal year t minus consensus (median) sales forecast for firm j announced at the m^{th} month of the current fiscal year t scaled by the actual sales at the end of the last fiscal year.
	$AFE\_S_{(j, t)}$	Average of all sales forecast errors for firm j within the same fiscal year t.
	$SFE\_S_{(j, t)}$	Sum of all sales forecast errors for firm j within the same fiscal year t.
Forecast Revisions	$FR\_EPS_{(j, t, m)}$	Consensus (median) earnings per share forecast for firm j announced at the m^{th} month of the current fiscal year t minus consensus (median) earnings per share forecast for firm j announced at the $m\text{-}1^{th}$ month of the current fiscal year t scaled by the stock price 2 days before the current forecast announcement date.
	$AFR\_EPS_{(j, t)}$	Average of all EPS forecast revisions for firm j within the same fiscal year t.
	$SFR\_EPS_{(j, t)}$	Sum of all EPS forecast revisions for firm j within the same fiscal year t.
	$FR\_S_{(j, t, m)}$	Consensus (median) sales forecast for firm j announced at the m^{th} month of the current fiscal year t minus consensus (median) sales forecast for firm j announced at the $m\text{-}1^{th}$ month of the current fiscal year t scaled by the actual sales at the end of the last fiscal year.
	$AFR\_S_{(j, t)}$	Average of all sales forecast revisions for firm j within the same fiscal year t.
	$SFR\_S_{(j, t)}$	Sum of all sales forecast revisions for firm j within the same fiscal year t.

	CAR(-1, 1)	3-day cumulative (buy-and-hold) abnormal returns centered on the forecast announcement date. Abnormal returns are size-adjusted by subtracting the stock returns value-weighted returns of the size group the stock belongs to.
	ACAR(-1, 1)	Average of all 3-day cumulative (buy-and-hold) abnormal returns within the same fiscal year.
	SCAR(-1, 1)	Sum of all 3-day cumulative (buy-and-hold) abnormal returns within the same fiscal year.
	CAR(2, -2)	Cumulative (buy-and-hold) abnormal returns from 2 days after one forecast to 2 days before the next one. Abnormal returns are size-adjusted by subtracting the stock returns value-weighted returns of the size group the stock belongs to.
	ACAR(2, -2)	Average of all post-forecast-revision price drifts between two consecutive forecasts within the same fiscal year.
	SCAR(2, -2)	Sum of all post-forecast-revision price drifts between two consecutive forecasts within the same fiscal year.
	CRET	12-month buy-and-hold returns starting from the 4th month after the beginning of the current fiscal year.
Control Variables	SIZE	Natural logarithm of the year end market value of equity.
	BTM	Book-to-market ratio at the beginning of the current fiscal year.
	DISP	Standard deviation of analyst EPS forecasts over the seven-month horizon before the last fiscal year end deflated by the price at the previous fiscal-year end and multiplied by 100. See e.g. Barron et al. (1998); Kim and Zhang (2017)
	ES	Changes in earnings per share deflated by last year's stock price. See e.g. Lang and Lundholm (1996).
	L_VOL	Natural log of the sum of the monthly trading volume over the 12-month period before the earliest earnings forecast included in the sample. See e.g. (Hayes, 1998).
	L_ANA	Natural logarithm of the number of analysts following a firm. See e.g. Lang and Lundholm (1996).
	MOMEN	Market-adjusted returns over the six months prior to the beginning of the current fiscal year. See e.g. So (2013)
	TACC	Change in noncash current assets minus the change in current liabilities, excluding the current portion of long-term debt and taxes payable, minus depreciation expense, scaled by total assets. See e.g. Kim (2013).

Appendix B. Distress Risk Measures

In this Appendix, we highlight the methods to calculate the three distress risk measures used in this paper. For further technical details, please refer to the reference papers being cited.

