Price-convexity, debt-related agency costs, and timely loss recognition*

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Abstract

The same economic forces that cause agency-related costs also yield stock prices that are a convex function of information about the firm's future cash flows. We provide evidence that our proxy for this price-convexity (viz. price-change-asymmetry) is related to the timely recognition of unrealized losses in accounting earnings, which is often viewed as an effective mechanism to reduce agency costs associated with incentives of shareholders to expropriate wealth from debtholders. We show that in samples with high leverage, dividend-payments, or speculative grade bond ratings, where agency-related costs are expected to be high a priori, price-change-asymmetry is strongly related to timely loss recognition. Finally, we argue that as price-convexity varies with price levels, deflating by price in earnings-return regressions is tantamount to conditioning on the magnitude of agency costs. We control for this effect by adding price-change-asymmetry as both a simple and an interaction term in the regression; these variables have significant incremental explanatory power for price-deflated earnings.

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1. Introduction

A vast recent literature has argued that the timely recognition of unrealized losses in earnings is due to the demands originating from contracts between the firm and suppliers of debt capital. Specifically, timely loss recognition is thought to be the accountant's response to agency-related conflicts between shareholders and bondholders. Timely loss recognition is most commonly measured using Basu (1997)-type regressions of price-deflated earnings on price-deflated dollar returns conditioned by the sign of returns as a proxy for the "good" and "bad" news that arrives during a period (Ball and Kothari 2007). No consensus exists in the literature on how to measure agency costs and progress in this area has been somewhat stymied by the use of relatively crude proxies such as leverage, default risk or debt covenant violations (Holthausen and Leftwich 1983; Duke and Hunt 1990; Ahmed, Billings, Morton and Stanford-Harris 2002; Dichev and Skinner 2002; Qiang 2007; Zhang 2008).

Our contribution to the literature is twofold: (1) we propose a theory-based (price-level-specific) proxy for agency costs and show the extent to which timely loss recognition depends on the severity of debt-related agency problems, (2) we document an association between agency costs as measured by our proxy and stock price levels and argue that price-deflation in Basu regressions conditions the earnings-return relation on the magnitude of agency conflicts. While under these circumstances the Basu regression continues to provide a valid representation of conditional conservatism, researchers interested in examining the association between agency problems and timely loss recognition should parse the price-deflator effect by including a proxy for agency problems as both a simple and interaction term in the regression.[1]

We argue that price-convexity (i.e., the observation that stock prices are a convex function of information about underlying economic fundamentals) can be used to gauge the severity of debt-related agency costs. Our price-convexity proxy offers three potential

[1] This suggestion is similar to the recommendations in Ball and Kothari (2007) on controlling for cross sectional variations in market-to-book ratio when the researcher's objective is to estimate the incremental effect of growth opportunities on the timeliness coefficient.

advantages over alternative approaches in the literature. First, the relation between price-convexity and agency costs follows directly from economic theory, which describes how the fact that shareholders hold a convex residual claim on the firm's earnings simultaneously gives rise to convexity in stock prices and to incentives for owners to expropriate bondholders.[2]

Second, price-convexity implies that stock prices react more to good news than to an equivalent amount of bad news about future cash flows (Miller 1977; Fischer and Verrecchia 1997; Xu 2007). We exploit this implication of price-change-asymmetry in our empirical measure of price-convexity by comparing the expected value of price changes under good news and bad news conditions, respectively. Price changes or dollar returns are also a central ingredient in the measurement of timely loss recognition. Thus, our proxy for agency costs is a priori likely to be associated with those factors that cause cross-sectional variation in timely loss recognition.

Third, our measure of agency costs requires only stock price data. This feature not only admits broad-sample based tests, but more importantly, addresses the critique on alternative agency-cost proxies (such as leverage or default risk) constructed from data taken from financial statements; inferences based on regressions that use these proxies to explain earnings properties may be spurious as both sides of the regression rely on the same underlying accounting data.[3]

Intuitively, the idea that price-convexity proxies for agency costs follows from the notion that a levered firm's equity can be seen as a call option on its assets (Black and Scholes 1973; Merton 1974; Myers 1977). If the value of the firm exceeds the face value of the debt when repayment is due, shareholders will pay off the debtholders and keep the excess value. If not, shareholders will default on the debt and due to limited liability their payoff will

[2] Duke and Hunt (1990) and Dichev and Skinner (2002) argue that it is unclear how alternative proxies such as leverage map into the conditions in which shareholders are closer to defaulting on the debt, and thus when redistribution incentives become strong enough that debtholders need to take action to protect their claim. Covenant violations are also often used as an indication of debt-related agency conflicts (Nikolaev 2007; Zhang 2008). However, covenants are usually set in such a manner that technical default occurs frequently. More often, in fact, than one would expect that shareholders want to default on the firm's debt (Dichev and Skinner 2002). Again, the mapping between covenant violation and shareholders incentives to expropriate the wealth of debtholders is not clear-cut.

[3] Most bankruptcy prediction models use financial statement data to generate estimates of default risk (Beaver 1966; Altman 1968; Ohlson 1980; Bellovary, Giacomino and Akers 2007).

be nil. Consequently, shareholders can reap all the excess when firm value increases, but face only limited risk when the opposite happens. Therefore, the stock price response to bad news will be more muted than the response to good news (Fischer and Verrecchia 1997; Core and Schrand 1999): the relation between equity prices and underlying information is increasing and convex. Debtholders, on the other hand, have a claim on the value of the assets less the value of equity (Merton 1974). In the region where price-convexity is present, they face increasing downside risk associated with their claim. Unlike the shareholders' muted response to bad news, bondholders become ever more sensitive to price changes as, in the price convex region, the likelihood that shareholders default on the debt is higher and so is the risk that wealth is transferred to shareholders at the debtholders' expense.[4] [5]

Arguably, the conflict of interest between debtholders and shareholders most directly affects accounting by creating a demand for the timely loss recognition (Watts 2003a, b; Ball and Shivakumar 2005, 2006; Ball, Robin and Sadka 2008). The argument is as follows. Debtholders favor contracting mechanisms that reduce agency problems when shareholders are closer to default on the firm's debt. In particular, lenders contract to receive the right to monitor and control the managers' actions in order to prevent managers from engaging in the kind of activities that benefit shareholders at the lenders' expense (Jensen and Meckling 1976). Debt contracts often use accounting numbers to determine the moment when debtholders gain the rights to control the actions of managers. To the extent that these accounting numbers reflect adverse circumstances early-on and thus trigger a timely transfer of power from managers to debtholders, the latter are in a better position to prevent detrimental wealth redistributions.

Indeed, the demands originating from contracts between the firm and suppliers of debt capital are a major force shaping the properties of accounting information (Smith and Warner 1979; Watts and Zimmerman 1986; Watts 2003a, b). As the firm moves closer to

[4] Watts (2003a; 2006) makes a similar point when he argues that the limited liability of shareholders induces an asymmetric loss function for debt holders (which causes lenders to be more sensitive to losses than to gains).

[5] This can happen because managers are especially tempted to engage in asset substitution or risk shifting when the price moves into the convex region and, in an ultimate gamble to turnaround the prospects of the firm, substitute low variance investments for high risk projects. Other agency problems related to the closeness of a firm to default are claim dilution, underinvestment, and dividend payment (Black 1976a; Myers 1977; Smith and Warner 1979).

violation of its debt covenant or to default, bondholders will increase their scrutiny of the firm and expect more timely loss recognition in accounting earnings. Auditors too are likely to react to the increased possibility of default (and to the pressure exerted by bondholders) as client bankruptcy substantially raises their exposure to litigation (St. Pierre and Anderson 1984; Lys and Watts 1994; Krishnan and Krishnan 1997; Heninger 2001). In sum, bondholders and auditors act in unison to increase the timeliness of loss recognition in earnings.

In our first set of empirical analyses, we construct four closely related empirical measures of price-convexity and confirm the theoretical notion that price-convexity varies across price-levels (Hayn 1995; Berger, Ofek and Swary 1996; Fischer and Verrecchia 1997). We also document that the slope coefficient on negative returns in a Basu-type regression is higher when estimated in low price-level portfolios than in high price-level portfolios. We then tie both results together by regressing the coefficient on negative returns estimated for each price-level portfolio onto our four measures of price-convexity and show a consistent, strongly significant positive association between price-convexity and timely loss recognition. One implication of this finding is that price-levels (the deflator of both the dependent and independent variables in a Basu regression) are themselves associated with the agency-conflicts. When documenting how the response of accounting earnings to news varies with agency conflicts, it then becomes paramount to partial out the deflator-effect.

In subsequent analysis, we refine our price-convexity proxies by measuring them at the firm level and by conditioning on the firm's stock price. These refined measures not only allow us to analyze the effect of shareholder-bondholder conflicts at the firm level, but also allow us to take care of the deflator effect.

We provide considerable evidence that our price-level-specific estimates of price-convexity capture the probability that wealth is redistributed from lenders to shareholders. In particular, we show that the correlations between our measure and Altman (1968), Shumway (2001), and Moody's KMV EDF® estimates of the probability of default are high. We then include our refined price-convexity proxies in the Basu regression as simple and interaction effects and show that timely loss recognition increases significantly at increased levels of price-convexity. Further, we show that the effect of price-convexity *at the firm level* is much stronger for firms with high leverage compared to zero-debt firms. By including the convexity proxies in the regression, we parse the price-deflator effect from our coefficient estimates of timely loss recognition.

Finally, we examine two other contexts in which shareholder-bondholder conflicts can be expected to abound and show that price-convexity impacts on timely loss recognition more (less), as predicted, in dividend-paying (zero-dividend) firms and in firms with a speculative (investment) grade bond rating. We also show that in different sub-samples, the consequences of price-deflation vary. Together, these findings provide evidence that price-convexity captures specific agency-related problems associated with the provision of debt. In addition, we document that the conflict of interest between debtholders and shareholders as measured by price-convexity is a major determinant of the demand for timely loss recognition in accounting earnings.

2. Hypothesis development

We begin this section by discussing explanations provided in the finance and accounting literatures for the existence of price-convexity and, based on this discussion, argue that price-convexity is a valid measure for the severity of agency related conflicts between shareholders and managers on one side and debtholders on the other. We then discuss the role of accounting information in debt contracts and develop a testable prediction for its relation with price-convexity.

A. Price-convexity as a proxy for agency-conflicts between shareholders and debtholders

We discuss two closely-related explanations for the observation that prices of equity are a convex function of the underlying information about future cash flows: (1) limited liability (Fischer and Verrecchia 1997) and (2) the abandonment option hypothesis (Berger et al. 1996).[6] Our aim is to provide a theoretical underpinning for the claim that price-convexity measures the severity of agency-related conflicts between shareholders and debtholders.

[6] Other explanations for price-convexity rely on differences in opinion among investors and on short-selling constraints (Miller 1977; Harris and Raviv 1993; Subramanyam 1996; Diether, Malloy and Scherbina 2002; Boehme, Danielsen and Sorescu 2006; Xu 2007; Xu and Zheng 2007).

In models of rational trade and asset pricing, the assumption of unlimited liability of equity holders yields the prediction that equity prices incorporate information in a linear fashion. Motivated by earlier work on the non-linear relation between returns and earnings,[7] Fischer and Verrecchia (1997) provide a model that suggests a non-linear mapping between information and returns. They then show that assuming limited liability for equity holders produces the prediction that prices react more strongly to positive than to negative public signals. Intuitively, this happens because equity holders have an unlimited upside potential (and can therefore capture all the potential future gains), but are shielded from downside risk (as they stand to loose at most their initial investment).

When prices are "in the convex region", negative signals about the firm's future prospects will have only a marginal impact on the equity price of the firm as investors are already very close to defaulting on the debt and to failing to exercise their call option on the firm's assets. The value of their out-of-the-money option will not be very sensitive to further bad news. It is precisely in these circumstances that debtholders need to be most cautious about maintaining the value of their (senior) claim on the firm's assets.

Note that one implication of prices being in the convex region is that positive returns are larger than negative returns, as prices respond more strongly to positive information about future cash flows than to negative information. We use this corollary below to construct empirical measures of price-convexity.

Similarly, firms have the option to liquidate or adapt their assets when the liquidation value of the assets, or their value in alternative deployment, exceeds the expected future cash flows from continued operations. This abandonment option has value (Berger et al. 1996), which in turn depends on the value of expected future cash flows. Indeed, as the value of expected future cash flows increases, the option moves farther out-of-the-money and its value declines. Unfavorable information, on the other hand, will generally increase the likelihood that the abandonment option is exercised and increases its value, which dampens the equity price effect of negative information about future cash flows. Since positive (cash flow) information continues to be fully reflected in prices, the view that shareholders hold a put

[7] See, e.g., Beaver, Clarke and Wright (1979), Cheng, Hopwood and McKeown (1992), Freeman and Tse (1992), Das and Lev (1994), Lipe, Bryant and Widener (1998).

option on the firm's assets also yields a non-linear relation between information and equity prices (see also, Hayn 1995; Burgstahler and Dichev 1997; Fischer and Verrecchia 1997).

It is important to recognize that when it becomes increasingly likely that shareholders use their abandonment option, it also becomes increasingly likely that debt-holders face more risk of detrimental wealth transfers. As the financial health of the firm deteriorates, the abandonment options becomes more valuable (and prices move into the convex region) and, at the same time, the incentives of shareholders become stronger to increase the riskiness of investment projects, to sell valuable property, or to reduce overall investments and use the proceeds to pay more dividends.

