The Value and Profitability Premiums

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Abstract

We present a unified risk-based explanation for the value premium and the profitability premium as well as for their inverse relationship in the time series. Our simple equity valuation model takes into account financial leverage and time-varying credit conditions explicitly and allows for potential shareholder recovery upon the resolution of financial distress. The model predicts that the value premium declines and the profitability premium is prominent when credit spreads increase under tightening credit conditions, while the opposite happens when credit spreads decrease, resulting in their inverse relationship in the time series. The model further predicts that the sensitivity of the value and profitability premiums to credit conditions depends on the degree of potential shareholder recovery. Our empirical evidence strongly supports these predictions.

Keywords: value premium, profitability premium, credit conditions, shareholder recovery

JEL classification: G12, G14, G33

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1 Introduction

The value premium is a well-known and robust empirical phenomenon that characterizes the difference in average returns of value stocks with high book-to-market ratios and growth stocks with low book-to-market ratios. It is considered as an anomaly in the context of the standard capital asset pricing model of Sharpe (1964), Lintner (1965), and Black (1972). Recently, Novy-Marx (2013) documents that average stock returns of most profitable firms are significantly higher than those of least profitable firms, dubbing the empirical regularity "the profitability premium". He shows that the profitability premium appears to complement the value premium in that they tend to move in opposite directions in the time series and therefore serve as hedges against each other. He further argues that a valid explanation of the value premium should also account for the profitability premium, which is a great challenge for the prevailing explanations of the value premium.

In this paper, we offer a unifying mechanism that is able to account for both the existence of the value and profitability premiums and their inverse relationship in the time series. This unifying mechanism takes financial leverage into account and allows for potential shareholder recovery upon the resolution of financial distress. With a simple equity valuation model that incorporates these considerations and time-varying credit conditions, we predict that the value premium declines and the profitability premium is prominent when credit spreads increase under tightening credit conditions, while the value premium is prominent and the profitability premium declines when credit spreads decrease, resulting in their inverse relationship in the time series. Using the TED Spread, the spread between the LIBOR rate and the Treasury bill rate, as the gauge of credit conditions, we find strong empirical support for this main prediction.

The key element in our model is the humped-shape relationship between a firm's conditional expected return and its default probability, as illustrated in Figure 1. This humped-shape relationship arises from the consideration of potential shareholder recovery upon the resolution of financial distress and has been empirically verified by Garlappi and Yan (2011), who show that this humped relationship helps explain the distress risk premium (Campbell, Hilscher, and Szilagyi 2008 and Garlappi, Shu, and Yan 2008) as well as the impact of distress risk on the value premium (Griffin and Lemmon 2002) and momentum profits (Avramov, Chordia, Jostova, and Philipov 2013). This economic mechanism originates in the literature of strategic default (e.g., Fan and Sundaresan 2000) and has found support in other recent studies, including Favara, Schroth, and Valta (2012), Morellec, Nikolov, and Schürhoff (2012), and Hackbarth, Haselmann, and Schoenherr (2015).

Based on the humped-shape relationship between expected return and default probability, the intuition for the value and profitability premiums goes as follows. Consider two otherwise identical firms, A and B, that experience opposite shocks to their operating cash flows, which are persistent. Suppose firm A receives a positive shock while firm B receives a negative shock. The positive shock increases the stock price and profitability of A, thereby giving A a lower book-to-market ratio and a higher profitability-to-asset ratio. The negative shock decreases the stock price and profitability of B, thereby giving B a higher book-to-market ratio and a lower profitability-to-asset ratio. When two firms are situated on the upward-sloping side of the humped shape in Figure 1, the positive shock moves A to the left and generates a lower expected return while the negative shock moves B to the right and generates a higher expected return. In this case, B earns a higher expected return than A. Accordingly, the value *premium* results, together with the profitability *discount*.

When two firms are situated on the downward-sloping side of the humped shape in Figure 1, however, the positive shock moves A to the left and generates a higher expected return while the negative shock moves B to the right and generates a lower expected return. In this case, B earns a lower expected return than A. Accordingly, the value *discount* results, together with the profitability *premium*.

We formalize this intuition in a simple equity valuation model that also incorporates time-varying credit conditions, as represented by the TED spread. Under favorable credit conditions when credit spreads are lower, firms are further away from their default boundaries, hence they tend to be situated on the upward-sloping side of the humped shape. Conversely, under adverse credit conditions when credit spreads are higher, firms are closer to their default boundaries and therefore tend to be situated on the downward-sloping side of the humped shape. As a result, we expect that the value premium is more pronounced under favorable credit conditions, while the profitability premium is more pronounced under adverse credit conditions. This leads to the empirically observed complementary patterns of the two premiums in the time series. Methodologically, the consideration of time-varying credit conditions adds a time-series dimension that allows us to examine the empirical implications through the sensitivity of the value/profitability premiums to credit conditions, without having to deal with the thorny issue of identifying default probabilities in the cross section.

Taken together, the model predicts that the value premium declines with tightening credit conditions while the profitability premium increases at the same time. Accordingly, the value-minus-profitability spread declines with tightening credit conditions. Using the TED spread as the gauge of credit conditions, we find strong empirical support for these predictions. Over 1990 to 2011, a 1% increase in the lagged TED spread decreases the CAPM-adjusted value premium by 1.78% per month and increases the CAPM-adjusted profitability premium by 2.00% per month.

Given the instrumental role of potential shareholder recovery upon the resolution of financial distress in producing the patterns of the value and profitability premiums consistent with the empirical evidence, the model yields cross-sectional predictions in terms of how the degree of potential shareholder recovery would affect the dependence of the value and profitability premiums on credit conditions. First, as the degree of potential shareholder recovery increases, the sensitivity of the value premium to credit conditions becomes more negative. Second, the sensitivity of the profitability premium to credit conditions becomes more positive if the degree of potential shareholder recovery increases from an initial low level. We adopt the proxies for the degree of potential shareholder recovery used in the extant literature and find empirical support for this set of predictions.

This paper makes several important contributions to the literature. First, we provide a unifying mechanism for understanding the coexistence of the dual phenomena of the value and profitability premiums and their underlying risk dynamics. While operating leverage (Carlson, Fisher, and Giammarino 2004) and investment irreversibility (Zhang 2005) have been argued to contribute to the value premium through their effects on the risk of the assets in place, recent literature has shown that financial leverage and its interaction with asset risk are instrumental in producing empirically comparable magnitudes for the value premium (Garlappi and Yan 2011, Ozdagli 2012, Choi 2013, and Obreja 2013). These recent studies mainly emphasize the amplification effect of financial leverage on the value premium, except for Garlappi and Yan (2011), which shows both theoretically and empirically that when shareholders can strategically default and recover some asset value upon the resolution of financial distress, the value premium can also be dampened when default probability is high. Our study extends this literature and demonstrates that the value and profitability premiums can be the two representations of the same risk dynamics in stock returns, along with their complementary time-series patterns.

Moreover, our study makes a methodological advance by introducing the time-series dimension through the consideration of the dynamics of credit conditions in the model and empirically measuring it in the form of the TED spread. By doing so, we are able to identify the dynamic credit conditions as an underlying state variable that drives the risk dynamics of the value and profitability premiums and their complementarity. Through measuring the sensitivity of the value and profitability premiums to the lagged TED spread, our empirical results highlight the important role of financial leverage and associated distress risk in producing the value and profitability premiums, hence providing a structural context to the intuition in Fama and French (1996) that the value premium may be attributed to the risk of financial distress.

The rest of this paper is organized as follows. Section 2 presents the model and develops testable hypotheses. Section 3 carries out empirical analysis to test these hypotheses. Section 4 discusses the robustness of the main results to controlling for investor sentiment. Section 5 concludes. The details of model derivations are included in the Appendix.

2 Theoretical Basis and Hypothesis Development

In this section, we sketch a stylized model to highlight the theoretical basis for the role of financial leverage and potential shareholder recovery upon the resolution of financial distress in producing the value and profitability premiums and their complementary time-series patterns. We model the dynamics of both cash flows and credit conditions explicitly, discuss the existence of the value and profitability premiums, and develop testable hypotheses based on relevant model predictions.

2.1 Model Setup

We analyze a representative firm. The firm has a capital stock, $K > 0$, which we regard as its book value of assets, and its operating cash flow at t is $X_t K$, where X_t is the operating cash flow generated by a unit of capital. The empirical counterpart of X_t is therefore the profitability-to-asset ratio. For tractability, we model that X_t follows a Brownian motion:

$$dX_t = \mu'_X dt + \sigma_A dW_A + \sigma_i dW_i, \tag{1}$$

where dW_A represents the aggregate (systematic) cash flow shock and dW_i is the idiosyncratic (firm-specific) cash flow shock; μ'_X is the drift; σ_A and σ_i are the volatility terms associated with dW_A and dW_i, respectively. The firm bears debt and its book leverage ratio is $0 < b < 1$. Accordingly, its book value of debt and book value of equity are Kb and $K(1-b)$, respectively.