B1. O-SCORE

Similar to Dichev (1998), O-SCORE for firm j at the end of fiscal year t is calculated by Equation A1 below with the coefficients from the Model 1 in Ohlson (1980). For simplicity, firm and time subscripts in are skipped.

$O\text{-}SCORE_{(t)}$ = – 1.32 – 0.407*log(total assets/GNP price – level index) + 6.03*(total liabilities/total assets) – 1.43*(working capital/total assets) + 0.076*(current liabilities/current assets) – 1.72*(1 if total liabilities > total assets; else 0) – 2.37*(net income/total assets) – 1.83*(funds from operations/total liabilities) + 0.285*(1 if net loss for the last two years; else 0) – 0.521*(net $income_{(t)}$ – net $income_{(t-1)}$]/[|net $income_{(t)}$| + |net $income_{(t-1)}$|] (A1)

B2. Probability of Default

The probability of default (PD) for every firm each year is calculated in the spirit of the Merton (1974) model. When the market value of a firms' total assets (hereafter, firm value) is greater than the face value of the firm's debt outstanding, equity holders find it profitable to continue owning the firm. Otherwise, the equity holders declares bankruptcy. PD thus refers to the probability that the firm goes into bankruptcy within certain period of time.

Firm value, V (> 0), is assumed following geometric Brownian motion:

$$dV = \mu V dt + \sigma_v V dW,$$

where μ is the expected return (continuously compounded) on V, σ_v is the volatility of V and dW is the standard Wiener process. The firm has an outstanding pure discount bond with face value F maturing in T years. Thus, the equity of the firm is a European call option on the underlying value of the firm with strike price and time-to-maturity equal F and T. By the Black-Scholes-Merton formula (Black and Scholes 1973), the value of the equity today, E, is given by

$$E = V\,\mathrm{N}(d_1) - e^{-rT} F\,\mathrm{N}(d_2), \quad \text{(B1)}$$

where E is the market value of the firm's equity, r is the instantaneous risk-free rate, $\mathcal{N}(\cdot)$ is the cumulative standard normal distribution function, $\mathrm{d}_1 = \frac{\ln\left(\frac{V}{F}\right)+(r+0.5\sigma_v^2)T}{\sigma_v\sqrt{T}}$ and $\mathrm{d}_2 = \mathrm{d}_1 - \sigma_v\sqrt{T}$. Furthermore, by the Ito's lemma:

$$\sigma_E = \left(\frac{V}{E}\right)\frac{\partial E}{\partial V}\sigma_V = \left(\frac{V}{E}\right)\mathcal{N}(d_1)\sigma_V, \qquad \text{(B2)}$$

where σ_E is the volatilities of the equity. Equation B2 is to translate the volatility of equity to the volatility of total assets because the market value of total assets and its volatility are unobservable.

Following Bharath and Shumway (2008), Equations (B1) and (B2) are solved by iterative procedure for V's and σ_v's every day in the previous year. (Specially, the initial value of σ_v is set to σ_E[E/(E + F)], where σ_E, E and F are observable parameters. We then calculate the implied log return on assets each day and use the returns series to generate new estimates of σ_v and μ. The procedure is repeated until the calculated σ_V converges, i.e., the absolute difference in adjacent σ_v's is less than 10^{-3}). Then the distance to default (DD) is calculated as$\mathrm{DD} = \frac{\ln\left(\frac{V}{F}\right)-(\mu-0.5\sigma_v^2)T}{\sigma_v\sqrt{T}}$, and the corresponding (implied) probability of default within one year (assuming T = 1) is:

$$PD = \mathcal{N}(-DD)$$

B.3 Credit Rating

The third proxy for distress risk is credit rating (RATING) that evaluate the credit risk of a firm as debtor. The higher its credit rating, the higher the chance the firm will be able to pay back its outstanding debts (i.e., lower distress risk). Credit ratings of sample firms are obtained from Compustat, and following Avramov et al. (2013), we assign numeric value to each symbolic ratings as AAA = 1, AA+ = 2, etc. If the rating is below B–, the value is set to 17. The higher number of RATING, the higher the financial risk.