The upshot of all this is that the very same economic forces that make prices move into the convex region also provide the circumstances in which the expropriation incentives of shareholders are present most. Price-convexity is therefore a priori a valid proxy to identify cases where debt-related agency problems are more pronounced.

B. Price-convexity and the incentives of managers

Thus far, we have assumed that the incentives of managers and shareholders are well-aligned. Indeed, we assume that debtholders want to control managers because they can undertake actions *on the shareholders' behalf* that hurt lenders. We may question whether, in practice, the incentives of managers to act in the shareholders' interest are strong; especially when the firm's financial position worsens. Note, however, that managers have their own incentives to engage in risk shifting and other behavior potentially harmful to lenders, independent of the shareholders' interests. Guay (1999) suggests that a manager's payoff is more convex if equity prices are themselves in the convex region, especially if the manager owns stock options. Convexity in payoffs implies that managers enjoy limited downside risk. Similar to the implications of limited liability of shareholders, lower downside compensation risk provides managers with incentives to engage in risk shifting behavior and other possibly damaging actions.

Ultimately, it is the convexity of the residual claims of managers and shareholders on the firm's cash flows that provides the incentives for opportunistic behavior when the firm's financial position deteriorates (and that yields a convex response of equity prices to public signals).

C. The relation between bondholder-shareholder conflicts and timely loss recognition

The role of accounting information in debt contracts has some distinguishing features, unlike its role in many other (implicit) contracts.[8] Debt-holders benefit if signals about the value of their claim arrive more fully through (or are quickly reflected in) financial statement information (Ball and Shivakumar 2005; Ball et al. 2008). Other contract parties, such as equity holders, likewise favor receiving value-relevant information but are relatively indifferent about the channel through which it arrives on the market. Since the provisions in debt contracts that arrange for transfer of control over the firm's assets are usually stated in accounting numbers (Smith and Warner 1979; Leftwich 1981; Holthausen and Leftwich 1983; Beneish and Press 1993), the degree to which these provisions shield debtholders from opportunistic actions of shareholders depends on the ability of accounting numbers to flag in a timely manner the probability of impending financial troubles. Indeed, bad news disclosures that do not affect (as yet) the balance sheet or the profit and loss statement, will rarely trigger covenant violations and are of relatively little use to protect the claims of debtholders. This "bellwether" function of accounting numbers is crucial and plays a key role in enabling debtholders to perform their monitoring function. As a consequence, there will be a debt contract-induced demand for accounting numbers that encapsulate negative news quickly (Ball and Shivakumar 2005).

When the default probability of a firm increases (and its stock price becomes more convex), it is not just bondholders that put the firm under closer scrutiny and expect more timely loss recognition. Auditors face considerable litigation risk when bankruptcy approaches (Kothari, Lys, Smith and Watts 1988; Lys and Watts 1994; Watts 2006) and their liability is increased when the firm is found not to have disclosed all pertinent bad news when it became known (Skinner 1997). Pratt and Stice (1994) and Krishnan and Krishnan (1996) document that auditors adjust their audit plan and increase the issuance of modified opinions in the face of client default and increased litigation risk. Both findings suggest more vigilant

[8] See Easton, Monahan, and Vasvari (2008) for a detailed discussion and analysis.

auditor inspection, which is likely to result in more conservatism in client firm financial statements. Indeed, in a survey among Big-N auditors, Nelson et al. (2002) find that when legal liability increases, auditors more actively thwart the attempts of managers to engage in upward earnings management. In some cases, auditors even become a directly interested-party to the debt contract as is the case when the contract stipulates that firms need to have their auditors attest that the company is not in violation of covenants or in technical default.[9] More direct evidence is provided in Basu (1997), Cahan and Zhang (2006), and Qiang (2007) who document an association between timely loss recognition and auditor legal liability.

Timely loss recognition can discipline companies that need continued access to the debt-capital markets (Ball and Shivakumar 2008). Timely loss recognition brings forward in time the moment in which shareholders loose control to debt holders. Whereas it might be difficult in practice to credibly commit to a level of timely loss recognition,[10] it is also clear that in many cases borrowing is a repeated game. Firms may derive benefits from earning a reputation for timely loss recognition (e.g., in the form of lower interest costs (Zhang 2008)), which they stand to loose when they subsequently deviate from their commitment. In any case, the demand for timely loss recognition is a function of the extent of the firm's dealings with the debt market (Ball et al. 2008).

In sum, contracting-induced demand and supply conditions exist that call for financial statement information that recognizes unrealized losses into earnings in a timely manner. As these contracting conditions derive from the fundamental conflict of interest between shareholders and debtholders, we predict that timely loss recognition is positively associated with the severity of these agency-related conflicts as measured by the degree of price-convexity.

[9] Consider, for example, the following excerpt from the public debt contract of American Color Graphics, Inc., "The Company shall deliver to the Trustee, within 120 days after the end of each fiscal year, beginning with the fiscal year in which this Indenture was executed, a certificate signed by the Company's independent certified public accountants (who shall be a firm of established national reputation) stating that in making the examination necessary for certification of the Company's year-end financial statements for such fiscal year, nothing came to their attention that caused them to believe that the Company was not in compliance with any of the terms, covenants, provisions or conditions of Article Four and Section 5.01 ("COVENANTS") of this Indenture as they pertain to accounting matters."

[10] Zhang (2008) mentions the use of fixed GAAP (the use of accounting procedures that are unaffected by mandatory or voluntary accounting method choices) as one way to commit to timely loss recognition.

3. Empirical measures of price-convexity

A. Theoretical notion of convexity

To develop an empirical measure of price-convexity we start with the mathematical definition of convexity.

Definition. A continuous real valued function $f(.)$ is said to be convex if for all real numbers m_0 and x the following inequality holds:

$$f\left(m_0\right) \leq \frac{f(m_0 + x) + f(m_0 - x)}{2}$$

Rearranging this inequality yields

$$\underbrace{f(m_0 + x) - f(m_0)}_{\equiv A} - (\underbrace{f(m_0) - f(m_0 - x)}_{\equiv B}) \geq 0$$

The degree of convexity could potentially be assessed by measuring the extent to which the difference between quantities A and B exceeds zero. This, however, would have unattractive empirical properties. Alternatively, as long as the function $f(.)$ is positively sloped and restricting x to be positive (at no loss of generality) we have:

$$\frac{f(m_0 + x) - f(m_0)}{f(m_0) - f(m_0 - x)} \geq 1$$

Thus, we employ the following ratio as a measure of convexity:

$$ConvexityRatio \equiv \frac{A}{-B} = -\frac{f(m_0 + x) - f(m_0)}{f(m_0 - x) - f(m_0)}$$

This is a relative measure of convexity adopted for our empirical tests. Intuitively, we view $f(.)$ as the value of equity and $f(m_0)$ as the beginning of period stock price. The end of period price then is given by $f(m_0 + x)$ or $f(m_0 - x)$, depending on the sign of news x arriving over the period. The amount of news x can be viewed as an average or standardized amount of news. As long as the value of equity is convex, increases in value due to positive news will outweigh decreases in value from negative news, holding the amount of information constant, and thus *ConvexityRatio* will exceed one. Since the average amount of information, which arrives during a period (either positive or negative) is different across firms, it is necessary to look at the ratio (of good news price changes to bad news price changes) and not merely at the difference.

B. Measures of convexity using price-level portfolios

Since price-convexity is likely to vary over time and in the cross-section, constructing a firm-specific measure of price-convexity is not straightforward. To identify the variation in convexity we use the theoretical notions discussed in Section A to argue that the degree of price-convexity decreases with the *level* of price.[11] A stock that trades at $5 will exhibit more price-convexity than a stock that trades at $50.[12] To gain some intuition about this idea, consider the following. Limited liability protects investors from downside risk, which causes their reaction to bad news to be more muted. Limited liability has more immediate relevance when prices are low. Indeed, one implication of limited liability is that equity prices are bounded below by zero (Fischer and Verrecchia 1997) and thus investors face limited downside but unlimited upside potential. Price-convexity, therefore, should be high for stocks trading at low price-levels. Alternatively, at low prices, the firm's put option on its assets (either to abandon or to adapt their use) will move into the money. Bad news about future profitability (which should have a negative effect on current stock prices) is cushioned by the increase in the value of the abandonment option at low stock prices.

We refer to the empirical measure of price-convexity as "price-change-asymmetry." To construct measures of price-change-asymmetry, we define 46 (beginning-of-year) price-level portfolios. At higher stock prices, we broaden the price-interval to keep the number of observations comparable across portfolios.[13]

At each price-level portfolio, we construct the ratio of the average price response to "good" news (arriving during a year) to the average price response to "bad" news.[14] We

[11] All analyses are repeated using market capitalization instead of price. Results are similar and inferences are the same.

[12] The possibility of stock splits would appear, at first sight, to contradict our statement that $5 stocks are different from $50 stocks. That is, should a $50 stock after a 10:1 split not exhibit the same convexity as before as nothing has changed in the underlying fundamentals of the firm? We argue in contrast that convexity should change, as research in finance suggests that stock splits can point to agency problems. For example, both the *managerial entrenchment* and *the optimal trading range* hypotheses say that managers concerned with a takeover threat or strict monitoring may carry out stock splits in order to achieve a broad and heterogeneous shareholder base. These changes in ownership structure are expected to make takeovers more difficult as small investors may not tender their shares to a bidder as quickly as institutional investors. In addition, small investors tend to be less vigilant monitors of the firm (Lakonishok and Lev 1987; Mukherji, Kim and Walker 1997).

[13] The boundaries of the intervals we use are given by the first column in Table 2.

[14] We do not use accounting variables to measure news when constructing price-convexity proxies to avoid possible spurious effects due to having earnings as a dependent variable in the subsequent earnings-returns regressions.

expect that in the convex region positive returns will be larger than negative returns (due to the equity holders' muted response to adverse information about future cash flows). Thus,

$$PCA1 = \frac{Average(Ret_{jt} \mid Ret_{jt} > 0, Price\text{-}level)}{\text{-}Average(Ret_{jt} \mid Ret_{jt} < 0, Price\text{-}level)} \tag{1}$$

where Ret_{jt} are the fiscal year annual returns. *PCA1* is the proxy for price-change-asymmetry. We define a very similar ratio using one-plus returns to avoid potential small denominator problems,

$$PCA2 = \frac{Average(1 + Ret_{jt} \mid Ret_{jt} > 0, Price\text{-}level)}{Average(1 - Ret_{jt} \mid Ret_{jt} < 0, Price\text{-}level)} \tag{2}$$

Our alternate price-change-asymmetry proxies rely on a related idea. Due to price-convexity, upward and downward price volatility will differ in magnitude.[15] Consequently, the alternative price-change-asymmetry measure is defined as the ratio of the standard deviation of positive returns to the standard deviation of negative returns, again conditional on each price-level.

$$PCA3 = \frac{\hat{\sigma}(Ret_{jt} \mid Ret_{jt} > 0, Price\text{-}level)}{\hat{\sigma}(Ret_{jt} \mid Ret_{jt} < 0, Price\text{-}level)} \tag{3}$$

where $\hat{\sigma}$ is the standard deviation of the expression in parentheses. Analogous to Equation (2), we also adjust this standard deviation-based proxy to avoid small denominator problems:

$$PCA4 = \frac{1 + \hat{\sigma}(Ret_{jt} \mid Ret_{jt} > 0, Price\text{-}level)}{1 + \hat{\sigma}(Ret_{jt} \mid Ret_{jt} < 0, Price\text{-}level)} \tag{4}$$

C. Refined price-level measures of price-convexity

We refine the first two price-change-asymmetry proxies by estimating them for each specific price rather than for each portfolio and denote them $PCA1_{jt}$ and $PCA2_{jt}$. To achieve this, we condition the ratios on the individual firm's stock price rather than on the somewhat

[15] The literature has documented how low stock return is associated with an increase in the subsequent return volatility (Black 1976b). This pattern, sometimes called "Black's leverage effect," while broadly consistent with the presence of non-linearity in equity prices and possibly associated with firm disclosure policies (Shin 2003), is nevertheless different from our notion of convexity in at least three respects. First, we do not condition on past returns when computing price-change-asymmetry. We also do not contrast the variance of high price level portfolios to the variance of low price level portfolios. Finally, one implication of the leverage hypothesis is that we should have higher variances conditional on bad news (negative returns), and price-change asymmetry measure should be lower than unity. This is not what we observe empirically and price-change-asymmetry, therefore, is unlikely to pick up Black's leverage effect.

cruder "price-level portfolios" we used before. We proceed by estimating two separate non-parametric local regressions to model the conditional mean of both positive and negative returns (Cleveland 1979; Cleveland, Devlin and Grosse 1988). Specifically, we run a local regression of positive (negative) fiscal year annual stock returns on a constant and the inverse of the beginning-of-year stock price. We use the inverse of price instead of price to obtain a more homogeneous distribution of the data when conducting the non-parametric analysis.[16] Local regression is based on the idea that, at any point, a function can be approximated by low order polynomials. Intuitively, the procedure estimates a simple Ordinary Least Squares regression in a neighborhood about each point in the dataset and smoothes the predicted curve. Our choice of a non-parametric method to measure price-change-asymmetry is due to our prior beliefs that convexity is a non-linear function of price albeit of unknown functional form. Our approach, then, allows us to measure price-change-asymmetry more precisely. Figure 1 depicts the non-parametric estimation results.