The firm has to pay interest on its debt with a time-varying interest rate r_t and the interest paid in the time interval $(t, t + dt)$ is $Kbr_t dt$. The difference between the interest rate r_t and the risk-free interest rate r captures the firm's borrowing cost and depends on the tightness of credit conditions. We assume a constant risk-free interest rate for simplicity. For tractability, we take a reduced-form approach to model r_t and cast the following intuitive formulation:

$$r_t = r + \gamma c_t, \tag{2}$$

where $\gamma > 0$ characterizes the firm's credibility and is higher for firms with e.g. lower credit ratings; c_t characterizes the tightness of credit conditions. For firms/institutions with virtually no credit risk (e.g. the U.S. government), $\gamma = 0$ and r_t is equal to the risk-free rate. We normalize $\gamma = 1$ for banks. Accordingly,

$$c_t = r_t(banks) - r, \tag{3}$$

is the spread between the interest rate for banks and the risk-free rate. Its empirical counterpart is then the difference between the LIBOR rate and the risk-free Treasury rate, i.e. the TED spread, a popular gauge of credit conditions. We also model that c_t follows a Brownian motion:

$$dc_t = \mu'_c dt + \sigma_c dW_c, \tag{4}$$

where μ'_c and σ_c are the drift and volatility terms, respectively.

With the above setup, the net profit after debt interest of the firm at t is:

$$\begin{aligned}\Pi_t &= X_t K - K b r_t \\ &= X_t K - K b(r + \gamma c_t).\end{aligned} \tag{5}$$

The stochastic discount factor is set exogenously as:

$$\frac{d\Lambda_t}{\Lambda_t} = -r dt - \lambda_A dW_A + \lambda_c dW_c, \tag{6}$$

where $\lambda_A > 0$ is the price of risk of the aggregate cash flow shock dW_A and $-\lambda_c < 0$ is the price of risk of the credit condition shock dW_c. Intuitively, the idiosyncratic cash flow shock dW_i is not priced. For simplicity, we assume that all three shocks, dW_A, dW_i, and dW_c are independent of each other.

Under the risk-neutral measure $\mathbb{Q}$, X_t evolves as follows:

$$dX_t = \mu_X dt + \sigma_A dW_A^{\mathbb{Q}} + \sigma_i dW_i, \tag{7}$$

where $\mu_X = \mu'_X - \lambda_A \sigma_A$ is the risk-adjusted drift of X_t, and c_t evolves as follows:

$$dc_t = \mu_c dt + \sigma_c dW_c^{\mathbb{Q}}, \tag{8}$$

where $\mu_c = \mu'_c + \lambda_c \sigma_c$ is the risk-adjusted drift of c_t.

2.2 Equity Value and Expected Return

We denote the equity value of the firm at t as J_t. Under the risk-neutral measure, the Hamilton-Jacobi-Bellman (HJB) equation for J_t is:

$$\begin{aligned} rJ_t &= \Pi_t + \mu_X J_X + \frac{1}{2}\sigma_X^2 J_{XX} + \mu_c J_c + \frac{1}{2}\sigma_c^2 J_{cc} \\ &= X_t K - Kb(r+\gamma c_t) + \mu_X J_X + \frac{1}{2}\sigma_X^2 J_{XX} + \mu_c J_c + \frac{1}{2}\sigma_c^2 J_{cc}. \end{aligned} \tag{9}$$

The left-hand side of equation (9) is the required dollar return from holding the equity. Six terms on the right-hand side represent components of the expected dollar return. The first two terms capture the net profit, and the last four terms capture the expected change of equity value due to fluctuations in X_t and c_t.

To solve for J_t, we introduce as the boundary conditions the potential shareholder recovery upon the resolution of financial distress following Garlappi and Yan (2011). Upon the resolution of financial distress, shareholders can recover a portion $\eta \geq 0$ of the firm's book value K, i.e., ηK. $\eta = 0$ corresponds to the case of liquidation default without recovery while $\eta > 0$ corresponds to the case of strategic default with recovery.

As shown in the Appendix, the equity value J_t that solves the HJB equation with appropriate boundary conditions is:

$$J_t = \begin{cases} (\frac{K\mu_X}{r^2} + \frac{KX_t}{r}) - (Kb + \frac{Kb\gamma\mu_c}{r^2} + \frac{Kb\gamma c_t}{r}) + \frac{Kb\gamma}{r\phi_2} e^{\phi_1(X_t - \underline{X})} & \text{if } X_t \geq \underline{X} \\ \eta K & \text{if } X_t < \underline{X} \end{cases}, \tag{10}$$

where $\underline{X}$ is the default boundary:

$$\underline{X} = r(b+\eta) + \frac{b\gamma\mu_c - \mu_X}{r} - \frac{b\gamma}{\phi_2} + b\gamma c_t, \tag{11}$$

$\phi_1 = -\frac{\phi_2}{b\gamma} < 0$, and $\phi_2 > 0$ solves the following equation:

$$\frac{1}{2}(\frac{\sigma_X^2}{b^2\gamma^2} + \sigma_c^2)\phi_2^2 + (\mu_c - \frac{\mu_X}{b\gamma})\phi_2 - r = 0. \tag{12}$$

When $X_t < \underline{X}$, the firm is at financial distress, and the equity value J_t is what shareholders can recover from the residual firm value: $J_t = \eta K$. When $X_t \geq \underline{X}$, J_t consists of three terms. The first bracket term is the present value of future operating profits, and the second bracket term is the present value of future interest payment. The third term is the value of the default option, where the exponential term is the risk-neutral default probability:

$$\begin{aligned}\pi(X_t, c_t) &= e^{\phi_1(X_t - \underline{X})} \\ &= e^{-\phi_1 r(b+\eta) - \frac{\phi_1(b\gamma\mu_c - \mu_X)}{r} - 1} e^{\phi_1 X_t + \phi_2 c_t} \in [0, 1],\end{aligned} \tag{13}$$

which is well-defined when $X_t \geq \underline{X}$ and equals to 1 when $X_t = \underline{X}$. It is easy to see that $\pi(X_t, c_t)$ increases with c_t and decreases with X_t.

The equity's return in the time period $(t,\ t + dt)$ is: $r_{t,t+dt} = \frac{1}{dt}\frac{\Pi_t dt + dJ_t}{J_t}$. The equity expected (excess) return in the time period $(t,\ t + dt)$ is then:

$$\begin{aligned}r_{E,t} &= \mathbb{E}_t[r_{t,t+dt}] - r \\ &= \frac{1}{dt}\mathbb{E}_t[\frac{\Pi_t dt + dJ_t}{J_t}] - r \\ &= \beta_{At}\lambda_A + \beta_{ct}(-\lambda_c),\end{aligned} \tag{14}$$

where the cash flow beta β_{At} is:

$$\begin{aligned}\beta_{At} &= \frac{Cov(\frac{dJ_t}{J_t}, dW_A)}{Var(dW_A)} \\ &= \frac{\sigma_A}{J_t}[\frac{K}{r} + A\phi_1 e^{\phi_1 X_t + \phi_2 c_t}]\end{aligned}$$

$$= \frac{K\sigma_A}{rJ_t}[1 - \pi(X_t, c_t)] \geq 0, \tag{15}$$

and the credit condition beta β_{ct} is:

$$\begin{aligned}
\beta_{ct} &= \frac{Cov(\frac{dJ_t}{J_t}, dW_c)}{Var(dW_c)} \\
&= \frac{\sigma_c}{J_t}[\frac{Kb\gamma}{r} + A\phi_2 e^{\phi_1 X_t + \phi_2 c_t}] \\
&= -\frac{Kb\gamma\sigma_c}{rJ_t}[1 - \pi(X_t, c_t)] \leq 0. \qquad (16)
\end{aligned}$$

When there is potential shareholder recovery, i.e. $\eta > 0$, the relationship between the equity return in Eq. (14) and the risk-neutral default probability in Eq. (13) is humped-shaped, as stated in the following proposition.

Proposition 1. *When $\eta > 0$, equity return shows a humped-shape relationship with default probability. Equity return increases with default probability when $\pi(X_t, c_t)$ is small and decreases with default probability when $\pi(X_t, c_t) \to 1$.*

Proof. See the Appendix.

Proposition 1 is illustrated in Figure 1. This is an extension of the result in Garlappi and Yan (2011) which is empirically verified.[1] The humped shape is driven by two offsetting effects of financial leverage on equity returns. When default probability is low, the amplifying effect of financial leverage on equity return dominates. As default probability increases and the firm gets closer to its default boundary, the mechanism of potential shareholder recovery starts to play a bigger role. This prospect of recovering a portion of assets protects shareholders and therefore lowers equity risk. This dampening effect of financial leverage dominates when default probability is sufficiently high, resulting in the humped shape.

[1] In Panel B of Table II of Garlappi and Yan (2011), for example, they show that the market beta is 0.77 for the lowest decile of default probability, 0.81 for deciles 3 and 4, and 0.54 for the highest decile.