Appendix C. Monthly EPS and Sales Forecast Errors and Forecast Revisions

Panel A: Sample firms are ranked by the O-SCORE into ten DR groups (osgrp) each year

FE_EPS

osgrp	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10
1	-0.22%	-0.15%	-0.10%	-0.08%	-0.04%	-0.03%	0.00%	0.00%	0.02%	0.03%
2	-0.24%	-0.15%	-0.10%	-0.08%	-0.07%	-0.06%	-0.02%	0.00%	0.00%	0.02%
3	-0.30%	-0.20%	-0.14%	-0.11%	-0.09%	-0.08%	-0.04%	0.00%	0.00%	0.02%
4	-0.41%	-0.29%	-0.22%	-0.17%	-0.14%	-0.12%	-0.09%	-0.04%	0.00%	0.00%
5	-0.37%	-0.25%	-0.18%	-0.14%	-0.10%	-0.09%	-0.06%	-0.02%	0.00%	0.00%
6	-0.44%	-0.28%	-0.18%	-0.15%	-0.12%	-0.10%	-0.07%	-0.03%	0.00%	0.00%
7	-0.58%	-0.39%	-0.27%	-0.24%	-0.17%	-0.14%	-0.10%	-0.05%	-0.04%	0.00%
8	-1.17%	-0.83%	-0.59%	-0.53%	-0.41%	-0.35%	-0.27%	-0.14%	-0.11%	-0.03%
9	-2.00%	-1.53%	-0.93%	-0.85%	-0.63%	-0.55%	-0.44%	-0.27%	-0.17%	-0.10%
10	-1.54%	-1.21%	-0.82%	-0.69%	-0.42%	-0.38%	-0.33%	-0.18%	-0.08%	0.00%

FE_S

osgrp	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10
1	-5.25%	-4.80%	-3.88%	-3.17%	-2.99%	-2.73%	-2.19%	-2.02%	-1.75%	-1.08%
2	-4.79%	-4.66%	-4.35%	-3.39%	-3.21%	-2.87%	-2.43%	-2.21%	-1.89%	-1.16%
3	-3.78%	-3.45%	-3.36%	-2.67%	-2.49%	-2.54%	-2.01%	-1.73%	-1.50%	-1.06%
4	-4.21%	-3.84%	-3.36%	-2.84%	-2.89%	-2.81%	-2.30%	-2.22%	-2.14%	-1.37%
5	-4.70%	-4.89%	-4.30%	-3.63%	-3.00%	-3.05%	-2.61%	-2.18%	-1.84%	-1.17%
6	-5.69%	-5.11%	-4.44%	-3.57%	-3.01%	-2.81%	-2.47%	-2.36%	-2.08%	-1.47%
7	-9.33%	-8.51%	-7.46%	-5.89%	-5.24%	-4.52%	-3.83%	-3.50%	-2.87%	-2.20%
8	-15.45%	-13.59%	-11.28%	-9.71%	-8.36%	-7.55%	-6.42%	-5.73%	-5.03%	-3.93%
9	-30.57%	-26.39%	-21.80%	-17.38%	-14.88%	-13.68%	-11.76%	-10.01%	-9.61%	-7.82%
10	-94.00%	-78.34%	-60.58%	-48.52%	-37.18%	-32.74%	-28.15%	-26.23%	-24.20%	-18.85%