We use the results from the non-parametric regression to construct the predicted value of positive (negative) annual returns conditional on the beginning-of-year stock price of the firm. We then divide, conditional on price, the expected positive returns by the expected negative returns to obtain refined versions of $PCA1_{jt}$ and $PCA2_{jt}$.[17]

4. Data

We obtain data from the intersection of the CRSP and Compustat Annual Industrial files and include all firm-year observations from 1963 to 2006 for non-financial firms (i.e., firms not in SIC codes 6000-6999). We remove firms with opening prices below $1 as they are likely to experience severe distress.[18]

All of our main empirical tests involve earnings-return regressions. Opening price deflated earnings (E_{jt} / P_{jt-1}) are measured as income before extraordinary items (Compustat

[16] We find similar results when we use the natural logarithm of price instead of the inverse of price. We also find similar results when we repeat the analyses with the natural logarithm of market capitalization instead of the inverse of price.
[17] As an example, consider a stock trading at $5 at the beginning of the fiscal year. The inverse of price (1/p) equals 0.2. It follows from Figure 1 that, for this stock, the expected price change conditional on positive news is 65 percent and the expected price change conditional on bad news is 35 percent. Price-change-asymmetry, $PCA1_{jt}$, in this case equals 65/35=1.86, while $PCA2_{jt}$ equals (1+0.65/1+0.35) = 1.22. All stocks trading at $5 are assigned this price-change-asymmetry estimate.
[18] Our results are unchanged when these firms are included in the sample.

data item 18) scaled by beginning of fiscal year stock price (Compustat data item 199) multiplied by shares outstanding (Compustat data item 25). Annual returns (Ret_{jt}) are obtained from monthly returns compounded over the 12-month fiscal year.[19] In sensitivity analyses, we include size, book-to-market, and leverage. All of these variables are measured for every firm j at the beginning of the fiscal year t. $LogMktCap_{jt}$ is the logarithm of market capitalization (Compustat data item 199 multiplied by data item 25). The book-to-market ratio (BTM_{jt}) is the book value of equity (Compustat data item 60) scaled by market capitalization (Compustat data item 199). Leverage (Lev_{jt}) is defined as the ratio of long-term debt (Compustat data item 9) over total assets (Compustat data item 6). Observations in the top and bottom 0.5 percent of all variables are deleted to reduce the effect of outliers.

Table 1 reports some selected descriptive statistics. The findings indicate that our sample is similar to those of studies that also use the population of Compustat firms. Correlations among the main variables are reported in Table 4.

5. The impact of price-change-asymmetry on timely loss recognition

A. Results using measures of price-change-asymmetry based on price-level portfolios

Our first set of tests relies on the price-change-asymmetry proxies *PCA1-PCA4* computed for each of the 46 price-level portfolios. We begin the analysis by estimating piecewise linear regressions of earnings on returns conditional on the sign of returns (following Basu (1997)) for each of the price-level portfolios. Specifically, the model is:

$$E_{jt} / P_{jt-1} = \alpha_0 + \alpha_1 * D(Ret_{jt} < 0) + \beta_0 * Ret_{jt} + \beta_1 * Ret_{jt} * D(Ret_{jt} < 0) + \varepsilon_{jt}, \quad (5)$$

where $D(.)$ is an indicator variable that takes the value of unity when the expression in parentheses is true; all other variables are as defined in Section 4.

Table 2 presents the estimation results of Equation (5). Column (1) reports the price-level interval. Column (2) has the number of observations in each price-level portfolio. Columns (3) and (4) report estimates of β_0 and β_1 from Equation (5). While the estimate of

[19] We also conduct all analyses using market-adjusted returns instead of raw returns. Using market-adjusted returns does not affect our inferences. In addition, we use returns accumulated over a 12 month period starting four months after the beginning of the fiscal year to ensure that the market response to the previous year's earnings is excluded. All conclusions remain the same.

the coefficient on Ret_{jt} ($\hat{\beta}_0$) remains virtually unchanged moving from the low price-level to the high-price-level portfolios, the opposite is true for $\hat{\beta}_1$, the estimated coefficient on negative returns ("bad news"). We find a steady decrease from a high value of 0.36 (at price-level 2.00 to 3.00) to a minimum value of 0.07 (at price-level 90 to 100). This is first evidence of the predicted positive relation between the severity of shareholder-debtholder conflicts of interest and timely loss recognition (as we argued in Section 3).

Columns (5) and (6) of Table 2 provide the input for the computation of *PCA1* and *PCA2*, respectively. Column (5) reports the average return when returns are positive, while Column (5) reports the average return when returns are negative. *PCA1* and *PCA2* (reported in Columns (7) and (8)), decrease as expected when moving from low to high price-level portfolios. Similarly, Columns (9) and (10) provide details on the standard deviation of returns when returns are positive (negative), and these statistics are used to compute the price-change-asymmetry proxies *PCA3* and *PCA4* in Columns (11) and (12), respectively. Once more, we find high price-change-asymmetry for low price-level portfolios and lower asymmetry for high price-level portfolios.

One important implication of these findings is that price-levels appear to be associated with agency costs; thus, price deflation (as in the Basu regression) can confound the relation of interest (i.e., how the estimate of the timely loss recognition coefficient varies with agency costs). Indeed, both the left hand and the right hand side in the Basu regression are deflated by prices, and inasmuch as prices capture agency conflicts, this will obscure the agency cost-induced cross sectional variation in how accounting earnings respond to dollar return news (we highlight this issue here and address it more directly in our firm-specific analysis below).

We also tabulate the *Skewness* of annual returns, which is the third-order moment about the mean measured for each price-level portfolio.[20] We include *Skewness* because earlier research avers that it is associated with price-convexity (Xu 2007).

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[20] We compute *Skewness* as: $\sum_{i=1}^{N}(x_i - \bar{x})^3 / N\hat{\sigma}_x^3$ where $\bar{x}$ and $\hat{\sigma}_x$ are the price-level portfolio sample mean and standard error.

Together the findings in Table 2 suggest that timely loss recognition as measured by the slope coefficient on negative returns varies predictably with the degree of price-change-asymmetry. We demonstrate this more formally next.

We use the $\hat{\beta}_1$ estimated for each of the 46 price-level-based portfolios as a dependent variable in the following regression:

$$\hat{\beta}_{1p} = c + \gamma * PCA_p + \varphi Controls_p + \varepsilon_p, \qquad (6)$$

where *j* indicates the price-level based portfolio (*p* = 1,…,46) and PCA_p is one of our price-change-asymmetry proxies (*PCA1*, *PCA2*, *PCA3*, or *PCA4*). Estimation is by weighted-least-squares using the number of observations per portfolio as weights. Table 3 presents our findings. Models (1) and (2) in this table, provide the baseline for our subsequent tests and regress $\hat{\beta}_{1p}$ only on the opening price-level or *Skewness*, respectively. The next four models regress the same coefficient onto each of our price-change-asymmetry proxies separately. In all four models, price-change-asymmetry is strongly (positively) associated with $\hat{\beta}_{1p}$. Adjusted R^2 from these regressions are about 70 percent; a significant improvement over the baseline model that includes only opening price-levels (*Skewness*), which reports an adjusted R^2 of 45 percent (less than 1 percent). These results are not sensitive to including the opening price-level and *Skewness* controls ($Control_p$) when estimating Equation (6). Indeed, the coefficient estimate $\hat{\gamma}$ on each of the price-change-asymmetry proxies has similar magnitude and the adjusted R^2s increase only a little by including the control variables.

The results of Table 3 are consistent with those reported in Table 2. Overall, these findings provide evidence consistent with the central prediction of this paper that timely loss recognition is positively associated with price-change-asymmetry.

For completeness, we conduct (untabulated) regressions of Equation 6 with β_{0p}, the coefficient on good news, as the dependent variable. Consistent with the idea that price-change-asymmetry indicates cases in which timely *loss* recognition is important to mitigate debt-contract related agency problems, we find no significant association between the coefficient on positive returns (which reflects the timely recognition of *unrealized gains*) and any of the price-change-asymmetry proxies.

B. Results using refined price-level measures of price-change-asymmetry

B.1. Correlations with other estimates of the probability of default

We have argued that a likely reason for the observation that price-change-asymmetry increases as price-levels decrease, is that agency related conflicts between shareholders and debtholders become more severe as the price-level declines. Similar arguments suggest a demand for timely loss recognition. Before analyzing the relation between price-change-asymmetry and timely loss recognition, we focus on our refined estimates of price-change-asymmetry, measured at the price-level, with a view to providing some empirical support for the argument that a high degree of price-change-asymmetry at low prices is associated with increasing possibility of agency related conflicts. To do so, we examine the correlation among our estimates of price-change-asymmetry and three estimates of the probability that shareholders will default on their debt: (1) Altman's (1968) z-score, (2) Shumway (2001), and (3) Moody's KMV EDF®. These correlations are included in Table 4 and are based on the pooled cross-section and time-series of observations. We report both Pearson (below the diagonal) and Spearman (above the diagonal) correlations. All correlations are significant at, at least, the 0.01 level suggesting that our price-change-asymmetry estimates are, indeed, capturing agency related conflicts. Table 4 also reports the correlations for $1/p_{jt-1}$, which is defined as the inverse of price. As suggested by the price-level portfolio analyses, $1/p_{jt-1}$ is strongly associated with our proxies for price-change-asymmetry. At the same time, however, its correlation with other proxies for default probability is (while significant in some instances) much lower than we report for price-change-asymmetry. We draw two conclusions from this. First, the inverse of price is associated with agency problems and thus price-deflation in an earnings-return regression will confound the effect of agency problems on the relation between accounting earnings and dollar-returns (news). Second, including $1/p_{jt-1}$ as a proxy for debt-related agency costs is unlikely to be as effective as using our price-change-asymmetry proxy as it does not appear to be as strongly associated with other proxies for default probability.

B.2. The relation between price-change-asymmetry and estimates of timely loss recognition

Our second set of tests uses the refined price-level proxies of price-change-asymmetry ($PCA1_{jt}$ and $PCA2_{jt}$). We conduct piecewise linear cross-sectional regressions of earnings onto returns conditioned by the sign of returns. Since we are interested in the association between price-convexity and timely loss recognition, we augment the specification and include proxies for price-change-asymmetry, both as simple effect and as interaction with all other variables. Specifically, we use the following model:

$$\begin{aligned} E_{jt} / P_{jt-1} &= \alpha_{10} + \alpha_{11} * D(Ret_{jt} < 0) + \beta_{10} * Ret_{jt} + \beta_{11} * Ret_{jt} * D(Ret_{jt} < 0) \\ &+ (\alpha_{20} + \alpha_{21} * D(Ret_{jt} < 0) + \beta_{20} * Ret_{jt} + \beta_{21} * Ret_{jt} * D(Ret_{jt} < 0)) * PCA_{jt} + \varepsilon_{jt}, \end{aligned} \tag{7}$$

where PCA_{jt} denotes one of the refined price-level price-change-asymmetry proxies ($PCA1_{jt}$ and $PCA2_{jt}$) and all remaining variables are as before. Equation (7) provides us with a direct test of our main prediction: a positive association between price-convexity and timely loss recognition implies a positive and significant coefficient β_{21}.

In this regression, we reparametrize our price-change-asymmetry proxies (year-by-year) to obtain economically meaningful interpretations of the coefficients of interest. Specifically, we linearly transform each proxy such that $PCA_{jt} = 0$ represents the yearly sample minimum price-change-asymmetry. Such transformation does not affect the coefficient (or standard errors) of the interaction terms, but simplifies the interpretation of the simple effects (Wooldridge 2000; Jaccard and Turrisi 2003). Thus, the estimated coefficient β_{11} represents the degree of timely loss recognition for firms with minimum price-change-asymmetry. This is an interesting statistic because it allows us to develop a sense of how much of the observed degree of timely loss recognition is due to debt contracting related agency costs. At minimum price-convexity, while there will be some demand for timely loss recognition, the expropriation risk to debtholders should be comparatively small. As such, we expect that for these firms, timely loss recognition is less due to the specific default-related debt contracting demands identified by price-convexity. By comparing β_{11} with the coefficient on timely loss recognition in a simple Basu regression, which does not control for price-convexity, we can better evaluate the economic significance of convexity.

The coefficients α_{20} (on PCA_{jt}) and α_{21} (on $D(Ret_{jt}<0)*PCA_{jt}$) are also of interest. Including price-change-asymmetry as a simple term and as an interaction with the negative returns indicator variable removes at least partially the confounding effect we emphasized earlier caused by the price deflator, which is itself a proxy for agency costs.

Table 5 reports the estimation results of Equation (7). We compute Fama-MacBeth (1973) t-statistics derived from annual cross-sectional regressions. Model 1 replicates the familiar Basu-motivated regression excluding the price-change-asymmetry proxy. As has been well-documented in earlier literature, we find a significant positive coefficient on the negative returns variable ($\hat{\beta}_1$= 0.36, t-statistic of 16.25). Model 2 estimates Equation (7) using price-change-asymmetry proxy $PCA1_{jt}$. The findings strongly support the prediction that price-change-asymmetry is positively associated with timely loss recognition. The estimated coefficient $\hat{\beta}_{21}$ equals 0.42 (t-statistic of 5.35), which implies that as price-convexity increases the bad news coefficient in a Basu-type regression increases as well. In model 2, β_{11} represents the degree of timely loss recognition for firms with minimum price-convexity. Compared with the baseline results in Model 1, the estimate of this coefficient has been notably reduced ($\hat{\beta}_{11}$= 0.14, t-statistic of 8.78). Nevertheless, the estimate of this coefficient remains significant; this implies that timely loss recognition, while strongly affected by debt-related agency costs (as proxied by price-change-asymmetry), is not completely explained by these costs.