2.3 Value and Profitability Premiums

Now, we discuss the model's implications for the value and profitability premiums. Although empirically the value premium is the return difference between high book-to-market ratio (value) stocks and low book-to-market ratio (growth) stocks, we represent here the value premium by:

$$\frac{dr_{E,t}}{dBM} = \frac{dr_{E,t}}{d(\frac{K(1-b)}{J_t})}, \tag{17}$$

where $BM = \frac{K(1-b)}{J_t}$ is the book-to-market ratio by definition.[2] Therefore, the value premium, which we denote as E_v, captures the dependence of the expected return on the book-to-market ratio in the cross section. With some algebra, one can show that:

$$E_v = (\frac{\lambda_A \sigma_A}{r(1-b)} + \frac{b\gamma\lambda_c\sigma_c}{r})[(1-\pi(X_t, c_t)) + J_t \frac{\pi(X_t, c_t)}{1-\pi(X_t, c_t)} \frac{r\phi_1}{K}]. \tag{18}$$

Similarly, the profitability premium, which we denote as E_p, is defined and evaluated as:

$$E_p = \frac{dr_{E,t}}{dX_t} = -\frac{K\lambda_A\sigma_A + Kb\gamma\lambda_c\sigma_c}{rJ_t^2}[\frac{K}{r}(1-\pi(X_t, c_t))^2 + J_t\phi_1\pi(X_t, c_t)]. \tag{19}$$

Therefore, the profitability premium captures the dependence of the expected return on X_t, the measure of profitability-to-asset ratio in our model, in the cross section.

Based on these expressions, we arrive at the following proposition.

Proposition 2. *When default probability $\pi(X_t, c_t)$ is low, the value premium is positive while the profitability premium is negative. When $\pi(X_t, c_t)$ is high, the value premium is negative while the profitability premium is positive.*

Proof. See the Appendix.

[2] In empirical analysis, we also examine the empirical counterpart of Eq. (17), which is the return difference between the value and growth portfolios scaled by the difference in book-to-market ratios between the two portfolios, as a measure of the value premium for robustness. We also do a similar robustness test for the profitability premium.

Proposition 2 highlights the complementarity between the value premium and the profitability premium. Since c_t applies across the market and X_t is specific to a firm, this proposition has implications in both the cross section and the time series. The default probability itself is not easy to measure directly, and in the cross section it can often be confounded by other firm characteristics that may also affect the value and profitability premiums. Accordingly, we focus on the time-series implication of Proposition 2, which is easier to examine empirically, as described in the following corollary.

Corollary 1. *When c_t is low, i.e., credit conditions are favorable, the value premium is positive while the profitability premium is negative; when c_t is high, i.e., credit conditions are adverse, the value premium is negative while the profitability premium is positive.*

Corollary 1 is obtained from Proposition 2 based on the fact that $\pi(X_t, c_t)$ increases monotonically with c_t. The intuition associated with Proposition 2 and Corollary 1 may be understood with the aid of Figure 1. Consider two otherwise identical firms, A and B, that experience opposite shocks to their persistent operating cash flows: firm A receives a positive shock while firm B receives a negative shock. The positive shock increases the stock price and profitability of A, thereby giving A a lower book-to-market ratio and a higher profitability-to-asset ratio. The negative shock decreases the stock price and profitability of B, thereby giving B a higher book-to-market ratio and a lower profitability-to-asset ratio. When c_t and default probability are low, two firms are situated on the upward-sloping side of the humped-shape relationship in Figure 1. The positive shock moves A to the left and generates a lower expected return while the negative shock moves B to the right and generates a higher expected return. In this case, B earns a higher expected return than A, resulting in a value premium and a profitability discount. When c_t and default probability are high, two firms are situated on the downward-sloping side of the humped-shape relationship in Figure 1. The positive shock moves A to the left and generates a higher expected return while the negative shock moves B to the right and generates a lower expected return. In this case, B earns a lower expected return than A, resulting in a value discount and a profitability premium.

A crucial element in the underlying mechanism for these results is shareholders' potential recovery upon the resolution of financial distress, which is represented by the parameter η in our model. The following proposition discusses the role of η in determining the dependence of the value and profitability premiums on credit conditions.

Proposition 3. *As η increases, the dependence of the value premium on c_t becomes more negative. As η increases, the dependence of the profitability premium on c_t becomes more positive, when η is small.*

Proof. See the Appendix.

2.4 Empirical Hypotheses

The dependence of the value and profitability premiums on credit conditions can be tested directly empirically. In accordance with Eq.(3), we measure credit conditions c_t with the TED spread, which is the spread between the 3-month London Interbank Offered Rate (LIBOR) and the 3-month Treasury rate.

In the model, the subsequent return $r_{t,t+dt}$ is the conditional expected return $r_{E,t}$ plus a noise term that is uncorrelated with credit conditions c_t.[3] Therefore, the relationship between the expected return and c_t is the same as that between the subsequent return and credit conditions. Accordingly, in our empirical analysis, we capture the dependence of the value and profitability premiums on credit conditions by regressing the subsequent value

[3]We can show that $r_{t,t+dt} = r_{E,t} + \beta_X dW_A + \beta_c dW_c + \beta_X \frac{\sigma_i}{\sigma_A} dW_i$.

and profitability premiums on the lagged TED spread. We control for the standard CAPM model and impose the following regression specification:

$$r_{t+1} = a + bTED_t + cMKT_{t+1} + \epsilon_{t+1}, \tag{20}$$

where r_{t+1} is the realized value or profitability premium in month $t+1$ and TED_t is the TED spread at the end of month t. The coefficient b therefore captures the dependence of the CAPM-adjusted value/profitability premium on lagged TED spread.

We also consider controlling for the Fama-French three factor model (Fama and French 1993).[4] Since the value premium is one of the two main subjects of study in this paper, it may not be appropriate to control for the HML factor. Nevertheless, we can run the following regression to control for the SMB (small minus big) factor:

$$r_{t+1} = a + bTED_t + cMKT_{t+1} + dSMB_{t+1} + \epsilon_{t+1}, \tag{21}$$

where SMB_{t+1} is the return of the SMB factor in month $t+1$.

In the model, the value premium given by Eq. (18) is defined as the slope of equity returns with respect to the book-to-market ratio. Its direct empirical counterpart should be the realized value premium scaled by the difference in book-to-market between the value and growth portfolios, which we refer to as the book-to-market spread. Similarly, the profitability premium given by Eq. (19) is defined as the slope of equity returns with respect to the profits-to-asset ratio (profitability). Its direct empirical counterpart should be the realized profitability premium scaled by the difference in profitability between the profitable and unprofitable portfolios, which we refer to as the profitability spread. For robustness and as a more direct test of the model, we also carry out scaled versions of regression Eqs. (20) and

[4]We thank Professor Ken French for making the data of the Fama-French three factors available on his website.

(21), in which the dependent variables are the realized value/profitability premiums scaled by the book-to-market/profitability-to-asset spread.

The parameter b in these regression equations is the main parameter of interest and it captures the dependence of the value/profitability premiums on credit conditions characterized by the lagged TED spread. Corollary 1 indicates that as c_t increases, i.e., credit conditions tighten, the value premium decreases, while the profitability premium increases. This implies the following hypothesis:

Hypothesis 1. *(a) The dependence of the value premium on the lagged TED spread is negative. (b) The dependence of the profitability premium on the lagged TED spread is positive.*

Proposition 2 yields another hypothesis regarding the role of the degree of potential shareholder recovery:

Hypothesis 2. *(a) As the degree of potential shareholder recovery increases, the dependence of the value premium on the lagged TED spread becomes more negative. (b) The dependence of the profitability premium on the lagged TED spread becomes more positive, if the degree of potential shareholder recovery increases from an initially low level.*

We turn to empirical tests of these two hypotheses in the next section.

3 Empirical Analysis

3.1 Data and Methodology

Stock prices and returns are obtained from the monthly CRSP (Center for Research in Securities Prices) database. All accounting information is obtained from the annual Compustat database. We merge these two datasets and form portfolios by sorting stocks into deciles/quintiles based on the book-to-market ratio, the gross profitability, and the measures of shareholder recovery. The value premium is obtained as the return on the HML (high-minus-low book-to-market ratio) portfolio and the profitability premium is obtained as the return on the PMU (profitable-minus-unprofitable) portfolio. Following the convention in empirical asset pricing (e.g. Fama and French 1992), we match the accounting data for all fiscal year-ends in calendar year $t-1$ with the returns for the period that starts in July of year t and ends in June of year $t+1$. We calculate value-weighted portfolio returns and exclude stocks with prices lower than \$5 at the portfolio formation dates. We follow Shumway (1997) and Shumway and Warther (1999) to deal with the delisting returns.