FR_EPS

osgrp	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10
1	-0.03%	-0.03%	-0.04%	-0.02%	0.03%	-0.03%	-0.03%	0.02%	-0.04%	-0.04%
2	-0.03%	-0.04%	-0.04%	-0.03%	0.04%	-0.03%	-0.04%	0.02%	-0.04%	-0.05%
3	-0.04%	-0.06%	-0.06%	-0.03%	0.04%	-0.02%	-0.04%	0.01%	-0.04%	-0.05%
4	-0.05%	-0.06%	-0.07%	-0.04%	0.03%	-0.03%	-0.04%	0.01%	-0.05%	-0.06%
5	-0.06%	-0.07%	-0.07%	-0.04%	0.04%	-0.03%	-0.04%	0.02%	-0.04%	-0.06%
6	-0.07%	-0.09%	-0.08%	-0.05%	0.03%	-0.03%	-0.05%	0.03%	-0.05%	-0.07%
7	-0.07%	-0.09%	-0.10%	-0.05%	0.03%	-0.04%	-0.05%	0.03%	-0.04%	-0.07%
8	-0.11%	-0.15%	-0.19%	-0.11%	-0.04%	-0.06%	-0.07%	-0.05%	-0.07%	-0.10%
9	-0.21%	-0.28%	-0.40%	-0.16%	-0.09%	-0.08%	-0.10%	-0.08%	-0.11%	-0.12%
10	-0.23%	-0.35%	-0.43%	-0.25%	-0.12%	-0.14%	-0.08%	-0.07%	-0.13%	-0.07%

FR_S

osgrp	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10
1	0.01%	0.02%	0.01%	0.02%	0.05%	0.01%	0.01%	0.04%	-0.01%	-0.01%
2	-0.01%	0.02%	-0.02%	0.01%	0.04%	0.01%	-0.02%	0.04%	-0.02%	-0.03%
3	-0.03%	-0.03%	-0.03%	0.00%	0.05%	-0.01%	-0.02%	0.03%	-0.03%	-0.04%
4	-0.04%	-0.04%	-0.04%	-0.03%	0.04%	-0.01%	-0.03%	0.03%	-0.04%	-0.05%
5	-0.05%	-0.08%	-0.08%	-0.04%	0.03%	-0.04%	-0.05%	-0.03%	-0.05%	-0.07%
6	-0.09%	-0.12%	-0.11%	-0.07%	0.03%	-0.04%	-0.06%	-0.04%	-0.05%	-0.09%
7	-0.11%	-0.16%	-0.15%	-0.11%	-0.06%	-0.06%	-0.08%	-0.10%	-0.07%	-0.12%
8	-0.16%	-0.26%	-0.25%	-0.17%	-0.12%	-0.09%	-0.12%	-0.13%	-0.11%	-0.14%
9	-0.26%	-0.36%	-0.38%	-0.24%	-0.18%	-0.13%	-0.16%	-0.18%	-0.14%	-0.18%
10	-0.55%	-0.66%	-0.75%	-0.47%	-0.34%	-0.24%	-0.31%	-0.42%	-0.26%	-0.36%

Panel B: Sample firms are ranked by the PB into ten DR groups (pdgrp) each year

FE_EPS

pdgrp	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10
1	0.05%	0.06%	0.06%	0.06%	0.04%	0.04%	0.04%	0.04%	0.04%	0.04%
2	0.00%	0.00%	0.02%	0.03%	0.02%	0.02%	0.03%	0.02%	0.03%	0.04%
3	-0.08%	-0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.03%
4	-0.23%	-0.14%	-0.09%	-0.09%	-0.07%	-0.06%	-0.03%	0.00%	0.00%	0.02%
5	-0.52%	-0.38%	-0.29%	-0.23%	-0.18%	-0.15%	-0.11%	-0.05%	-0.02%	0.00%
6	-0.71%	-0.56%	-0.39%	-0.35%	-0.30%	-0.26%	-0.21%	-0.12%	-0.10%	-0.04%
7	-1.27%	-0.99%	-0.76%	-0.64%	-0.52%	-0.48%	-0.39%	-0.20%	-0.17%	-0.09%
8	-1.80%	-1.45%	-1.12%	-0.93%	-0.67%	-0.62%	-0.51%	-0.29%	-0.21%	-0.10%
9	-2.75%	-2.24%	-1.88%	-1.61%	-1.20%	-1.11%	-0.95%	-0.60%	-0.51%	-0.38%
10	-5.26%	-4.65%	-3.92%	-3.37%	-2.62%	-2.45%	-2.20%	-1.43%	-1.24%	-0.91%