Turning to the controls for the price-deflator effect, we find the following. The estimated coefficient on the simple effect of $PCA1_{jt}$, $\hat{\alpha}_{20}$ equals -0.263 (t-statistic of -13.54) and the interaction between $PCA1_{jt}$ and the negative returns indicator, $\hat{\alpha}_{21}$ equals -0.023, which is not significant.[21] We conclude from these findings that correcting for the price-deflator effect when estimating timely loss recognition is important regardless of the sign of returns.

[21] It turns out that $\hat{\alpha}_{21}$ does not attain significance in any of the subsequent tests. For brevity, we therefore focus on $\hat{\alpha}_{20}$ when we discuss the adjustments for the price-deflator effect. However, conceptually both coefficients need to be evaluated.

Model 3 presents the findings for Equation (7) using price-change-asymmetry proxy *PCA2*. The findings are consistent with those reported for Model 2.

The interaction of price-change-asymmetry and good news (as captured by β_{20}) is not significant. Our theory only predicts an association between price-convexity and bad news timeliness, and therefore there is no reason to believe that good news timeliness should respond to debt-related agency costs. Correspondingly, we find that good news timeliness is unaffected by price-change-asymmetry.

Taken together, these analyses using refined price-level price-change-asymmetry proxies are consistent with our earlier findings based on price-level portfolio proxies. Price-change-asymmetry is strongly positively associated with the coefficient on negative returns in regressions of earnings onto positive and negative returns. Timely loss recognition is much more pronounced for those sample firms with severe shareholder-debtholder conflicts as measured by price-convexity.

B.3. Additional analyses using refined price-level proxies of price-change-asymmetry

Next, we further augment the model and include variables, which are known to influence the earnings-return relation (Freeman 1987; Easton and Zmijewski 1989; Roychowdhury and Watts 2007; LaFond and Watts 2008). This expanded model is as follows:

$$\begin{aligned} E_{jt} / P_{jt-1} &= \alpha_{10} + \alpha_{11} * D(Ret_{jt} < 0) + \beta_{10} * Ret_{jt} + \beta_{11} * Ret_{jt} * D(Ret_{jt} < 0) \\ &+ (\alpha_{20} + \alpha_{21} * D(Ret_{jt} < 0) + \beta_{20} * Ret_{jt} + \beta_{21} * Ret_{jt} * D(Ret_{jt} < 0)) * PCA_{jt} \\ &+ \sum_{ki} (\alpha_{i0} + \alpha_{i1} * D(Ret_{jt} < 0) + \beta_{i0} * Ret_{jt} + \beta_{i1} * Ret_{jt} * D(Ret_{jt} < 0)) * Control_{kjt} + \varepsilon_{jt} \end{aligned} \quad (8)$$

where $Control_{kjt}$ denotes the vector of control variables which includes $Size_{jt}$, BTM_{jt}, and Lev_{jt}. We do not tabulate the details of these analyses as our conclusions remain unchanged by including controls, albeit with one exception. When we include $LogMktCap_{jt}$ as a control for *size*, it subsumes the role of our price-change-asymmetry proxies. This is not unexpected given that the logarithm of the market value of equity and is correlated with the inverse of price-level $1/p_{jt}$ and with price-change-asymmetry (see, Table 4). In fact, when we measure $Size_{jt}$ as the logarithm of total book value of assets (or alternatively book value of liabilities plus market value of equity), the PCA_{jt} proxies are significant. As in LaFond and Watts

(2008),[22] we interpret the results for *size* as consistent with our prediction that timely loss recognition reflects debt-related agency costs as (in this case) proxied by the market value of equity.

6. Price-change-asymmetry in samples partitioned on leverage, dividend payments, and bond ratings

A. Further analyses for samples with zero, low and high levels of leverage

While we have argued that leverage is too crude a proxy to identify debt-related agency conflicts, it is also clear that the potential for conflicts varies with the extent to which a firm relies on debt-financing. Indeed, all else equal, high leverage implies that debtholders have a larger claim on the firm's assets (Watts and Zimmerman 1986; Ahmed et al. 2002). Debtholders in levered firms are commensurately more concerned about potentially harmful activities of shareholders (and managers) than those in low leverage firms. Note, however, that high leverage does not necessarily imply that the debtholders wealth is at imminent (expropriation) risk. In our sample, this is underscored by the low correlation between leverage and the three measures of probability of default (see, Table 4). That said, when price-convexity signals that the debtholders' wealth is at risk, the impact of convexity on timely loss recognition should a priori be larger (smaller) in high (low) leverage firms. We examine this conjecture by partitioning the sample into zero-leverage, low-leverage and high-leverage firms. We use the median of the group of non-zero leverage firms to split the sample into low- and high-leverage groups. Given that the mapping between leverage and expropriation risk is not straightforward, we hasten to emphasize that the expected relations might be difficult to observe empirically. Considering the crudeness of using leverage to proxy for debt-related agency costs, we also do not necessarily expect to find monotonic patterns in the analyses we present below.

We first use the measures of price-change-asymmetry based on price-level portfolios to examine the effect of leverage. Table 6 reports our findings. While for each of our four proxies, price-change-asymmetry is positively and significantly associated with the estimated coefficient on negative returns $\hat{\beta}_1$, the magnitude of this coefficient increases significantly

[22] LaFond and Watts (2008) report that *Size* subsumes their (Probability of Informed Trade [PIN]-based) proxy for information asymmetry.

when moving from the zero-leverage sample to the high-leverage sample. To illustrate, consider the results for *PCA1*. For firms without long-term debt, the coefficient is 0.14 (t-statistic of 4.56). In contrast, for low-leverage firms the coefficient on *PCA1* is 0.33 (t-statistic of 8.60), which increases further for high-leverage firms to 0.37 (t-statistic of 4.06). The alternative price-convexity proxies (*PCA2-PCA4*) exhibit a very similar pattern. Untabulated results indicate that controlling for *Skewness* and opening price-level does not materially change our inferences. The column "Difference" provides a formal test of the hypothesis that the estimated coefficient on PCA_{jt} is larger for high than for zero leverage firms. For all our price-change-asymmetry proxies, the difference between the two coefficients is significant in the predicted direction. These findings are consistent with our conjecture that the joint occurrence of high leverage and prices which are in the convex region describes the cases in which the demand for timely loss recognition is particularly strong.

Turning to the analyses based on the refined price-level price-change-asymmetry proxies, our conclusions are reinforced. Table 7 shows the details. We first run the baseline model (Equation 5) for each of the three sample partitions based on leverage. We expect that the estimated timely loss recognition coefficient $\hat{\beta}_1$ will increase when moving from the zero-leverage to high-leverage sample. Indeed, $\hat{\beta}_1$ increases from 0.25 (t-statistic of 9.98) to 0.46 (t-statistic of 16.41) as leverage increases. Our claim is that the role of price-convexity should become more pronounced as leverage increases. As there is no straightforward mapping from leverage to the severity of agency conflicts, partitioning on leverage only captures the size of the claim of debtholders on the firm's assets, but does not reflect whether this claim is currently under threat of expropriation. Introducing price-change-asymmetry into the regression allows us the tease out the effect of an increased probability of wealth redistribution from the effect of the size of the debtholders' claim. In addition, the increase of $\hat{\beta}_1$, when increasing leverage, captures both the effect of changes in timely loss recognition *and* the price-deflator effect. We can thus only interpret the change in $\hat{\beta}_1$ in terms of agency costs once we adequately control for using price as a deflator in the regression.

Indeed, Table 7 shows that $\hat{\alpha}_{20}$ is strongly significant in all specifications, which highlights the potential impact of price-deflation in each of the samples. Once we control for price deflation, the coefficient $\hat{\beta}_{21}$ now represents the effect of agency-related conflicts (as measured by price-change-asymmetry) on timely loss recognition. $\hat{\beta}_{21}$ is about twice as large for high-leverage firms than for firms without long-term debt (for both $PCA1_{jt}$ and $PCA2_{jt}$) but the difference in these coefficient estimates is not statistically significant. We interpret this as further evidence that leverage may be a very noisy indicator of debt-related agency costs might be a very noisy. While the coefficient on negative returns ($\hat{\beta}_{11}$), which represents the timely loss recognition coefficient for firms with yearly sample minimum price-convexity, increases as we move from the zero-leverage to the high-leverage sample (e.g., for $PCA2_{jt}$ from 0.08 to 0.21), the effect of leverage is weaker, consistent with the idea that low-price convexity firms have fewer agency problems regardless of their leverage.

Our conclusion remains the same as before: when the threat of harmful wealth redistributions is large and, at the same time, debtholders have a more substantial claim on the firm's assets, timely loss recognition is most evident. These analyses support the a priori supposition that price-convexity should play a larger role in high-leverage firms and thus provide further validation for our use of price-change-asymmetry to identify cases in which debt-related agency costs associated with default are high.

B. Bond ratings and dividend payments as alternative proxies for debt-related agency costs

Excessive dividend payments are perhaps the most direct way in which shareholders can potentially expropriate wealth from debtholders (Kalay 1982; Handjinicolaou and Kalay 1984). Indeed, if unrestricted by covenants, shareholders can increase dividend payouts by using the proceeds of additional debt raising activities, by selling the firm's assets and thus leaving debtholders with an empty shell (Black 1976a), or by under investing in new positive net present value projects and as such reducing the value of the firm. If a firm pays low dividends, debtholders are less likely to be concerned about excessive payouts. High dividend payout rates, on the other hand, are likely to indicate more severe shareholder-debtholder conflicts of interest (Ahmed et al. 2002).

Bond rating agencies express in their ratings of the firm's senior debt their opinion about the firm's capacity and willingness to meet its financial commitments as they come due and assess factors that could affect the ultimate payment in the event of default. Clearly, as a firm's debt rating deteriorates, the likelihood of debtholders being able to recover their claim also worsens. Thus, for firms whose senior debt receives speculative grade ratings, we expect that debt-related agency costs are higher than for those with investment grade ratings.

We use these insights to explore (similar to the case for leveraged firms) how the association between price-convexity and timely loss recognition changes as we consider contexts in which the shareholder-debtholder conflict is a priori likely to be more severe. We only discuss the findings for firm level price-change-asymmetry proxies, but the results are consistent when we use the measures based on price-level portfolios.

To conduct these tests, we obtain further data from Compustat on dividends and debt ratings. Dividend Yield ($DivYield_{jt}$) is common dividends (Compustat data item 21) divided by book value of equity (Compustat data item 60). $LtCr_{jt}$ is measured at the beginning of the year and is based on the Standard's & Poor senior debt ratings (reported as Compustat data item 280).

We consider two partitions of the sample. We first divide the sample into dividend-paying firms and firms that do not pay dividends. Next, we examine separate samples of firms with "investment grade" ratings (between AAA and BBB-) and of firms with "speculative grade" ratings (between BB and D). Table 8 reports the findings for (non)-dividend paying firms. Note first that, in contrast with the findings for samples partitioned on leverage, the coefficient on timely loss recognition in the original Basu model (β_1) is very similar for dividend-paying and zero-dividend firms. This cannot be interpreted as unambiguous evidence that timely loss recognition does not respond to dividend payments (as a proxy of agency costs). For this purpose, we first need to control for the effect of the price-deflator. Indeed, as Table 8 shows, controlling for price-deflation matters in the zero-dividend sub-sample, while its effect seems less important for dividend-paying firms (e.g., consider $PCA1_{jt}$, $\hat{\alpha}_{20}$ equals -0.304, t-statistic of -15.951 for zero-dividend firms vs. -0.064, t-statistic of -3.397 for dividend-paying firms). After controlling for price-deflation, timely loss recognition is very different for dividend-paying and zero-dividend firms. Indeed, in those cases where price-change-asymmetry indicates the presence of agency costs, the coefficient on timely loss recognition ($\hat{\beta}_{21}$) is over three times higher for dividend-paying firms than for zero-dividend firms. This finding is independent of the price-change-asymmetry proxy we use. We report a formal test of the difference in coefficients between the two groups in the columns in Table 8 labeled "Difference", which confirms our earlier conclusion.

A similar pattern arises from Table 9. In the original Basu-specification, timely loss recognition appears to be very different for firms with investment grade and speculative ratings. But this finding may reflect the implicit inclusion of agency conflicts via the price-deflator in this regression. It turns out that the effect of price-deflation is not the same across sub-samples. To illustrate, consider the results for $PCA1_{jt}$. The estimated coefficient on $PCA1_{jt}$, $\hat{\alpha}_{20}$ equals -0.038 (t-statistic of -1.704) in the investment grade sub sample. In the speculative grade sub-sample, in contrast, $\hat{\alpha}_{20}$ is -0.380 (t-statistic of -6.398). After controlling for the price-deflator effect, the magnitude of the coefficient on the interaction between negative returns and price-change-asymmetry is 0.56 in the investment grade sub-sample compared to 0.88 for the speculative grade sub-sample. Formal tests of the difference in coefficient estimates are consistent with our prediction but do not attain the conventional critical values. It appears that the association between timely loss recognition and agency costs is much more similar across credit ratings than one might glean from the original Basu-specification, In addition, the estimate of the coefficient β_{11}, which represents timely loss recognition for firms with low price-convexity is much higher for firms rated as speculative grade.

Similar to our reasoning for the analysis of the leverage samples, we argue that the joint occurrence of high dividend payments or speculative grade bond ratings *and* high price-convexity identifies cases when the shareholder-debtholder conflict of interest becomes manifest and urgent. Together, the consistent findings for sample partitions based on leverage, dividend payments, and bond ratings, supports our conjecture that our price-convexity-based proxy captures debt contract-related agency costs. We also show that price-deflation can have different effects in different samples, which emphasizes the need to control for its effect.