For the value premium, the book-to-market ratio of a firm is the book value of equity scaled by the market value of equity. These two values of equity are calculated as follows. We measure a firm's market equity as the the price of each share times the number of outstanding shares at the end of December of year $t-1$, and it is matched with returns in July of year t to June of year $t+1$. We calculate the book value of equity following Daniel and Titman (2006). We first obtain shareholders' equity. For this measure, we use stockholders' equity (Compustat item SEQ) if not missing. Otherwise, we use Total Common Equity (Compustat item CEQ) plus Preferred Stock Par Value (Compustat item PSTK) if both of these are not missing. Otherwise, we use Total Assets (Compustat AT) minus Total Liabilities (Compustat item LT), if both are not missing. If a valid measure of shareholders' equity is still not obtained after these procedures, we treat shareholders' equity as missing for this firm year. We then subtract the preferred stock value from shareholders' equity to obtain book equity. In this process, we use redemption value (Compustat item PSTKRV), liquidating value (Compustat item PSTKL), or carrying value (Compustat item PSTK), in that order as available, as the preferred stock value. If none of the redemption, liquidating, and carrying values is present, we treat book equity as missing for this firm year. Finally, we add to book equity balanced sheet deferred taxes (Compustat item TXDITC) and subtract off FASB106 adjustment (Compustat item PRBA), if both are present.

For the profitability premium, we follow Novy-Marx (2013) and measure the profitability as the gross profits, i.e. total revenue (Compustat item REVT) minus cost of goods sold (Compustat item COGS), scaled by total assets (Compustat item AT).

The sample period of our analysis runs from January 1990 to December 2011. The monthly time series of annualized TED spread is plotted in Figure 2. The lowest value of TED spread is 0.12% while the highest value is 3.15%.

Table 1 reports the summary statistics of the five firm-level variables used to sort stocks into portfolios in our sample. These five variables include the book-to-market ratio for the value premium, the profitability (i.e. the gross profits-to-asset ratio) for the profitability premium, and three proxies of shareholder recovery: R&D, the Herfindahl index, and asset tangibility.[5] Panel A of Table 1 shows the summary statistics for the sample without winsorization and Panel B shows the summary statistics for the sample where all five variables are winsorized at the 1st and 99th percentiles of all firm-month observations.

3.2 Value Premium, Profitability Premium, and Credit Conditions

We sort stocks into deciles based on their book-to-market and profitability and obtain the value/profitability premium as the return on the portfolio buying the top decile and shorting the bottom decile. The time-series average of the cross-sectional mean characteristics of these decile portfolios are presented in Panels A and B of Table 2. For the book-to-market portfolios, the book-to-market ratio increases from 0.11 for the growth portfolio to 2.31 for the value portfolio. The time-series average of the book-to-market spread between the

[5] See Section 3.3.1 for the details of these measures and how they are related to shareholder recovery.

value and growth portfolios is then around 2.2.[6] Therefore, scaling by the book-market spread reduces the magnitude of the value premium by half on average. For the profitability portfolios, the gross-profits-to-asset ratio increases from -0.06 for the unprofitable portfolio to 0.89 for the profitable portfolio. The time-series average of the profitability spread is then around 0.95. Therefore, scaling by the book-market spread does not change much the magnitude of the profitability premium on average.

We then run the regressions specified in Eqs. (20) and (21) to test Hypothesis 1. All standard errors are robust heteroskedasticity-consistent standard errors of White (1980) and also corrected for autocorrelation using the Newey-West (Newey and West 1987) approach throughout the paper. Hypothesis 1 predicts that the estimated coefficient $\hat{b}$ from these regressions is negative for the value premium and is positive for the profitability premium.

The results presented in Table 3 strongly support Hypothesis 1. Columns (1) and (3) report the estimated coefficients with the realized value/profitability premiums as the dependent variable. Columns (2) and (4) report the estimated coefficients with the realized value/profitability premiums scaled by the book-to-market/profitability spread between the top and bottom deciles as the dependent variable. Since these two sets of results are very similar, we focus our discussion on the results from Columns (1) and (3), since they are easy to interpret empirically. The estimated coefficient $\hat{b}$ is -1.78 ($t = -2.52$) for the value premium and 2.00 ($t = 2.97$) for the profitability premium. To put these numbers into perspective, a 1% increase in lagged TED spread leads to a decrease of the monthly CAPM-adjusted value premium by 1.78% and an increase of the monthly CAPM-adjusted profitability premium by 2.00%.

To illustrate the negative relationship between the value premium and credit conditions and the positive relationship between the profitability premium and credit conditions, we plot in Figure 3 the three-year trailing (backward looking) averages of lagged TED spread and

[6]Note that the average of the difference is the difference of the average.

CAPM-adjusted value and profitability premiums. The CAPM-adjusted return is obtained as the constant plus the residual term from the regression of the portfolio return onto the market factor. It is clear that the profitability premium performs relatively well when the value premium performs relatively poorly and vice versa, consistent with Novy-Marx (2013). It is also clear that lagged TED spread potentially serves as an underlying state variable that drives the inverse relationship between the value and profitability premiums.

3.3 The Effect of Shareholder Recovery

3.3.1 Measures of Shareholder Recovery

In order to test Hypothesis 2 regarding the role of shareholder recovery η, we first need to find appropriate empirical measures of the parameter η.

Although not treated explicitly in our model, the process of strategic default and thereby shareholder recovery is largely as follows.[7] When firms' cash flows drop, or credit conditions deteriorate, or both, shareholders have the option to default, which leads to either asset liquidation in the case of liquidation default or debt renegotiation in the case of strategic default. In the former case, debt holders liquidate the remaining assets at a fractional liquidation cost of α. In the latter case, debt renegotiation costs a fraction $\kappa < \alpha$ of the assets. The fact that renegotiation is less costly than liquidation makes strategic default feasible. Debt holders are willing to renegotiate with equity holders in order to share the renegotiation surplus $\alpha - \kappa > 0$. Depending on their bargaining power, shareholders extract a fraction of the renegotiation surplus. Hence, the parameter η captures two components—shareholders' bargaining power and firms' liquidation costs (assuming that the debt renegotiation cost is the same)—in a reduced-form way. It increases with both shareholders' bargaining power

[7] See, for example, Fan and Sundaresan (2000), Garlappi, Shu, and Yan (2008), Morellec, Nikolov, and Schürhoff (2012), and Favara, Schroth, and Valta (2012).

and firms' liquidation costs. We therefore follow the the existing literature and use the empirical proxies for these two components as the proxies for shareholder recovery.

Shareholders' Bargaining Power Following Garlappi, Shu, and Yan (2008), we use the ratio of research and development expenditure to assets (denoted by $R\&D$ below) as a proxy for shareholders' bargaining power. This choice of proxy also finds its support in Opler and Titman (1994), who show that firms with higher R&D are more vulnerable to liquidity shortage at financial distress, which puts them in a disadvantaged bargaining position with creditors. Therefore, it is expected that shareholders of firms with higher $R\&D$ tend to have lower bargaining power in renegotiation and therefore lower η. We calculate $R\&D$ as the ratio of a firm's research and development expenditure (Compustat item XRD) to total assets (Compustat item AT) and use it as an *inverse* proxy for shareholder recovery.

Liquidation Costs We use two proxies for liquidity costs of a firm's assets: the industry concentration and the asset tangibility.

Liquidation costs represent the deadweight loss incurred by debt holders when shareholders choose liquidation default and firms' assets are liquidated. All else being equal, a higher liquidation cost makes renegotiation more attractive to debt holders than liquidation since the deadweight loss can be avoided through renegotiation. This in turn increases shareholders' potential recovery through strategic default.

Similar to Garlappi, Shu, and Yan (2008), we use a firm's asset specificity to measure its liquidation costs. This is motivated by Shleifer and Vishny (1992)'s argument that a firm with highly specific assets (to a particular industry) may experience substantial fire-sale discounts in liquidation auctions. The reason is that for such a firm, the potential buyers of its asset are likely to be its industry peers. When this firm experiences adverse conditions and need to sell their assets, the potential buyers may suffer from similar problems as well, which leads to a lower selling price of its assets and higher liquidation costs.

Following Garlappi, Shu, and Yan (2008), the first proxy of asset specificity and liquidation costs in our empirical analysis is the Herfindahl index of sales in an industry, which captures the degree of industry concentration. Firms in a more concentrated industry (with a higher Herfindahl index) tend to have more specific assets and thereby higher liquidation costs. The Herfindahl index (denoted by $Hfdl$) is calculated as:

$$Hfdl_j = \sum_{i=1}^{I_j} s_{i,j}^2, \tag{22}$$

where $s_{i,j}$ denotes the sales of firm i as a fraction of total sales in industry j to which firm i belongs to, and I_j is the number of all firms in industry j. We collect the sales and SIC code of all firms, categorize firms into different industries based on their three-digit SIC code, calculate $Hfdl$ for each industry in each fiscal year with Eq. (22), and assign this $Hfdl$ to all firms in the same industry.