FE_S

pdgrp	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10
1	-2.76%	-2.78%	-2.31%	-1.45%	-1.27%	-1.11%	-0.80%	-0.90%	-0.97%	-0.49%
2	-3.29%	-2.85%	-2.92%	-2.13%	-2.44%	-2.27%	-1.89%	-1.83%	-1.62%	-0.96%
3	-4.48%	-4.01%	-3.68%	-3.24%	-3.34%	-3.20%	-2.89%	-2.84%	-2.49%	-1.60%
4	-7.44%	-7.04%	-6.07%	-5.09%	-4.78%	-4.45%	-3.72%	-3.56%	-2.89%	-2.18%
5	-12.29%	-10.50%	-9.07%	-7.17%	-6.39%	-5.68%	-4.87%	-4.78%	-4.41%	-3.20%
6	-10.82%	-10.05%	-9.45%	-7.50%	-6.48%	-6.20%	-5.47%	-5.13%	-4.79%	-3.64%
7	-19.85%	-16.22%	-13.28%	-10.97%	-9.16%	-8.17%	-6.81%	-6.04%	-5.44%	-4.01%
8	-20.17%	-17.40%	-14.52%	-12.02%	-9.98%	-9.36%	-8.08%	-7.47%	-6.57%	-4.84%
9	-27.08%	-23.70%	-18.41%	-14.82%	-11.70%	-10.65%	-9.27%	-8.02%	-7.45%	-5.98%
10	-32.40%	-26.86%	-21.16%	-17.20%	-13.49%	-12.16%	-10.32%	-8.39%	-7.53%	-6.18%

FR_EPS

pdgrp	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10
1	0.01%	0.02%	0.01%	0.02%	0.05%	0.01%	0.01%	0.04%	-0.01%	-0.01%
2	-0.01%	0.02%	-0.02%	0.01%	0.04%	0.01%	-0.02%	0.04%	-0.02%	-0.03%
3	-0.03%	-0.03%	-0.03%	0.00%	0.05%	-0.01%	-0.02%	0.03%	-0.03%	-0.04%
4	-0.04%	-0.04%	-0.04%	-0.03%	0.04%	-0.01%	-0.03%	0.03%	-0.04%	-0.05%
5	-0.05%	-0.08%	-0.08%	-0.04%	0.03%	-0.04%	-0.05%	-0.03%	-0.05%	-0.07%
6	-0.09%	-0.12%	-0.11%	-0.07%	0.03%	-0.04%	-0.06%	-0.04%	-0.05%	-0.09%
7	-0.11%	-0.16%	-0.15%	-0.11%	-0.06%	-0.06%	-0.08%	-0.10%	-0.07%	-0.12%
8	-0.16%	-0.26%	-0.25%	-0.17%	-0.12%	-0.09%	-0.12%	-0.13%	-0.11%	-0.14%
9	-0.26%	-0.36%	-0.38%	-0.24%	-0.18%	-0.13%	-0.16%	-0.18%	-0.14%	-0.18%
10	-0.55%	-0.66%	-0.75%	-0.47%	-0.34%	-0.24%	-0.31%	-0.42%	-0.26%	-0.36%