7. Limitations and conclusion

Timely loss recognition has been proposed as a fundamental accounting property that plays a pivotal contracting role. As such it has been the subject of much empirical research in the past decade. From this body of work, there are substantial indications that timely loss recognition functions as an instrument to reduce the conflict of interest between shareholders and debtholders. To protect the claims of debtholders, lending contracts usually specify conditions that require a transfer of decision making power to debtholders when the probability is high that shareholders try to redistribute wealth away from lenders. Such contractual provisions as a rule use information derived from financial statements to trigger the transfer of control rights. Contracting parties therefore benefit if financial statements quickly reflect adverse news about the economic fundamentals of the firm. Hence the debt-contract related demand for timely loss recognition. Extant tests of the relation between timely loss recognition and the severity of debt-related agency problems, suffer from the problem that available proxies for the shareholder-debtholder conflict are crude. As a consequence, such tests lack power and the findings are not unambiguously attributable to debt-contracting.

In contrast, we propose a simple measure that relies on economic theory to identify circumstances in which the conflict between shareholders and debtholders is urgent. Price-convexity varies with the value of the call option that shareholders have on the firm’s assets. When this call option is out-of-the-money, the expropriation risk of debtholders is high, since the shareholders are getting ever closer to defaulting on the firm’s debt. At the same time, price-convexity will be high because the firm’s stock price is relatively impervious to further bad news as the shareholders’ liability is limited (as is the amount they stand to loose).

Consistent with this reasoning, we show that timely loss recognition is strongly positively associated with debt-related agency problems as measured by price-change-asymmetry. We also show that in those contexts in which price-convexity is more likely to be important, in particular in firms with high leverage, high dividend payouts, or speculative bond ratings, more timely loss recognition ensues. This is consistent with the idea that the potential for shareholder-debtholder conflicts is higher in such firms, and so is the a priori demand for timely loss recognition. By including price-change-asymmetry in the analysis, we can identify not just when there is a potential for agency conflicts, but, more precisely, when these conflicts become manifest and urgent.

Our examination of price-convexity reveals that debt-related agency costs vary with price-levels. This finding has important implications for the use of earnings-return regressions deflated by price in examining the effect of agency costs on timely loss recognition. Price deflation conditions both the dependent and independent variables in the Basu-regression on the magnitude of agency costs. When agency costs are the focus of analysis, price deflation obscures the relation of interest. Consequently, we include a proxy for agency costs both as simple and interaction terms in the regression to remove this effect of price-deflation.

For our conclusions to pass muster, it is crucial that we are able to measure price-convexity reliably. While we rely on theory to inform the construction of our measures and use several different proxies all with consistent results in the analyses, how to capture price-convexity remains a largely unsettled issue. Indeed, as far as we are aware, we are the first to suggest a refined price-level measure of convexity. Our proxies have the additional advantage that they impose few data requirements which allows for the use of broad-based samples. Nevertheless, it is possible that our price-change-asymmetry variables are too crude to capture the shareholder-debtholder conflict of interest. Future researchers may find it worthwhile to improve on our proxies given that price-convexity is likely to play a role in many other settings in which accountants are interested.

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Table 1
Descriptive Statistics

Variable	N	Mean	Std. Dev.	Min	Q1	Median	Q3	Max
Ret_{jt}	126981	0.135	0.581	-0.898	-0.215	0.053	0.351	4.129
E_{jt} /P_{jt-1}	126981	0.012	0.224	-2.327	-0.003	0.056	0.100	0.563
$PCA1_{jt}$	126980	-0.007	0.213	-0.515	-0.159	-0.066	0.096	0.814
$PCA2_{jt}$	126980	-0.003	0.076	-0.148	-0.058	-0.023	0.032	0.311
$Altman_{jt}$	120855	0.008	0.006	0	0.005	0.009	0.012	0.970
$Shumway_{jt}$	123151	0.025	0.102	0	0.001	0.002	0.007	1
KMV_{jt}	62753	3.201	5.189	0.020		0.936		20.00
$1/p_{jt}$	126981	0.175	0.507	0	0.038	0.072	0.164	32
$LogMktCap_{jt}$	125908	-1.245	10.510	4.802	3.300	4.650	6.198	-1.245
BTM_{jt}	124274	-6.263	5.901	0.727	0.320	0.571	0.953	-6.263
Lev_{jt}	126981	0.182	0.173	0	0.021	0.150	0.289	0.99
$Divyld_{jt}$	124111	0.031	0.920	0	0	0.000	0.038	0.22
$LtCr_{jt}$	19113	11.55	3.902	2	9	11	15	29

The table reports selected descriptive statistics. Opening price deflated earnings (E_{jt} /P_{jt-1}) are measured as income before extraordinary items (Compustat data item 18) scaled by beginning of the fiscal year stock price (Compustat data item 199) multiplied by shares outstanding (Compustat data item 25). $PCA1_{jt}$ and $PCA2_{jt}$ are firm level price-change-asymmetry measures used in cross-sectional analysis in Table 5 (to construct firm-level estimates of price-change asymmetry, we model the conditional mean of positive (negative) returns by estimating a non-parametric local regression of positive (negative) returns on a constant and the inverse of the beginning of the year price (we use the inverse of price instead of price to obtain a more homogeneous distribution of the data when conducting the non-parametric analysis); the results from the non-parametric regression are used to construct the predicted value of positive (negative) returns conditional on the beginning of the year stock price of the firm; subsequently, we divide, conditional on price, the expected positive returns by the expected negative returns to obtain *PCA1* and *PCA2*). Annual returns (Ret_{jt}) are obtained from monthly returns compounded over the 12-month fiscal year period. *Size* is the logarithm of market capitalization (Compustat data item 199 multiplied by data item 25). $Altman_{jt}$ is the probability of bankruptcy based on the Altman (1968) estimates and $Shumway_{jt}$ is the probability of bankruptcy based on model in Shumway (2001). KMV_{jt} is the estimate of default frequency (EDF®) provided by Moody's KMV, $1/p_{jt}$ the inverse of price (used in non-parametric regressions). The book-to-market ratio (BTM_{jt}) is the book value of equity (Compustat data item 60) scaled by market capitalization (Compustat data item 199). $LogMktCap_{jt}$ is the logarithm of market capitalization (Compustat data item 199 multiplied by data item 25). The book-to-market ratio (BTM_{jt}) is the book value of equity (Compustat data item 60) scaled by market capitalization (Compustat data item 199 multiplied by data item 25). Leverage (Lev_{jt}) is defined as the ratio of long-term debt (Compustat data item 9) to total assets (Compustat data item 60). $Divyld_{jt}$ is dividend yield calculated as a ratio of dividends (Compustat data item 21) to book value of equity (Compustat data item 60). $LtCr_{jt}$ is long term credit rating by S&P (Compusat data item 280). The complete CRSP-Compustat (1963-2006) population of non-financial firms is used with 0.5 percent of observations truncated at each tail to mitigate the influence of outliers.

T a b l e 2

Piecewise linear Earnings-Return Relation and Price-Change-Asymmetry: Portfolio Level Estimates

Price Level portfolio ($) (1)	# Obs. (2)	$\hat{\beta}_0$ (3)	$\hat{\beta}_1$ (4)	Avg(Ret_{jt} | Ret_{jt} > 0) (5)	Avg(Ret_{jt} | Ret_{jt} < 0) (6)	*PCA1* (7)= -(5)/(6)	*PCA2* (8)= [-(1)+1]/ [(2)+1]	$\hat{\sigma}$ (Ret_{jt} | Ret_{jt} > 0) (9)	$\hat{\sigma}$ (Ret_{jt} | Ret_{jt} < 0) (10)	*PCA3* (11)= (9)/(10)	*PCA4* (12)= [(9)+1]/ [(10)+1]	*Skewness* (13)
1.00 to 2	5802	0.03	0.33	0.80	-0.37	2.15	1.31	0.83	0.23	3.57	1.48	1.72
2.00 to 3	5997	0.01	0.36	0.74	-0.36	2.05	1.28	0.78	0.23	3.32	1.44	1.74
3 to 4	6277	0.03	0.32	0.67	-0.35	1.90	1.23	0.70	0.23	3.07	1.38	1.75
4 to 5	5808	0.03	0.32	0.61	-0.34	1.82	1.21	0.65	0.23	2.89	1.35	1.74
5 to 6	5339	0.03	0.30	0.58	-0.34	1.74	1.18	0.64	0.22	2.88	1.34	1.82
6 to 7	4993	0.02	0.34	0.55	-0.34	1.65	1.16	0.57	0.23	2.53	1.28	1.61
7 to 8	5257	0.02	0.30	0.55	-0.33	1.69	1.17	0.60	0.22	2.73	1.31	1.78
8 to 9	4539	0.03	0.25	0.55	-0.31	1.77	1.18	0.58	0.22	2.69	1.30	1.71
9 to 10	4103	0.03	0.23	0.54	-0.31	1.75	1.18	0.57	0.21	2.68	1.29	1.72
10 to 11	3816	0.03	0.24	0.52	-0.30	1.73	1.17	0.55	0.21	2.59	1.28	1.73
11 to 12	3514	0.03	0.26	0.50	-0.29	1.70	1.16	0.51	0.21	2.43	1.25	1.56
12 to 13	3442	0.04	0.22	0.48	-0.31	1.56	1.13	0.53	0.21	2.54	1.27	1.88
13 to 14	3484	0.01	0.26	0.45	-0.30	1.52	1.12	0.49	0.21	2.36	1.23	1.75
14 to 15	3382	0.03	0.15	0.44	-0.29	1.50	1.11	0.50	0.21	2.34	1.23	1.78
15 to 16	3200	0.03	0.18	0.44	-0.28	1.56	1.12	0.46	0.20	2.24	1.21	1.69
16 to 17	3102	0.02	0.20	0.42	-0.29	1.46	1.10	0.45	0.21	2.14	1.20	1.69
17 to 18	3003	0.02	0.17	0.42	-0.28	1.53	1.11	0.45	0.21	2.12	1.20	1.67
18 to 19	2914	0.03	0.13	0.42	-0.27	1.60	1.13	0.47	0.20	2.30	1.22	1.84
19 to 20	2642	0.04	0.12	0.43	-0.26	1.64	1.13	0.46	0.20	2.29	1.22	1.81
20 to 21	2321	0.01	0.16	0.40	-0.26	1.54	1.11	0.44	0.20	2.17	1.20	1.89
21 to 22	2178	0.04	0.13	0.38	-0.25	1.51	1.10	0.42	0.20	2.14	1.19	1.73
22 to 23	2132	0.03	0.14	0.40	-0.26	1.54	1.11	0.44	0.20	2.16	1.20	1.86
23 to 24	2361	0.02	0.09	0.37	-0.25	1.47	1.09	0.39	0.19	2.00	1.16	1.59
24 to 25	2153	0.02	0.15	0.39	-0.25	1.56	1.11	0.39	0.21	1.89	1.15	1.21
25 to 26	2027	0.04	0.10	0.37	-0.25	1.50	1.10	0.39	0.20	1.92	1.15	1.40
26 to 27	1901	0.02	0.14	0.36	-0.25	1.44	1.09	0.36	0.20	1.82	1.13	1.22
27 to 28	1814	0.02	0.12	0.36	-0.24	1.53	1.10	0.38	0.19	1.97	1.16	1.66
28 to 29	1681	0.03	0.10	0.35	-0.25	1.42	1.08	0.35	0.20	1.77	1.13	1.18
29 to 30	1557	0.03	0.16	0.36	-0.24	1.47	1.09	0.35	0.20	1.73	1.12	1.12
30 to 31	1417	0.03	0.17	0.33	-0.25	1.35	1.07	0.31	0.20	1.57	1.09	0.93
31 to 32	1307	0.01	0.13	0.35	-0.23	1.55	1.10	0.39	0.18	2.17	1.18	1.99
32 to 33	1295	0.01	0.14	0.36	-0.24	1.48	1.09	0.39	0.20	1.91	1.15	1.83
33 to 34	1255	0.00	0.11	0.35	-0.23	1.53	1.10	0.37	0.19	1.96	1.15	1.78
34 to 35	1242	0.01	0.09	0.36	-0.23	1.55	1.10	0.41	0.19	2.08	1.18	2.11
35 to 36	1121	0.01	0.08	0.34	-0.23	1.43	1.08	0.37	0.20	1.86	1.14	1.66
36 to 37	1102	0.01	0.12	0.36	-0.23	1.56	1.11	0.35	0.20	1.78	1.13	1.28
37 to 38	1026	0.00	0.13	0.35	-0.23	1.51	1.10	0.40	0.19	2.09	1.17	2.28
38 to 39	964	0.03	0.10	0.35	-0.23	1.50	1.09	0.33	0.20	1.64	1.11	0.94
39 to 40	905	0.04	0.14	0.34	-0.23	1.51	1.09	0.31	0.19	1.68	1.11	0.94
40 to 50	6129	0.01	0.11	0.34	-0.22	1.55	1.10	0.36	0.19	1.89	1.14	1.63
50 to 60	3294	0.01	0.10	0.33	-0.22	1.52	1.09	0.32	0.19	1.70	1.11	1.29
60 to 70	1781	0.00	0.11	0.33	-0.23	1.44	1.08	0.35	0.20	1.76	1.12	1.51
70 to 80	1060	0.00	0.11	0.33	-0.24	1.39	1.07	0.39	0.21	1.81	1.14	2.27
80 to 90	594	0.01	0.07	0.36	-0.25	1.44	1.09	0.40	0.22	1.77	1.14	1.64
90 to 100	328	0.01	0.09	0.35	-0.25	1.42	1.08	0.33	0.21	1.53	1.09	0.76
≥100	929	0.01	0.12	0.37	-0.26	1.42	1.09	0.49	0.23	2.18	1.22	2.49