The second proxy of asset specificity and liquidation costs is the asset tangibility measure first introduced by Berger, Ofek, and Swary (1996). As suggested in Garlappi, Shu, and Yan (2008), an increase in asset tangibility corresponds to a decrease in liquidation costs and shareholder recovery. This is also consistent with Campello and Hackbarth (2012)'s argument that an increase in asset tangibility reduces shareholders' incentive to default strategically since the outside option of debt holders in contract renegotiation is higher. As in Berger, Ofek, and Swary (1996), and Almeida and Campello (2007), we calculate asset tangibility (denoted by $Tang$) for a firm as:

$$Tang = 0.715 \times Receivables + 0.547 \times Inventory + 0.535 \times Capital + Cash, \tag{23}$$

where $Receivables$, $Inventory$, $Capital$, and $Cash$ are Compustat items RECT, INT, PPENT, and CHE, all scaled by Compustat item AT, respectively.

3.3.2 Results

Now we present results of testing Hypothesis 2. To test this hypothesis, we double sort (5×5) stocks into quintiles independently according to book-to-market/profitability and three measures of shareholder recovery. For each shareholder recovery quintile, we obtain the time series of the value premium and the profitability premium. We then obtain the estimated coefficient $\hat{b}$ from regression Eqs. (20) and (21) for the value premium and the profitability premium, for each shareholder recovery quintile.

To test Hypothesis 2(a), we compare the difference in $\hat{b}$ between the highest and lowest quintiles of shareholder recovery for the value premium. Hypothesis 2(a) predicts that this difference $\hat{b}$ is negative. As for the profitability premium, Hypothesis 2(b) predicts that the dependence of the profitability premium on credit conditions increases with shareholder recovery when the level of shareholder recovery is small initially. We therefore compare the difference in $\hat{b}$ between the middle quintile of shareholder recovery and the lowest quintile of shareholder recovery for the profitability premium.[8] Hypothesis 2(b) predicts that this difference in $\hat{b}$ is positive.

This set of results is presented in Tables 4 to 6. Again, the results with the value/profitability premium as the dependent variable presented in Columns (1) and (3) and those with the scaled value/profitability premium as the dependent variable presented in Columns (2) and (4) are very similar. We therefore focus our discussion our the results in reported Columns (1) and (3) . Panels A to E of these tables report the coefficient $\hat{b}$ for the value premium and the profitability premium, for the lowest to the highest quintiles of shareholder recovery, respectively. Panel G of these tables presents the difference in the coefficient $\hat{b}$ between the highest and lowest quintiles of shareholder recovery. Hypothesis 2(a) predicts that this

[8] Since shareholder recovery decreases with R&D, and increases with Herfindahl index and asset tangibility, the highest quintile of shareholder recovery is the quintile 1 for R&D and quintile 5 for Herfindahl index and asset tangibility. Conversely, the lowest quintile of shareholder recovery is the quintile 5 for R&D and quintile 1 for Herfindahl index and asset tangibility. The middle quintile is quintile 3 for all three proxies.

difference is negative for the value premium. Focusing on Column (1) of Panel G of these Tables, the difference in b is negative for all three measures of shareholder recovery. It is -1.67 ($t = -1.28$), -2.02 ($t = -2.35$), and -2.51 ($t = -3.69$) when R&D, the Herfindahl index, and asset tangibility is used as the proxy for shareholder recovery, respectively. In other words, as shareholder recovery increases, the dependence of the value premium on lagged TED spread becomes more negative. These results support Hypothesis 2(a).

Panel F of Tables 4 to 6 reports the difference in the coefficient b between the middle and lowest quintiles of shareholder recovery. Hypothesis 2(b) predicts that this difference is positive for the profitability premium. Focusing on Column (2) of Panel F of these tables, the difference in b is positive for all three measures of shareholder recovery. It is 2.21 ($t = 1.44$), 2.61 ($t = 2.31$), and 3.46 ($t = 3.92$) when R&D, the Herfindahl index, and asset tangibility is used as the proxy of shareholder recovery, respectively. In other words, as shareholder recovery increases from a low level, the dependence of the profitability premium on lagged TED spread becomes more positive. These results support Hypothesis 2(b).

Collectively, the results presented in Tables 4 to 6 show that the level of potential shareholder recovery indeed plays an important role in determining the dependence of the value and profitability premiums on credit conditions. These results lend further support to our model.

4 Controlling for Investor Sentiment

Our model presents a risk-based mechanism that generates the value/profitability premium and also their time variation across different credit conditions. Meanwhile, we also acknowlege the possibility that the behavioral/mispricing-based mechanisms may also contribute the time varition of the value and profitability premiums. For example, Stambaugh, Yu, and Yuan (2012) show that a set of well-known anomalies become more pronounced following periods of high sentiment measured by the sentiment index proposed by Baker and Wurgler (2006). Considering this, we perform a robustness test and examine the dependence of the value and profitability premiums on lagged TED, controlling for the effect of sentiment. To this end, we use the Baker-Wurgler index to measure sentiment, and repeat our empirical analysis by including the lagged sentiment index, which we denote by S_t, into the regression Eqs. (20) and (21). The monthly time series of this sentiment index is plotted in Figure 4.[9]

Table 7 reports the estimated coefficients from the regressions $r_{t+1} = a + bTED_t + cMKT_{t+1} + eS_t + \epsilon_{t+1}$ and $r_{t+1} = a + bTED_t + cMKT_{t+1} + dSMB_{t+1} + eS_t + \epsilon_{t+1}$ for the value and profitability premiums. After controlling for sentiment, the value (profitability) premium still shows negative (positive) dependence on lagged TED spread and the magnitude of this dependence becomes even stronger. Table 8 reports the estimated coefficent $\hat{b}$ from the regressions $r_{t+1} = a + bTED_t + cMKT_{t+1} + eS_t + \epsilon_{t+1}$ for different quintiles of three measures of shareholder recovery. The results are similar to those without controlling for investor sentiment presented in Tables 4 to 6 and support Hypothesis 2.

5 Conclusion

The profitability premium (Novy-Marx 2013) and its complementarity with the value premium have been argued as a great challenge for the prevailing explanations of the value premium. In this paper, we present a unified risk-based explanation for the value premium, the profitability premium, and their inverse relationship in the time series.

With an equity valuation model that considers financial leverage and time-varying credit conditions explicitly and allows for potential shareholder recovery upon the resolution of financial distress, we predict that the value premium declines with tightening credit condi-

[9] The monthly data of the Baker-Wurgler index is obtained from Professor Jeffrey Wurgler's website and we thank him for making the data available. We present the results using the sentiment index orthognalized by a set of macroeconomic variables and in unreported tables we confirm that the results using the unorthognalized sentiment index are similar.

tions while the profitability premium increases at the same time. Our model further predicts that the sensitivity of the value and profitability premiums to credit conditions depends on the degree of potential shareholder recovery. Using the TED spread as a gauge of credit conditions and several empirical measures of shareholder recovery proposed in the extant literature, we find supporting evidence for these model predictions.

While our study provides a theoretical basis for the efficacy of the value and profitability factors in empirical asset pricing models, as in Fama and French (2014), the simple equity valuation model we use highlights the nonlinear risk structure due to financial leverage and the outcome of an endogenous default for financially distressed firms. This nonlinear risk structure may inform on a better understanding of conditional factor models and of additional cross-sectional "anomalies" in stock returns. We leave this exciting prospect to future research.

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Appendix

A.1 Derivation of Equity Value

We guess that the general formula of J_t satisfying Eq. (9) is $J_t = \nu_0 + \upsilon_1 X_t - \nu_2 c_t + Ae^{\phi_1 X_t + \phi_2 c_t}$ and ν_0, ν_1, ν_2, A, ϕ_1, and ϕ_2 are coefficients to be determined.

By matching coefficients, we obtain:

$$\nu_0 = -Kb - \frac{Kb\gamma\mu_c}{r^2} + \frac{K\mu_X}{r^2}, \tag{24}$$

$$\nu_1 = \frac{K}{r}, \tag{25}$$

and

$$\nu_2 = \frac{Kb\gamma}{r}. \tag{26}$$

$\phi_1 < 0$ and $\phi_2 > 0$ jointly solve the following quadratic equation:

$$\frac{1}{2}\sigma_X^2\phi_1^2 + \mu_X\phi_1 + \frac{1}{2}\sigma_c^2\phi_2^2 + \mu_c\phi_2 - r = 0. \tag{27}$$

To solve for A, ϕ_1, and ϕ_2, we need to impose default boundary conditions. The manager of the firm may optimally choose the default boundary, and upon the resolution of financial distress, shareholders may recover ηK.