FR_S

pdgrp	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10
1	-0.02%	0.12%	0.35%	0.25%	0.55%	0.63%	0.56%	0.72%	0.67%	0.70%
2	-0.03%	0.00%	0.03%	-0.08%	0.16%	0.08%	0.10%	0.08%	0.06%	-0.12%
3	-0.08%	-0.04%	-0.01%	-0.21%	0.06%	0.05%	0.03%	-0.01%	-0.14%	-0.26%
4	-0.10%	-0.06%	-0.19%	-0.40%	-0.39%	-0.42%	-0.51%	-0.68%	-0.70%	-0.82%
5	-0.17%	-0.22%	-0.41%	-0.73%	-0.88%	-1.05%	-1.21%	-1.42%	-1.59%	-1.71%
6	-0.13%	-0.23%	-0.48%	-0.85%	-1.11%	-1.21%	-1.32%	-1.72%	-2.01%	-2.28%
7	-0.26%	-0.52%	-1.04%	-1.63%	-2.11%	-2.37%	-2.76%	-3.61%	-3.79%	-4.14%
8	-0.39%	-0.76%	-1.56%	-2.24%	-3.42%	-3.45%	-3.88%	-5.11%	-5.31%	-5.57%
9	-0.55%	-1.21%	-2.47%	-3.00%	-4.33%	-4.58%	-5.16%	-6.26%	-7.22%	-7.68%
10	-0.81%	-1.92%	-3.58%	-5.13%	-6.86%	-7.33%	-7.61%	-9.36%	-10.06%	-10.36%

Panel C: Sample firms are ranked by the RATING into ten DR groups (ratgrp) each year

FE_EPS

ratgrp	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10
1	0.00%	0.02%	0.02%	0.03%	0.01%	0.01%	0.02%	0.02%	0.02%	0.02%
2	0.00%	0.04%	0.05%	0.04%	0.03%	0.03%	0.04%	0.03%	0.03%	0.04%
3	-0.07%	0.00%	0.02%	0.03%	0.02%	0.03%	0.03%	0.03%	0.03%	0.05%
4	-0.17%	-0.08%	-0.04%	-0.02%	-0.02%	0.00%	0.00%	0.00%	0.00%	0.04%
5	-0.20%	-0.12%	-0.06%	-0.06%	-0.08%	-0.07%	-0.05%	-0.02%	0.00%	0.02%
6	-0.38%	-0.21%	-0.13%	-0.11%	-0.08%	-0.05%	-0.04%	-0.03%	0.00%	0.00%
7	-0.48%	-0.37%	-0.22%	-0.18%	-0.20%	-0.20%	-0.17%	-0.11%	-0.09%	-0.03%
8	-1.02%	-0.84%	-0.54%	-0.48%	-0.39%	-0.36%	-0.26%	-0.19%	-0.15%	-0.05%
9	-2.33%	-1.93%	-1.49%	-1.30%	-1.04%	-1.00%	-0.83%	-0.55%	-0.41%	-0.29%
10	-5.19%	-4.67%	-3.71%	-3.17%	-2.51%	-2.10%	-1.93%	-1.42%	-1.12%	-0.86%

FE_S

ratgrp	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10
1	1.59%	1.78%	1.65%	1.77%	1.46%	1.46%	1.47%	0.96%	1.03%	1.24%
2	0.29%	0.54%	0.54%	1.11%	0.77%	0.69%	0.61%	0.35%	0.29%	0.56%
3	-0.60%	0.27%	-0.05%	-0.04%	-0.21%	0.00%	0.03%	0.33%	0.59%	0.68%
4	-1.60%	-1.86%	-1.62%	-0.92%	-0.85%	-0.66%	-0.37%	-0.73%	-0.68%	-0.33%
5	-1.51%	-1.64%	-1.63%	-1.58%	-1.47%	-1.35%	-0.96%	-0.97%	-0.71%	-0.42%
6	-2.32%	-2.13%	-2.23%	-1.82%	-1.77%	-1.67%	-1.35%	-1.56%	-1.16%	-1.13%
7	-4.20%	-4.06%	-3.81%	-3.15%	-2.47%	-2.36%	-2.13%	-1.71%	-1.40%	-0.91%
8	-6.52%	-5.68%	-5.43%	-4.28%	-4.68%	-4.40%	-3.93%	-3.82%	-3.09%	-2.44%
9	-11.13%	-9.76%	-8.70%	-7.51%	-6.28%	-6.40%	-5.28%	-4.91%	-4.29%	-3.22%
10	-25.54%	-21.70%	-18.72%	-15.34%	-13.59%	-12.45%	-11.29%	-9.00%	-8.91%	-7.13%