The table compares the estimates from piecewise-linear regressions of earnings onto returns conditional on the sign of returns with four proxies of price-change asymmetry (*PCA1-PCA4*). The following model is estimated for each of the 46 price-level portfolios:

$$E_{jt} / P_{jt-1} = \alpha_0 + \alpha_1 * D(Ret_{jt} < 0) + \beta_0 * Ret_{jt} + \beta_1 * Ret_{jt} * D(Ret_{jt} < 0) + \varepsilon_{jt},$$

where E_{jt} is earnings, measured as income before extraordinary items (Compustat item 18), P_{jt-1} is beginning of the period market capitalization (Compustat item 199 multiplied by Compustat item 25); Ret_{jt} is stock return compounded over the 12 months fiscal year and *D(.)* is an indicator function. Price-level portfolios are given by intervals specified in the first column; the intervals widen with price to keep the number of observations in each portfolio approximately the same. Firms are allocated across the intervals based on the beginning of period price. *PCA1 – PCA4* proxy for price-change asymmetry. *PCA1* is the ratio of average positive fiscal year returns to average negative fiscal year returns: $PCA1 = -Average(Ret_{jt} | Ret_{jt} > 0)/Average(Ret_{jt} | Ret_{jt} < 0)$. *PCA2* is defined in a similar way but uses gross returns to avoid small denominator problem: $PCA2 = Average(Ret_{jt}+1 | Ret_{jt} > 0)/Average(Ret_{jt}+1 | Ret_{jt} < 0)$. *PCA3* is the ratio of standard deviation of positive fiscal year returns to standard deviation of negative fiscal year returns, used to measure the following concept: $PCA3 = \hat{\sigma}(Ret_{jt} | Ret_{jt} > 0)/ \hat{\sigma}(Ret_{jt} | Ret_{jt} < 0)$. $PCA4 = [\hat{\sigma}(Ret_{jt} | Ret_{jt} > 0)+1]/[\hat{\sigma}(Ret_{jt} | Ret_{jt} < 0)+1]$ is analogous to *PCA3* but adds 1 to both numerator and denominator. *Skewness* is computed as the third moment of return distribution about the mean (scaled by the cube of the variance). The complete CRSP-Compustat (1963-2006) population of non-financial firms is used to estimate the model with 0.5 percent of observations truncated at each tail to mitigate the influence of outliers.

T a b l e 3

Regressions of $\hat{\beta}_1$ Slope Coefficient from Piecewise Linear Earnings-Return Relation on Estimates of Price-Change-Asymmetry

Variable	Statistic	MODEL1	MODEL2	MODEL3	MODEL4	MODEL5	MODEL6	MODEL7	MODEL8	MODEL9	MODEL10
Intercept	**Estimate**	**0.239**	**0.114**	**-0.457**	**-1.340**	**-0.160**	**-0.780**	**-0.289**	**-1.071**	**-0.078**	**-0.688**
	t-statistic	16.79	2.02	-6.43	-10.06	-5.38	-9.94	-3.06	-6.30	-1.91	-7.12
	P-value	0.000	0.049	0.000	0.000	0.000	0.000	0.004	0.000	0.063	0.000
Price level	**Estimate**	**-0.002**						**-0.001**	**-0.001**	**0.000**	**-0.001**
	t-statistic	*-6.11*						*-2.65*	*-2.40*	*-0.91*	*-1.64*
	P-value	0.000						0.011	0.021	0.370	0.109
Skewness	**Estimate**		**0.035**					**0.004**	**0.000**	**-0.058**	**-0.048**
	t-statistic		*1.03*					*0.20*	*-0.01*	*-3.21*	*-2.93*
	P-value		0.308					0.845	0.990	0.003	0.005
PCA1	**Estimate**			**0.399**				**0.306**			
	t-statistic			*8.88*				*5.50*			
	P-value			0.000				0.000			
PCA2	**Estimate**				**1.343**				**1.124**		
	t-statistic				*11.36*				*7.56*		
	P-value				0.000				0.000		
PCA3	**Estimate**					**0.151**				**0.161**	
	t-statistic					*11.37*				*8.73*	
	P-value					0.000				0.000	
PCA4	**Estimate**						**0.789**				**0.789**
	t-statistic						*12.15*				*9.47*
	P-value						0.000				0.000
Adj R-Sq		0.446	0.001	0.634	0.740	0.740	0.765	0.671	0.761	0.799	0.820

The analysis in this table is based on the estimates reported in Table 2. The following model is estimated based on 46 price-level portfolio observations using weighted least squares (weights are given by the number of observations in each portfolio):

$$\hat{\beta}_{1p} = c + \gamma\, PCA_p + \varphi * Controls_p + \varepsilon \quad (6).$$

where PCA_p is one of our estimates of price-change asymmetry (*PCA1*, *PCA2*, *PCA3*, or *PCA4*). *PCA1* is the ratio of average positive fiscal year returns to average negative fiscal year returns: $PCA1 = -Average(Ret_{jt} \mid Ret_{jt} > 0)/Average(Ret_{jt} \mid Ret_{jt} < 0)$. *PCA2* is defined in a similar way but uses gross returns to avoid small denominator problem: $PCA2 = Average(Ret_{jt}+1 \mid Ret_{jt} > 0)/E(Ret_{jt}+1 \mid Ret_{jt} < 0)$. *PCA3* is the ratio of standard deviation of positive fiscal year returns to standard deviation of negative fiscal year returns, used to measure the following concept: $PCA3 = Std.Dev.(Ret_{jt} \mid Ret_{jt} > 0) / Std.Dev.(Ret_{jt} \mid Ret_{jt} < 0)$. $PCA4 = [\hat{\sigma}(Ret_{jt} \mid Ret_{jt} > 0)+1]/[\hat{\sigma}(Ret_{jt} \mid Ret_{jt} < 0)+1]$ is analogous to *PCA3* but adds 1 to both numerator and denominator. *Price level* and *Skewness* of returns are used as control variables (omitted in some specifications). Price levels are given by intervals specified in the first column in Table 2. The lower bound of each interval is used as a control variable. *Skewness* is computed as the third moment of return distribution about the mean (scaled by the cube of the variance). β_1 is estimated by running the following regression for each price level portfolio:

$$E_{jt} / P_{jt-1} = \alpha_0 + \alpha_1 * D(Ret_{jt} < 0) + \beta_0 * Ret_{jt} + \beta_1 * Ret_{jt} * D(Ret_{jt} < 0) + \varepsilon_{jt} \quad (B),$$

where E_{jt} is earnings, measured as income before extraordinary items (Compustat item 18), P_{jt-1} is beginning of the period market capitalization (Compustat item 199 times Compustat item 25); Ret_{jt} is stock return compounded over the 12 months of the fiscal year and *D(.)* is an indicator function. Firms are allocated to portfolios based on the beginning of period price. The complete CRSP-Compustat (1963-2006) population of non-financial firms is used to estimate equation (*B*) with 0.5 percent of observations truncated at each tail to mitigate the influence of outliers.

Table 4

Correlations among Main Variables Including Firm-Specific Estimates of Price-Change-Asymmetry and Estimates of the Probability of Default

Variable	Ret_{jt}	E_{jt}/P_{jt-1}	$PCA1_{jt}$	$PCA2_{jt}$	$Shumway_{jt}$	$Altman_{jt}$	KMV_{jt}	$1/p_{jt}$	$Size_{jt}$	BTM_{jt}	Lev_{jt}	$Divyld_{jt}$	$LtCr_{jt}$
Ret_{jt}	1	0.42	-0.17	-0.18	-0.60	-0.19	-0.39	-0.07	0.04	0.15	0.03	0.11	-0.08
E_{jt}/P_{jt-1}	0.20	1	-0.26	-0.26	-0.49	0.12	-0.37	-0.27	0.05	0.26	0.15	0.35	-0.22
$PCA1_{jt}$	-0.09	-0.37	1	0.99	0.51	0.16	0.66	0.81	-0.71	0.22	-0.07	-0.38	0.45
$PCA2_{jt}$	-0.10	-0.38	1.00	1	0.54	0.16	0.68	0.85	-0.73	0.23	-0.07	-0.40	0.54
$Shumway_{jt}$	-0.22	-0.47	0.35	0.35	1	0.41	0.45	0.56	-0.48	0.03	0.12	-0.40	0.56
$Altman_{jt}$	-0.15	-0.03	0.09	0.09	0.09	1	0.77	0.14	-0.18	0.52	0.56	0.13	0.33
KMV_{jt}	-0.28	-0.47	0.59	0.60	0.50	0.40	1	0.69	-0.64	0.23	0.08	-0.46	0.64
$1/p_{jt}$	0.02	-0.24	0.47	0.49	0.21	0.01	0.31	1	-0.71	0.25	-0.08	-0.50	0.62
$LogMktCap_{jt}$	-0.03	0.16	-0.64	-0.66	-0.18	-0.10	-0.48	-0.29	1	-0.34	0.10	0.35	-0.60
BTM_{jt}	0.11	-0.02	0.21	0.21	-0.08	0.29	0.20	0.11	-0.34	1	0.13	0.13	0.12
Lev_{jt}	0.00	0.00	-0.04	-0.04	0.03	0.37	0.11	-0.03	0.08	0.03	1	0.15	0.50
$Divyld_{jt}$	0.01	0.20	-0.32	-0.33	-0.14	0.06	-0.22	-0.15	0.34	-0.04	0.08	1.00	-0.69
$LtCr_{jt}$	0.01	-0.27	0.50	0.55	0.23	0.29	0.40	0.32	-0.61	0.10	0.49	-0.59	1

The table reports correlations (Pearson below the diagonal and Spearman above the diagonal) based on the pooled cross-section end time-series of observations. Opening price deflated earnings (E_t /P_{t-1}) are measured as income before extraordinary items (Compustat data item 18) scaled by beginning of the fiscal year stock price (Compustat data item 199) multiplied by shares outstanding (Compustat data item 25). $PCA1_{jt}$ and $PCA2_{jt}$ are firm level price-change-asymmetry measures used in cross-sectional analysis in Table 5 (to construct firm-level estimates of price-change asymmetry, we model the conditional mean of positive (negative) returns by estimating a non-parametric local regression of positive (negative) returns on a constant and the inverse of the beginning of the year price (we use the inverse of price instead of price to obtain a more homogeneous distribution of the data when conducting the non-parametric analysis); the results from the non-parametric regression are used to construct the predicted value of positive (negative) returns conditional on the beginning of the year stock price of the firm; subsequently, we divide, conditional on price, the expected positive returns by the expected negative returns to obtain $PCA1_{jt}$ and $PCA2_{jt}$). Annual returns (Ret_{jt}) are compounded over the 12-month fiscal year period. $LogMktCap_{jt}$ is the logarithm of market capitalization (Compustat data item 199 multiplied by data item 25). $Altman_{jt}$ is the probability of bankruptcy based on the Altman (1968) estimates and $Shumway_{jt}$ is the probability of bankruptcy based on model in Shumway (2001). KMV_{jt} is the estimate of default frequency (EDF®) provided by Moody's KMV, $1/p_{jt}$ the inverse of price (used in the non-parametric regressions). The book-to-market ratio (BTM_{jt}) is the book value of equity (Compustat data item 60) scaled by market capitalization (Compustat data item 199 multiplied by data item 25). $LogMktCap_{jt}$ is the logarithm of market capitalization (Compustat data item 199 multiplied by data item 25). The book-to-market ratio (BTM_{jt}) is the book value of equity (Compustat data item 60) scaled by market capitalization (Compustat data item 199 multiplied by data item 25). Leverage (Lev_{jt}) is defined as the ratio of long-term debt (Compustat data item 9) to total assets (Compustat data item 60). $Divyld_{jt}$ is dividend yield calculated as a ratio of dividends (Compustat data item 21) to book value of equity (Compustat data item 60). $LtCr_{jt}$ is long term credit rating by S&P (Compusat data item 280). The complete CRSP-Compustat (1963-2006) population of non-financial firms is used with 0.5 percent of observations truncated at each tail to mitigate the influence of outliers.