For a given c_t, there is an optimal default boundary $X_t = \underline{X}$ at which the following value matching and smooth pasting conditions hold:

$$J_t(\underline{X}, c_t) = \nu_0 + \nu_1\underline{X} - \nu_2 c_t + Ae^{\phi_1\underline{X} + \phi_2 c_t} = \eta K, \tag{28}$$

$$\frac{\partial J_t}{\partial X_t}(\underline{X}, c_t) = \nu_1 + A\phi_1 e^{\phi_1\underline{X} + \phi_2 c_t} = 0. \tag{29}$$

and

$$\frac{\partial J_t}{\partial c_t}(\underline{X}, c_t) = -\nu_2 + A\phi_2 e^{\phi_1\underline{X} + \phi_2 c_t} = 0. \tag{30}$$

From Eqs. (29) and (30), we have:

$$A = \frac{\nu_2}{\phi_2} e^{-\phi_1 \underline{X} - \phi_2 c_t}, \tag{31}$$

and

$$\phi_1 = -\frac{\nu_1}{\nu_2}\phi_2 = -\frac{1}{b\gamma}\phi_2. \tag{32}$$

Substituting Eq. (32) into Eq. (27) leads to Eq. (12) which solves for ϕ_2, and substituting Eq. (31) into Eq. (28) arrives at Eq. (11). Finally, substituting Eq. (31) into $J_t = \nu_0 + \upsilon_1 X_t - \nu_2 c_t + Ae^{\phi_1 X_t + \phi_2 c_t}$ gives Eq. (10). □

A.2 Proof of Proposition 1

Proof. From Eqs. (13) and (14), we have:

$$\begin{aligned}
\frac{dr_{E,t}}{d\pi(X_t, c_t)} &= \frac{dr_{E,t}}{dX_t}\frac{dX_t}{d\pi(X_t, c_t)} + \frac{dr_{E,t}}{dc_t}\frac{dc_t}{d\pi(X_t, c_t)} \\
&= \frac{Kb\gamma\sigma_A}{rJ_t^2}[\phi_1\pi(X_t, c_t)J_t + (1-\pi(X_t, c_t))^2\frac{K}{r}][-\frac{dX_t}{d\pi(X_t, c_t)} + \frac{dc_t}{d\pi(X_t, c_t)}] \\
&= \frac{Kb\gamma\sigma_A}{rJ_t^2}[\phi_1\pi(X_t, c_t)J_t + (1-\pi(X_t, c_t))^2\frac{K}{r}][-\frac{1}{\pi(X_t, c_t)\phi_1} + \frac{1}{\pi(X_t, c_t)\phi_2}].
\end{aligned}$$

When $\pi(X_t, c_t) = \epsilon$, with ϵ as an infinitesimal positive number, $\frac{dr_{E,t}}{d\pi(X_t,c_t)} = \frac{Kb\gamma\sigma_A}{rJ_t^2}(1-\epsilon)^2\frac{K}{r}[-\frac{1}{\epsilon\phi_1} + \frac{1}{\epsilon\phi_2}] > 0$. When $\pi(X_t, c_t) \to 1$, $\frac{dr_{E,t}}{d\pi(X_t,c_t)} \to \frac{Kb\gamma\sigma_A}{rJ_t}\phi_1[-\frac{1}{\phi_1} + \frac{1}{\phi_2}] < 0$. □

A.3 Proof of Proposition 2

Proof. Case I: when $\pi(X_t, c_t) \to 0$. In this case, we have the value premium $E_v \to \frac{\lambda_A\sigma_A}{r(1-b)} + \frac{b\gamma\lambda_c\sigma_c}{r} > 0$ and the profitability premium $E_p \to -\frac{K^2\lambda_A\sigma_A + K^2 b\gamma\lambda_c\sigma_c}{r^2 J_t^2} < 0$.

Case II: when $\pi(X_t, c_t) \to 1$. Suppose $\pi(X_t, c_t) \to 0 = 1 - \epsilon$, where ϵ is an infinitesimal positive number. We then have $E_v = (\frac{\lambda_A\sigma_A}{r(1-b)} + \frac{b\gamma\lambda_c\sigma_c}{r})[2\eta\frac{r\phi_1}{\phi_2\epsilon}] < 0$. Furthermore, as $\pi(X_t, c_t) \to 1$, $E_p \to -\frac{\lambda_A\sigma_A + b\gamma\lambda_c\sigma_c}{r\eta}\phi_1 > 0$. □

A.4 Proof of Proposition 3

Proof. From Eqs. (13) and (18), we have:

$$\frac{dE_v}{dc_t} = (\frac{\lambda_A \sigma_A}{1-b} + b\gamma\lambda_c\sigma_c)\frac{\phi_1\phi_2}{K}\frac{J_t\pi(X_t,c_t)}{(1-\pi(X_t,c_t))^2}.$$

We then have:

$$\begin{aligned}\frac{d^2E_v}{d\eta dc_t} &= (\frac{\lambda_A \sigma_A}{1-b} + b\gamma\lambda_c\sigma_c)\frac{\phi_1\phi_2}{K}\pi(X_t,c_t)[\frac{K+\frac{r\phi_2}{b\gamma}J_t}{(1-\pi(X_t,c_t))^2} + \frac{\frac{2r}{b\gamma}J_t\phi_2}{(1-\pi(X_t,c_t))^3}] \\ &< 0,\end{aligned}$$

where the inequality is due to $\phi_1 < 0$. So we prove that as η increases, the dependence of the value premium on c_t decreases, which is the first part of Proposition 3.

From Eqs. (13) and (19), we have:

$$\frac{dE_p}{dc_t} = \frac{K(\lambda_A\sigma_A + b\gamma\lambda_c\sigma_c)}{r}[\frac{\frac{3K}{r}\phi_2(1-\pi(X_t,c_t))\pi(X_t,c_t)}{J_t^2} - \frac{\phi_1\phi_2\pi(X_t,c_t)}{J_t} - \frac{2\frac{K^2b\gamma}{r^2}(1-\pi(X_t,c_t))^3}{J_t^3}].$$

We then have:

$$\begin{aligned}&\frac{d^2E_p}{d\eta dc_t} \\ = \;&\frac{K(\lambda_A\sigma_A + b\gamma\lambda_c\sigma_c)}{rJ_t^2}\pi(X_t,c_t)\{\frac{\frac{3K}{r}\phi_2[\frac{r\phi_2}{b\gamma}(1-2\pi(X_t,c_t))J_t - 2K(1-\pi(X_t,c_t))\pi(X_t,c_t)]}{J_t^3} \\ &-\frac{\phi_1\phi_2[\frac{r\phi_2}{b\gamma}J_t - \pi(X_t,c_t)K]}{J_t^2} - \frac{2\frac{K^2b\gamma}{r^2}[-\frac{3r\phi_2}{b\gamma}(1-\pi(X_t,c_t))^2J_t - 3(1-\pi(X_t,c_t))^3K]}{J_t^4}\},\end{aligned}$$

The sign of $\frac{d^2E_p}{d\eta dc_t}$ depends on the sign of the term in the curly brackets of the equation immediately above, which we denote by B. We consider two extremes. When $\pi(X_t,c_t) \to 0$, we have:

$$B = [\frac{\frac{3K\phi_2^2}{b\gamma}}{J_t^2} - \frac{\frac{r\phi_1\phi_2^2}{b\gamma}}{J_t} + \frac{\frac{2K^2b\gamma}{r^2}(\frac{3r\phi_2}{b\gamma}J_t + 3K)}{J_t^4}] > 0. \tag{33}$$

When $\pi(X_t,c_t) \to 1$, we have:

$$B = -\frac{\phi_2^2}{\eta^2Kb\gamma}(4+\phi_1 r\eta), \tag{34}$$

which can be negative for a wide range of parameters, i.e. $4 + \phi_1 r\eta > 0$. Since $\pi(X_t, c_t)$ increases with η from Eq. (13), the extreme of $\pi(X_t, c_t) \to 0$ is closer when η is small. Therefore, the dependence of the profitability premium on c_t increases with η when η is small. $\square$

Table 1: **Summary statistics**

This table presents the summary statistics of the five firm-level sorting variables used to form portfolios. We merge the CRSP and Compustat datasets and remove stocks with prices below $5 at the portfolio formation dates. The sample period is January 1990 to December 2011. Panel A reports the summary statistics for the original sample without winsorization while Panel B reports the summary statistics for the sample where each of the five variables is winsorized at the 1st and 99th percentiles of all firm-month observations. Book-to-market is the book equity value scaled by the market equity value. Profitability is the gross profits (Compustat item REVT minus COGS) scaled by total assets (Compustat item AT). R&D is research and developement expenditure (Compustat item XRD) scaled by total assets (Compustat item AT). Herfindahl is the Herfindahl index of the industry where a firm belongs to, given by Eq. (22). Tangibility is the asset tangibility given by Eq. (23). S.D. stands for standard deviation, and p25 and p75 standard for the 25th and 75th percentiles, respectively.