FR_EPS

ratgrp	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10
1	-0.02%	-0.03%	-0.01%	-0.01%	0.03%	-0.01%	-0.01%	0.02%	-0.02%	-0.02%
2	-0.03%	-0.04%	-0.02%	-0.01%	0.04%	0.01%	-0.02%	0.04%	-0.02%	-0.02%
3	-0.04%	-0.05%	-0.03%	-0.02%	0.04%	-0.02%	-0.03%	0.03%	-0.03%	-0.03%
4	-0.05%	-0.07%	-0.04%	-0.03%	0.04%	-0.01%	-0.04%	0.03%	-0.03%	-0.04%
5	-0.04%	-0.06%	-0.04%	-0.02%	0.06%	-0.01%	-0.03%	0.02%	-0.04%	-0.05%
6	-0.05%	-0.07%	-0.06%	-0.03%	0.06%	-0.02%	-0.04%	0.04%	-0.04%	-0.06%
7	-0.06%	-0.10%	-0.11%	-0.05%	0.06%	-0.03%	-0.05%	0.03%	-0.04%	-0.09%
8	-0.17%	-0.12%	-0.16%	-0.08%	0.03%	-0.05%	-0.08%	0.04%	-0.08%	-0.10%
9	-0.20%	-0.28%	-0.31%	-0.14%	-0.17%	-0.10%	-0.15%	-0.20%	-0.12%	-0.17%
10	-0.38%	-0.50%	-0.93%	-0.32%	-0.29%	-0.15%	-0.16%	-0.34%	-0.22%	-0.28%

FR_S

ratgrp	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10
1	-0.04%	-0.10%	0.05%	0.05%	0.34%	0.34%	0.18%	0.51%	0.50%	0.39%
2	-0.06%	-0.05%	0.02%	0.00%	0.39%	0.42%	0.30%	0.48%	0.52%	0.45%
3	-0.10%	-0.10%	-0.04%	-0.08%	0.04%	-0.06%	-0.05%	-0.04%	-0.07%	-0.16%
4	-0.11%	-0.12%	-0.07%	-0.25%	-0.05%	-0.01%	-0.08%	-0.37%	-0.49%	-0.42%
5	-0.10%	-0.11%	-0.02%	-0.16%	0.19%	0.23%	0.05%	0.06%	0.06%	-0.04%
6	-0.08%	-0.21%	-0.30%	-0.42%	-0.22%	-0.19%	-0.20%	-0.52%	-0.52%	-0.37%
7	-0.13%	-0.29%	-0.56%	-0.90%	-0.73%	-0.77%	-0.74%	-1.29%	-1.38%	-1.60%
8	-0.18%	-0.26%	-0.68%	-1.00%	-1.32%	-1.39%	-1.46%	-2.29%	-2.27%	-2.67%
9	-0.25%	-0.64%	-1.89%	-2.50%	-3.31%	-3.50%	-4.37%	-5.45%	-5.65%	-5.78%
10	-0.89%	-1.55%	-3.09%	-3.84%	-4.86%	-5.52%	-6.29%	-7.78%	-8.55%	-8.88%

This Appendix presents the median values of FE_EPS and FE_S, and FR_EPS and FR_S, the (pooled) monthly EPS and sales forecast errors and revisions within the sample periods. Median values of the 11th fiscal month (M11) and 12th fiscal month (M12) are not reported because the number of observations in these two months are too few. Results for the three sets of DR groups ranked by O-SCORE, PD and RATING are reported in Panel A, B and C respectively.