T a b l e 5
Firm level Estimates of Price-Change-Asymmetry and Timely Loss Recognition

$$E_{jt} / P_{jt-1} = \alpha_{10} + \alpha_{11} * D(Ret_{jt} < 0) + \beta_{10} * Ret_{jt} + \beta_{11} * Ret_{jt} * D(Ret_{jt} < 0)$$
$$+ (\alpha_{20} + \alpha_{21} * D(Ret_{jt} < 0) + \beta_{20} * Ret_{jt} + \beta_{21} * Ret_{jt} * D(Ret_{jt} < 0)) * PCA_{jt} + \varepsilon_{jt}$$

Variable	Statistic	MODEL1	MODEL2	MODEL3
PCA_{jt} =			$\boldsymbol{PCA1_{jt}}$	$\boldsymbol{PCA2_{jt}}$
Intercept	Estimate	0.046***	0.032***	0.030***
	t-statistic	7.04	4.12	3.85
$D(Ret_{jt}<0)$	Estimate	0.002	0.003	0.003
	t-statistic	0.45	0.99	0.93
Ret_{jt}	Estimate	0.022***	0.044***	0.047***
	t-statistic	3.56	8.03	8.46
$D(Ret_{jt}<0)*Ret_{jt}$	Estimate	0.361***	0.237***	0.222***
	t-statistic	16.29	17.04	16.87
PCA_{jt}	Estimate		-0.264***	-0.818***
	t-statistic		-13.57	-13.58
$PCA_{jt} *D(Ret_{jt}<0)$	Estimate		-0.023	-0.067
	t-statistic		-1.18	-1.11
$PCA_{jt} *Ret_{jt}$	Estimate		0.019	0.043
	t-statistic		1.14	0.79
$PCA_{jt} *D(Ret_{jt}<0)*Ret_{jt}$	Estimate		0.427***	1.447***
	t-statistic		5.35	5.70
Adj R-squared		0.136	0.214	0.221

To construct firm-level estimates of price-change asymmetry, we model the conditional mean of positive (negative) returns by estimating a non-parametric local regression of positive (negative) returns on a constant and the inverse of the beginning of the year price (we use the inverse of price instead of price to obtain a more homogeneous distribution of the data when conducting the non-parametric analysis). The results from the non-parametric regression are used to construct the predicted value of positive (negative) returns conditional on the beginning of the year stock price of the firm. Subsequently, we divide, conditional on price, the expected positive returns by the expected negative returns to obtain refined price-level versions of $PCA1_{jt}$ and $PCA2_{jt}$ (denoted by PCA_{jt} in the model). Opening price deflated earnings (E_{jt} /P_{jt-1}) are measured as income before extraordinary items (Compustat item 18) scaled by beginning of the fiscal year stock price (Compustat item 199) multiplied by shares outstanding (Compustat item 25). Annual returns (Ret_{jt}) are compounded over the 12-month period of the fiscal year. Following Fama-MacBeth (1973), the coefficient estimates and t-statistics are based on annual cross-sectional regressions. The control variables are measured at the beginning of the fiscal year. To facilitate the interpretation, $PCA1_{jt}$ and $PCA2_{jt}$ are transformed year by year such that PCA_{jt}=0 corresponds to the sample minimum value of price-change-asymmetry. The complete CRSP-Compustat (1963-2006) population of non-financial firms is used. Observations in the top or bottom 0.5 percent of all variables are truncated to reduce the effect of outliers.

Table 6

Regressions of the Estimated Timely Loss Recognition Coefficient $\hat{\beta}_1$ on Estimates of Price-Change Asymmetry Using Samples Partitioned on Leverage

		Zero Leverage				Low Leverage				High Leverage				Difference
Variable	**Stats**	Model1	Model2	Model3	Model4	Model1	Model2	Model3	Model4	Model1	Model2	Model3	Model4	
Intercept	**Estimate**	**-0.087**	**-0.674**	**-0.063**	**-0.439**	**-0.382**	**-1.207**	**-0.127**	**-0.639**	**-0.387**	**-1.697**	**-0.199**	**-1.061**	
	t-stat	-1.716	-5.137	-1.738	-4.572	-6.177	-10.531	-4.978	-9.412	-2.654	-6.015	-3.508	-7.017	
	P-value	0.093	0.000	0.089	0.000	0.000	0.000	0.000	0.000	0.011	0.000	0.001	0.000	
PCA1	**Estimate**	**0.142**				**0.334**				**0.370**				**0.229**
	t-stat	4.556				8.599				4.056				2.372
	P-value	0.000				0.000				0.000				0.018
PCA2	**Estimate**		**0.714**				**1.201**				**1.693**			**0.979**
	t-stat		6.213				11.825				6.734			3.541
	P-value		0.000				0.000				0.000			0.000
PCA3	**Estimate**			**0.085**				**0.123**				**0.192**		**0.107**
	t-stat			5.765				10.967				7.221		3.521
	P-value			0.000				0.000				0.000		0.000
PCA4	**Estimate**				**0.462**				**0.648**				**1.068**	**0.606**
	t-stat				6.047				11.608				8.369	4.076
	P-value				0.000				0.000				0.000	0.000
Adj R-Sq		0.310	0.461	0.423	0.447	0.618	0.755	0.726	0.748	0.256	0.496	0.532	0.605	

The following model is estimated based on 46 price-level observations for each leverage-based sub-sample using weighted least squares (weights are given by the number of observations in each portfolio):

$$\hat{\beta}_{1p} = c + \gamma PCA_p + \varepsilon \quad (A),$$

where *PCA* is one of our estimates of price-change asymmetry (*PCA1*, *PCA2*, *PCA3*, or *PCA4*). *PCA1* is the ratio of average positive fiscal year returns to average negative fiscal year returns: $PCA1 = -Average(Ret_{jt}\ |Ret_{jt} > 0)/Average(Ret_{jt}\ |Ret_{jt} < 0)$. *PCA2* is defined in a similar way but uses gross returns to avoid small denominator problem: $PCA2 = Average(Ret_{jt}+1\ |Ret_{jt} > 0)/Average(Ret_{jt}+1\ |Ret_{jt} < 0)$. *PCA3* is the ratio of standard deviation of positive fiscal year returns to standard deviation of negative fiscal year returns, used to measure the following concept: $PCA3 = \hat{\sigma}(Ret_{jt}\ |Ret_{jt} > 0)/\ \hat{\sigma}(Ret_{jt}\ |Ret_{jt} < 0)$. $PCA4 = [\hat{\sigma}(Ret_{jt}\ |Ret_{jt} > 0)+1]/[\hat{\sigma}(Ret_{jt}\ |Ret_{jt} < 0)+1]$ is analogous to *PCA3* but adds 1 to both numerator and denominator. β_1 is estimated by running the following regression for each price level portfolio:

$$E_{jt} / P_{jt-1} = \alpha_0 + \alpha_1 * D(Ret_{jt} < 0) + \beta_0 * Ret_{jt} + \beta_1 * Ret_{jt} * D(Ret_{jt} < 0) + \varepsilon_{jt} \quad (B),$$

where E_{jt} is earnings, measured as income before extraordinary items (Compustat item 18), P_{jt-1} is beginning of the period market capitalization (Compustat item 199 times Compustat item 25); Ret_{jt} is stock return compounded over the 12 months fiscal year and *D(.)* is an indicator function. Firms are allocated to portfolios based on the beginning of period price. Leverage is measured at the beginning of fiscal year and is defined as long term debt (item #9) divided by total assets (Compustat item 6). The sample is split into high and low group at the median value of non-zero leverage companies. The complete CRSP-Compustat (1963-

2006) population of non-financial firms is used to estimate equation (*B*) with 0.5 percent of observations truncated at each tail to mitigate the influence of outliers.

T a b l e 7

Refined Estimates of Price-Change-Asymmetry and Timeliness Loss Recognition Using Samples Partitioned on Leverage

$$E_{jt} / P_{jt-1} = \alpha_{10} + \alpha_{11} * D(Ret_{jt} < 0) + \beta_{10} * Ret_{jt} + \beta_{11} * Ret_{jt} * D(Ret_{jt} < 0)$$
$$+ (\alpha_{20} + \alpha_{21} * D(Ret_{jt} < 0) + \beta_{20} * Ret_{jt} + \beta_{21} * Ret_{jt} * D(Ret_{jt} < 0)) * PCA_{jt} + \varepsilon_t$$

Variable	**Stat.**	Zero Lev.	Low Lev.	High Lev.	Zero Lev.	Low Lev.	High Lev.	High-Zero Difference	Zero Lev.	Low Lev.	High Lev.	Difference
						PCA=PCA1				*PCA=PCA2*		
Intercept	**Estimate**	**0.006**	**0.045**	**0.059**	0.081	0.093	0.110	0.029	0.075	0.088	0.105	0.030
	t-stat	0.920	6.737	9.049	18.613	20.648	17.623	3.861	19.408	19.887	16.739	4.034
	P-value	0.363	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$D(Ret_{jt}<0)$	**Estimate**	**-0.004**	**-0.002**	**0.010**	**0.017**	**0.001**	**0.020**	**0.003**	**0.019**	**0.001**	**0.017**	**-0.002**
	t-stat	-0.722	-0.702	1.839	2.432	0.259	3.447	0.341	3.082	0.268	3.370	-0.203
	P-value	0.474	0.486	0.073	0.019	0.797	0.001	0.733	0.004	0.790	0.002	0.839
Ret_{jt}	**Estimate**	**0.005**	**0.022**	**0.032**	**0.033**	**0.041**	**0.045**	**0.013**	**0.043**	**0.045**	**0.048**	**0.006**
	t-stat	0.808	3.568	4.431	4.392	6.795	6.093	1.192	5.559	7.401	6.532	0.559
	P-value	0.424	0.001	0.000	0.000	0.000	0.000	0.233	0.000	0.000	0.000	0.576
$D(Ret_{jt}<0)*Ret_{jt}$	**Estimate**	**0.250**	**0.310**	**0.458**	**0.099**	**0.076**	**0.223**	**0.125**	**0.080**	**0.064**	**0.205**	**0.125**
	t-stat	9.988	14.784	16.415	4.221	3.770	8.165	3.463	3.519	3.585	8.214	3.718
	P-value	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.000	0.000
PCA_{jt}	**Estimate**				**-0.283**	**-0.234**	**-0.280**	**0.003**	**-0.873**	**-0.721**	**-0.882**	**-0.009**
	t-stat				-10.868	-10.787	-13.423	0.077	-10.794	-10.964	-13.420	-0.087
	P-value				0.000	0.000	0.000	0.939	0.000	0.000	0.000	0.930
$PCA_{jt}*D(Ret_{jt}<0)$	**Estimate**				**-0.058**	**-0.017**	**-0.029**	**0.030**	**-0.204**	**-0.057**	**-0.067**	**0.137**
	t-stat				-1.518	-0.820	-0.888	0.591	-1.555	-0.918	-0.668	0.833
	P-value				0.136	0.417	0.379	0.555	0.127	0.364	0.508	0.405
$PCA_{jt}*Ret_{jt}$	**Estimate**				**-0.014**	**0.006**	**0.046**	**0.060**	**-0.102**	**0.006**	**0.143**	**0.245**
	t-stat				-0.494	0.300	2.006	1.659	-1.195	0.108	1.945	2.173
	P-value				0.624	0.766	0.051	0.097	0.239	0.914	0.058	0.030
$PCA_{jt}*D(Ret_{jt}<0)*Ret_{jt}$	**Estimate**				**0.220**	**0.483**	**0.412**	**0.191**	**0.813**	**1.591**	**1.412**	**0.600**
	t-stat				1.877	5.448	3.548	1.160	1.956	5.872	3.902	1.088
	P-value				0.067	0.000	0.001	0.246	0.057	0.000	0.000	0.277
Adj R-Sq		0.112	0.135	0.158	0.205	0.214	0.235		0.225	0.220	0.242	
Number of years		44	44	44	44	44	44		44	44	44	

The model is estimated separately on sub-samples of companies with zero, low, and high leverage. To construct firm-level estimates of price-change asymmetry, we model the conditional mean of positive (negative) returns by estimating a non-parametric local regression of positive (negative) returns on a constant and the inverse of the beginning of the year price (we use the inverse of price instead of price to obtain a more homogeneous distribution of the data when conducting the non-parametric analysis). The results from the non-parametric regression are used to construct the predicted value of positive (negative) returns conditional on the beginning of the year stock price of the firm. Subsequently, we divide, conditional on price, the expected positive returns by the expected negative returns to obtain $PCA1_{jt}$ and $PCA2_{jt}$ (denoted by PCA_{jt} in the model). Opening price deflated earnings (E_{jt} / P_{jt-1}) are measured as income before extraordinary items (Compustat item 18) scaled by beginning of the fiscal year stock price (Compustat item 199) multiplied by shares outstanding (Compustat item 25). Annual returns (Ret_{jt}) are compounded over the 12-month fiscal year. Leverage (Lev_{jt}) is defined as the ratio of long-term debt (Compustat item 9) over total assets (Compustat item 6). The sample is split into high and low group at the median value of non-zero leverage companies. Following Fama-MacBeth (1973), the coefficient estimates and t-statistics are based on annual cross-sectional regressions. To facilitate the interpretation, $PCA1_{jt}$ and $PCA2_{jt}$ are transformed year by year such that PCA_{jt}=0 corresponds to the sample minimum value of price-change-asymmetry. The complete CRSP-Compustat (1963-2006) population of non-financial firms is used. Observations in the top or bottom 0.5 percent of all variables are truncated to reduce the effect of outliers.