	Mean	S.D.	Min	p25	Median	p75	Max
Panel A: Original sample							
Book-to-Market	0.71	1.01	0.00	0.31	0.54	0.86	230.91
Profitability	0.31	0.30	-32.94	0.08	0.26	0.46	9.46
R&D	0.07	0.13	0.00	0.01	0.03	0.10	25.31
Herfindahl	0.03	0.02	0.00	0.02	0.02	0.03	1.00
Tangibility	0.52	0.16	0.00	0.44	0.53	0.61	1.00
Panel B: Winsorized sample							
Book-to-Market	0.68	0.56	0.04	0.31	0.54	0.86	3.51
Profitability	0.31	0.27	-0.30	0.08	0.26	0.46	1.18
R&D	0.07	0.10	0.00	0.01	0.03	0.10	0.55
Herfindahl	0.03	0.01	0.01	0.02	0.02	0.03	0.07
Tangibility	0.52	0.16	0.12	0.44	0.53	0.61	0.94

Table 2: **Decile portfolio characteristics**

This table presents the portfolio characteristics of the decile portfolios sorted on book-to-market for the value premium (Panel A) and those sorted on profitability for the profitability premium (Panel B). We merge the CRSP and Compustat datasets and remove stocks with prices below $5 at the portfolio formation dates. The sample period is January 1990 to December 2011. The time-series average of the cross-sectional mean of the following four characteristics are reported: book-to-market, book equity, market equity, profitability, together with the mean monthly excess return. Book-to-market is the book equity value scaled by the market equity value. Profitability is the gross profits (Compustat item REVT minus COGS) scaled by total assets (Compustat item AT). Book equity and market equity are in millions of dollars.

Panel A: book-to-market portfolios										
	Low	2	3	4	5	6	7	8	9	High
Book-to-Market	0.11	0.23	0.32	0.42	0.51	0.62	0.73	0.88	1.11	2.31
Book Equity	643	1050	1218	1246	1169	1275	1220	1194	1289	1570
Market Equity	5629	4803	3872	3177	2372	2114	1738	1434	1306	961
Profitability	0.44	0.42	0.38	0.34	0.30	0.27	0.24	0.23	0.22	0.24
Panel B: profitability portfolios										
	Low	2	3	4	5	6	7	8	9	High
Profitability	-0.06	0.05	0.09	0.15	0.23	0.30	0.38	0.46	0.58	0.89
Book Equity	983	1127	1938	2008	1585	1200	1004	838	761	454
Market Equity	1422	1848	3203	3059	2961	2649	3009	3235	3549	2545
Book-to-Market	0.85	0.85	0.84	0.91	0.77	0.72	0.64	0.60	0.54	0.49

Table 3: **Dependence of the value and profitability premiums on credit conditions** This table reports the estimated coefficients from the regression Eqs. (20) and (21). Columns (1) and (3) report the coefficients with the realized value/profitability premiums as the dependent variable. Columns (2) and (4) report the coefficients with the realized value/profitability premiums scaled by the book-to-market/profitability spread between the top and bottom deciles as the dependent variable. The robust Newey-West standard errors are reported in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

	(1) Value	(2) Scaled Value	(3) Profitability	(4) Scaled Profitability
Panel A: $r_{t+1} = a + bTED_t + cMKT_{t+1} + \epsilon_{t+1}$ (20)				
$\hat{b}$	-1.78**	-1.05***	2.00***	2.69***
	(-2.52)	(-2.97)	(2.97)	(2.84)
$\hat{c}$	-0.11	-0.06	-0.41***	-0.53***
	(-0.76)	(-0.85)	(-3.98)	(-4.19)
Panel B: $r_{t+1} = a + bTED_t + cMKT_{t+1} + dSMB_{t+1} + \epsilon_{t+1}$ (21)				
$\hat{b}$	-1.78**	-1.05***	1.97***	2.65***
	(-2.46)	(-2.91)	(3.54)	(3.50)
$\hat{c}$	-0.11	-0.06	-0.38***	-0.49***
	(-0.89)	(-0.99)	(-3.54)	(-3.42)
$\hat{d}$	-0.00	0.01	-0.17**	-0.19**
	(-0.01)	(0.07)	(-2.31)	(-2.17)

Table 4: **The effect of shareholder recovery: R&D**

This table reports how the dependence of CAPM-adjusted returns on lagged TED spread for the value premium and the profitability premium varies with the potential shareholder recovery proxied by R&D. We perform 5×5 independent sorts on stocks based on their $R\&D$ and book-to-market ratios/profitability. For each quintile of R&D, we perform the regression $r_{t+1}(\bar{r}_{t+1}) = a + bTED_t + cMKT_{t+1} + \epsilon_{t+1}$ for the value premium and the profitability premium. Columns (1) and (3) report the coefficients with the realized value/profitability premiums as the dependent variable. Columns (2) and (4) report the coefficients with the realized value/profitability premiums scaled by the book-to-market/profitability spread between the top and bottom quintiles as the dependent variable. The robust Newey-West standard errors are reported in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

	(1) Value	(2) Scaled Value	(3) Profitability	(4) Scaled Profitability
	Panel A: Highest R&D quintile			
$\hat{b}$	-0.45	-0.23	-2.12**	-2.45*
	(-0.50)	(-0.23)	(-2.10)	(-1.92)
	Panel B: R&D quintile 4			
$\hat{b}$	-0.35	-0.46	-1.34	-1.65
	(-0.36)	(-0.43)	(-1.13)	(-0.89)
	Panel C: R&D quintile 3			
$\hat{b}$	-2.07**	-1.77	0.09	0.16
	(-2.35)	(-1.35)	(0.09)	(0.10)
	Panel D: R&D quintile 2			
$\hat{b}$	-1.29	-1.05	0.37	0.96
	(-1.60)	(-1.41)	(0.64)	(1.05)
	Panel E: Lowest R&D quintile			
$\hat{b}$	-2.12*	-2.34**	2.70***	5.11***
	(-1.93)	(-2.13)	(3.06)	(3.36)
	Panel F: Panel C – Panel A			
$\Delta\hat{b}$	-1.63*	-1.54	2.21	2.61
	(-1.65)	(-1.45)	(1.44)	(1.15)
	Panel G: Panel E – Panel A			
$\Delta\hat{b}$	-1.67	-2.11*	4.82***	7.57***
	(-1.28)	(-1.65)	(3.39)	(3.62)

Table 5: **The effect of shareholder recovery: Herfindahl index**

This table reports how the dependence of CAPM-adjusted returns on lagged TED spread for the value premium and the profitability premium varies with the potential shareholder recovery measured by the Herfindahl index. We perform 5 × 5 independent sorts on stocks based on their Herfindahl index and book-to-market ratios/profitability. For each quintile of Herfindahl index, we perform the regression $r_{t+1}(\bar{r}_{t+1}) = a + bTED_t + cMKT_{t+1} + \epsilon_{t+1}$ for the value premium and the profitability premium. Columns (1) and (3) report the coefficients with the realized value/profitability premiums as the dependent variable. Columns (2) and (4) report the coefficients with the realized value/profitability premiums scaled by the book-to-market/profitability spread between the top and bottom quintiles as the dependent variable. The robust Newey-West standard errors are reported in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

	(1) Value	(2) Scaled Value	(3) Profitability	(4) Scaled Profitability
Panel A: Lowest Herfindahl quintile				
$\hat{b}$	-0.97	-0.69	-1.68*	-2.66*
	(-1.42)	(-1.27)	(-1.77)	(-1.86)
Panel B: Herfindahl quintile 2				
$\hat{b}$	-2.09***	-1.66***	2.67***	4.11***
	(-3.22)	(-4.16)	(3.69)	(3.92)
Panel C: Herfindahl quintile 3				
$\hat{b}$	-1.63*	-1.46*	0.93	2.15*
	(-1.67)	(-1.87)	(1.22)	(1.95)
Panel D: Herfindahl quintile 4				
$\hat{b}$	-1.05	-0.56	0.01	0.17
	(-0.98)	(-0.57)	(0.01)	(0.11)
Panel E: Highest Herfindahl quintile				
$\hat{b}$	-2.99**	-2.26**	0.95	1.56
	(-2.51)	(-2.49)	(0.70)	(0.88)
Panel F: Panel C – Panel A				
$\Delta\hat{b}$	-0.67	-0.77	2.61**	4.81***
	(-0.81)	(-1.17)	(2.31)	(2.89)
Panel G: Panel E – Panel A				
$\Delta\hat{b}$	-2.02**	-1.56**	2.63*	4.22*
	(-2.35)	(-2.10)	(1.75)	(1.94)

Table 6: **The effect of shareholder recovery: Asset tangibility**

This table reports how the dependence of CAPM-adjusted returns on lagged TED spread for the value premium and the profitability premium varies with the potential shareholder recovery proxied by asset tangibility. We perform 5 × 5 independent sorts on stocks based on their asset tangibility and book-to-market ratios/profitability. For each quintile of asset tangibility, we perform the regression $r_{t+1}(\bar{r}_{t+1}) = a + bTED_t + cMKT_{t+1} + \epsilon_{t+1}$ for the value premium and the profitability premium. Columns (1) and (3) report the coefficients with the realized value/profitability premiums as the dependent variable. Columns (2) and (4) report the coefficients with the realized value/profitability premiums scaled by the book-to-market/profitability spread between the top and bottom quintiles as the dependent variable. The robust Newey-West standard errors are reported in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