Table 8

Refined Estimates of Price-Change Asymmetry and Timeliness Loss Recognition Using Samples Partitioned on Dividends

$$E_{jt} / P_{jt-1} = \alpha_{10} + \alpha_{11} * D(Ret_{jt} < 0) + \beta_{10} * Ret_{jt} + \beta_{11} * Ret_{jt} * D(Ret_{jt} < 0)$$

$$+ (\alpha_{20} + \alpha_{21} * D(Ret_{jt} < 0) + \beta_{20} * Ret_{jt} + \beta_{21} * Ret_{jt} * D(Ret_{jt} < 0)) * PCA_{jt} + \varepsilon_t$$

Variable	Statistic	Zero Dividend	Non-Zero Dividend	Zero Dividend	Non-Zero Dividend	Difference	Zero Dividend	Non-Zero Dividend	Difference
					PCA=PCA1			*PCA=PCA2*	
Intercept	**Estimate**	**-0.004**	**0.083**	**0.087**	**0.091**	**0.003**	**0.085**	**0.089**	**0.004**
	t-stat	-0.631	14.320	15.933	15.588	0.414	15.204	15.727	0.509
	P-value	0.532	0.000	0.000	0.000	0.679	0.000	0.000	0.611
D(Ret$_{it}$<0)	**Estimate**	**0.003**	**0.009**	**0.020**	**-0.001**	**-0.020**	**0.020**	**-0.001**	**-0.021**
	t-stat	0.672	3.478	3.417	-0.174	-3.016	3.660	-0.466	-3.408
	P-value	0.505	0.001	0.001	0.863	0.003	0.001	0.643	0.001
Ret$_{it}$	**Estimate**	**0.025**	**0.055**	**0.032**	**0.054**	**0.022**	**0.036**	**0.054**	**0.018**
	t-stat	3.909	10.994	6.683	6.660	2.318	7.036	7.017	1.904
	P-value	0.000	0.000	0.000	0.000	0.020	0.000	0.000	0.057
D(Ret$_{it}$<0)*Ret$_{it}$	**Estimate**	**0.308**	**0.285**	**0.160**	**0.054**	**-0.106**	**0.147**	**0.055**	**-0.092**
	t-stat	15.925	11.368	7.004	2.465	-3.356	6.799	2.945	-3.196
	P-value	0.000	0.000	0.000	0.018	0.001	0.000	0.005	0.001
PCA$_{jt}$	**Estimate**			**-0.304**	**-0.064**	**0.241**	**-0.959**	**-0.198**	**0.760**
	t-stat			-15.951	-3.397	9.000	-15.987	-3.197	8.811
	P-value			0.000	0.001	0.000	0.000	0.003	0.000
PCA$_{jt}$*D(Ret$_{it}$<0)	**Estimate**			**-0.040**	**0.031**	**0.071**	**-0.123**	**0.109**	**0.232**
	t-stat			-1.745	1.217	2.068	-1.808	1.365	2.212
	P-value			0.088	0.230	0.039	0.078	0.179	0.027
PCA$_{jt}$ *Ret$_{it}$	**Estimate**			**0.023**	**0.036**	**0.013**	**0.052**	**0.138**	**0.086**
	t-stat			1.422	1.101	0.360	1.031	1.325	0.742
	P-value			0.162	0.277	0.719	0.308	0.192	0.458
PCA$_{jt}$*D(Ret$_{it}$<0)*Ret$_{it}$	**Estimate**			**0.272**	**1.038**	**0.765**	**0.927**	**3.436**	**2.509**
	t-stat			3.674	5.600	3.835	4.020	6.152	4.153
	P-value			0.001	0.000	0.000	0.000	0.000	0.000
Adj R-Sq		0.110	0.172	0.183	0.221		0.189	0.228	
Number of years		44	44	44	44		44	44	

The model is estimated separately on sub-samples of companies with zero vs. non-zero dividend-paying firm. To construct firm-level estimates of price-change asymmetry, we model the conditional mean of positive (negative) returns by estimating a non-parametric local regression of positive (negative) returns on a constant and the inverse of the beginning of the year price (we use the inverse of price instead of price to obtain a more homogeneous distribution of the data when conducting the non-parametric analysis). The results from the non-parametric regression are used to construct the predicted value of positive (negative) returns conditional on the beginning of the year stock price of the firm. Subsequently, we divide, conditional on price, the expected positive returns by the expected negative returns to obtain $PCA1_{jt}$ and $PCA2_{jt}$ (denoted by PCA_{jt} in the model). Opening price deflated earnings (E_{jt} / P_{jt-1}) are measured as income before extraordinary items (Compustat item 18) scaled by beginning of the fiscal year stock price (Compustat item 199) multiplied by shares outstanding (Compustat item 25). Annual returns (Ret_{jt}) are compounded over a 12-month period of the fiscal year. Dividend ($DivYild_{jt}$) is defined as the ratio of long-term debt (Compustat item 9) over total assets (Compustat item 6). Following Fama-MacBeth (1973), the coefficient estimates and t-statistics are based on annual cross-sectional regressions. To facilitate the interpretation, $PCA1_{jt}$ and $PCA2_{jt}$ are transformed year by year such that PCA_{jt}=0 corresponds to the sample minimum value of price-change-asymmetry. The complete CRSP-Compustat (1963-2005) population of non-financial firms is used. Observations in the top or bottom 0.5 percent of all variables are truncated to reduce the effect of outliers.

Table 9

Refined Estimates of Price-Change Asymmetry and Timely Loss Recognition Using Samples Partitioned on Credit Ratings

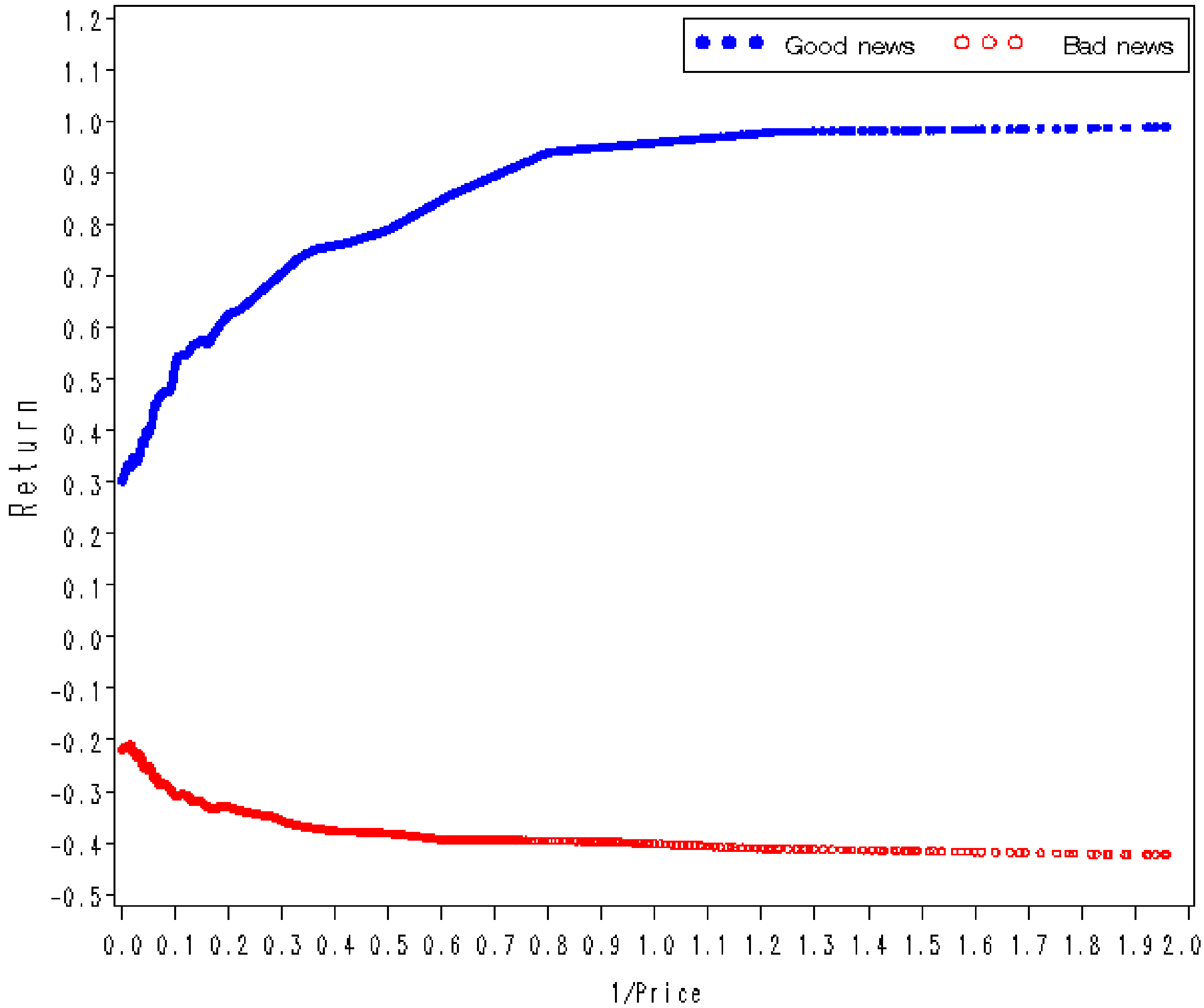
$$E_{jt} / P_{jt-1} = \alpha_{10} + \alpha_{11} * D(Ret_{jt} < 0) + \beta_{10} * Ret_{jt} + \beta_{11} * Ret_{jt} * D(Ret_{jt} < 0)$$

$$+ (\alpha_{20} + \alpha_{21} * D(Ret_{jt} < 0) + \beta_{20} * Ret_{jt} + \beta_{21} * Ret_{jt} * D(Ret_{jt} < 0)) * PCA_{jt} + \varepsilon_t$$

Variable	Statistic	Investment Grade	Non-Investment	Investment Grade	Non-Investment	Difference	Investment Grade	Non-Investment	Difference
				PCA=PCA1			PCA=PCA2		
Intercept	**Estimate**	**0.060**	**0.028**	**0.063**	**0.086**	**0.023**	**0.064**	**0.080**	**0.015**
	t-stat	19.306	4.419	19.140	11.049	2.679	19.051	11.800	2.021
	P-value	0.000	0.000	0.000	0.000	0.007	0.000	0.000	0.043
$D(Ret_{jt}<0)$	**Estimate**	**0.006**	**0.045**	**0.000**	**0.044**	**0.044**	**0.000**	**0.043**	**0.043**
	t-stat	1.355	5.512	-0.045	2.463	2.304	-0.076	2.560	2.445
	P-value	0.191	0.000	0.965	0.023	0.021	0.940	0.019	0.014
Ret_{jt}	**Estimate**	**0.031**	**0.013**	**0.033**	**0.065**	**0.032**	**0.031**	**0.068**	**0.037**
	t-stat	5.638	1.216	3.031	3.866	1.590	3.214	4.263	1.990
	P-value	0.000	0.238	0.007	0.001	0.112	0.004	0.000	0.047
$D(Ret_{jt}<0)*Ret_{jt}$	**Estimate**	**0.189**	**0.623**	**0.097**	**0.282**	**0.186**	**0.086**	**0.266**	**0.179**
	t-stat	3.576	11.949	2.528	3.062	1.859	2.882	3.072	1.960
	P-value	0.002	0.000	0.020	0.006	0.063	0.009	0.006	0.050
PCA_{jt}	**Estimate**			**-0.038**	**-0.380**	**-0.342**	**-0.233**	**-1.209**	**-0.976**
	t-stat			-1.704	-6.398	-5.388	-2.757	-6.634	-4.861
	P-value			0.104	0.000	0.000	0.012	0.000	0.000
$PCA_{jt}*D(Ret_{jt}<0)$	**Estimate**			**0.035**	**-0.001**	**-0.036**	**0.108**	**0.011**	**-0.097**
	t-stat			0.509	-0.007	-0.321	0.401	0.041	-0.254
	P-value			0.617	0.994	0.748	0.693	0.968	0.799
$PCA_{jt} *Ret_{jt}$	**Estimate**			**0.004**	**-0.067**	**-0.072**	**0.141**	**-0.220**	**-0.361**
	t-stat			0.040	-1.102	-0.586	0.366	-1.167	-0.841
	P-value			0.968	0.284	0.558	0.718	0.257	0.401
$PCA_{jt}*D(Ret_{jt}<0)*Ret_{jt}$	**Estimate**			**0.558**	**0.879**	**0.321**	**2.672**	**2.904**	**0.232**
	t-stat			1.379	3.136	0.653	2.001	3.436	0.147
	P-value			0.183	0.005	0.514	0.059	0.003	0.883
Adj R-Sq		0.146	0.176	0.188	0.297		0.200	0.307	
Number of years		21	21	21	21		21	21	

The model is estimated separately on sub-samples of companies with investment vs. non-investment credit rating. To construct firm-level estimates of price-change asymmetry, we model the conditional mean of positive (negative) returns by estimating a non-parametric local regression of positive (negative) returns on a constant and the inverse of the beginning of the year price (we use the inverse of price instead of price to obtain a more homogeneous distribution of the data when conducting the non-parametric analysis). The results from the non-parametric regression are used to construct the predicted value of positive (negative) returns conditional on the beginning of the year stock price of the firm. Subsequently, we divide, conditional on price, the expected positive returns by the expected negative returns to obtain $PCA1_{jt}$ and $PCA2_{jt}$ (denoted by PCA_{jt} in the model). Opening price deflated earnings (E_{jt}/P_{jt-1}) are measured as income before extraordinary items (Compustat item 18) scaled by beginning of the fiscal year stock price (Compustat item 199) multiplied by shares outstanding (Compustat item 25). Annual returns (Ret_{jt}) are compounded over a 12-month of the fiscal year. Investment grade companies are those with credit rating above BBB-. Following Fama-MacBeth (1973), the coefficient estimates and t-statistics are based on annual cross-sectional regressions. To facilitate the interpretation, $PCA1_{jt}$ and $PCA2_{jt}$ are transformed year by year such that PCA_{jt}=0 corresponds to the sample minimum value of price-change-asymmetry. The complete CRSP-Compustat (1963-2005) population of non-financial firms is used. Observations in the top or bottom 0.5 percent of all variables are truncated to reduce the effect of outliers.

Figure 1: Fitted Positive and Negative Returns Conditional on (one over) Price



Non-parametric local regression of positive (negative) fiscal year returns on a constant and the inverse of the beginning of the year price (we use the inverse of price instead of price to obtain a more homogeneous distribution of the data when conducting the non-parametric analysis). Separate local regressions are used to estimate each line in the graph. The results from the non-parametric regression are used to construct the predicted value of positive (negative) returns conditional on the beginning of the year stock price of the firm. The analysis is based on 128,000 observations.