	(1) Value	(2) Scaled Value	(3) Profitability	(4) Scaled Profitability
Panel A: Lowest tangibility quintile				
$\hat{b}$	-1.15**	-0.87***	1.79**	3.31**
	(-2.41)	(-2.87)	(2.30)	(2.40)
Panel B: Tangibility quintile 2				
$\hat{b}$	-1.03	-0.88	1.01	1.53
	(-1.43)	(-1.39)	(1.44)	(1.33)
Panel C: Tangibility quintile 3				
$\hat{b}$	-2.05**	-1.81*	5.25***	8.88***
	(-2.15)	(-1.81)	(7.46)	(7.68)
Panel D: Tangibility quintile 4				
$\hat{b}$	-1.30	-1.04	2.31**	3.60**
	(-1.48)	(-1.32)	(2.52)	(2.43)
Panel E: Highest tangibility quintile				
$\hat{b}$	-3.66***	-2.63***	0.55	0.82
	(-4.58)	(-4.73)	(0.59)	(0.63)
Panel F: Panel C – Panel A				
$\Delta\hat{b}$	-0.90	-0.94	3.46***	5.57***
	(-1.13)	(-1.10)	(3.92)	(3.56)
Panel G: Panel E – Panel A				
$\Delta\hat{b}$	-2.51***	-1.77***	-1.23	-2.49
	(-3.69)	(-4.01)	(-1.33)	(-1.51)

Table 7: **Robustness of single sorting results: Controlling for investor sentiment** This table reports the dependence on lagged TED spread for the value premium and the profitability premium, controlling for investor sentiment. Columns (1) and (3) report the coefficients with the realized value/profitability premiums as the dependent variable. Columns (2) and (4) report the coefficients with the realized value/profitability premiums scaled by the book-to-market/profitability spread between the top and bottom quintiles as the dependent variable. The robust Newey-West standard errors are reported in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)
	Value	Scaled Value	Profitability	Scaled Profitability
Panel A: $r_{t+1} = a + bTED_t + cMKT_{t+1} + eS_t + \epsilon_{t+1}$				
$\hat{b}$	-2.27***	-1.27***	2.24***	3.02***
	(-3.22)	(-3.45)	(3.27)	(3.64)
$\hat{c}$	-0.13	-0.07	-0.38***	-0.48***
	(-0.94)	(-0.94)	(-3.83)	(-5.14)
$\hat{e}$	1.80***	0.89***	0.35	0.37
	(3.28)	(2.95)	(0.86)	(0.60)
Panel B: $r_{t+1} = a + bTED_t + cMKT_{t+1} + dSMB_{t+1} + eS_t + \epsilon_{t+1}$				
$\hat{b}$	-2.28***	-1.27***	2.20***	2.98***
	(-3.14)	(-3.37)	(4.17)	(3.89)
$\hat{c}$	-0.12	-0.07	-0.35***	-0.45***
	(-1.07)	(-1.05)	(-3.08)	(-2.98)
d	-0.03	-0.01	-0.16**	-0.18**
	(-0.17)	(-0.08)	(-2.13)	(-2.05)
$\hat{e}$	1.81***	0.89***	0.38	0.40
	(3.21)	(2.91)	(1.21)	(0.97)

Table 8: **Robustness of double sorting results: Controlling for investor sentiment**
This table reports how the dependence of CAPM-adjusted returns on lagged TED spread for the value premium and the profitability premium varies with the potential shareholder recovery, controlling for investor sentiment. We perform 5 × 5 independent sorts on stocks based on the three measures of shareholder recovery and book-to-market ratios/profitability. For each quintile of shareholder recovery, we perform the regression $r_{t+1} = a + bTED_t + cMKT_{t+1} + eS_t + \epsilon_{t+1}$, where the dependence variable is the realized value premium and the profitability premium. The robust Newey-West standard errors are reported in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

	(1) Value R&D	(2) Value Herfindahl	(3) Value Tangibility	(4) Profitability R&D	(5) Profitability Herfindahl	(6) Profitability Tangibility
	Panel A: Lowest shareholder recovery quintile					
$\hat{b}$	-1.04	-1.26*	-1.37**	-2.39**	-1.38	2.10***
	(-1.25)	(-1.79)	(-2.41)	(-2.44)	(-1.38)	(2.79)
	Panel B: Shareholder recovery quintile 2					
$\hat{b}$	-0.62	-2.17**	-1.43**	-1.53	2.86***	1.51**
	(-0.66)	(-2.21)	(-2.10)	(-1.28)	(3.06)	(2.46)
	Panel C: Shareholder recovery quintile 3					
$\hat{b}$	-2.45***	-1.94**	-2.38**	0.01	1.15*	5.62***
	(-3.42)	(-2.00)	(-2.40)	(0.01)	(1.70)	(9.51)
	Panel D: Shareholder recovery quintile 4					
$\hat{b}$	-1.54*	-1.40	-1.69*	0.35	0.00	2.49**
	(-1.74)	(-1.39)	(-1.80)	(0.60)	(0.00)	(2.26)
	Panel E: Highest shareholder recovery quintile					
$\hat{b}$	-2.33*	-3.34**	-4.10***	2.87***	0.79	0.77
	(-1.92)	(-2.51)	(-5.41)	(3.12)	(0.58)	(0.89)
	Panel F: Panel C – Panel A					
$\Delta\hat{b}$	-1.41	-0.68	-1.01	2.40	2.54**	3.52***
	(-1.35)	(-1.02)	(-1.26)	(1.56)	(2.33)	(3.88)
	Panel G: Panel E – Panel A					
$\Delta\hat{b}$	-1.29	-2.08**	-2.73***	5.26***	2.18	-1.33
	(-1.08)	(-2.29)	(-4.17)	(3.68)	(1.55)	(-1.31)

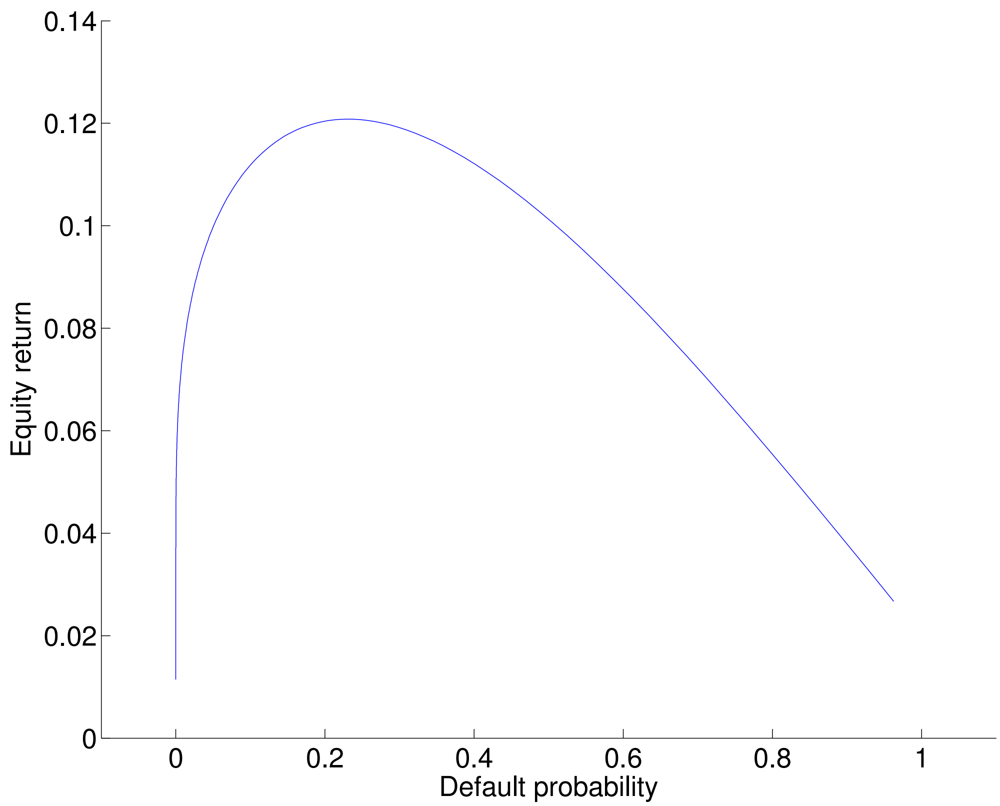

Figure 1: **Equity return (beta) and default probability.** This figure plots the relationship between conditional expected equity return given in Eq. (14) and risk-neutral default probability in Eq. (13), from the model. Since the expected return is proportional to two equity betas, β_{At} in Eq. (15) and β_{ct} in Eq. (16), the relationship between equity beta (or the absolute value of equity beta for β_{ct}) and default probability has the same shape. The parameter values are: $r = 5\%$, $b = 0.5$, $\gamma = 2$, $K = 1$, $\eta = 20\%$, $\mu_X = \mu_c = 0$, $\lambda_A = \lambda_c = 1$, and $\sigma_X = \sigma_c = 0.1\%$.

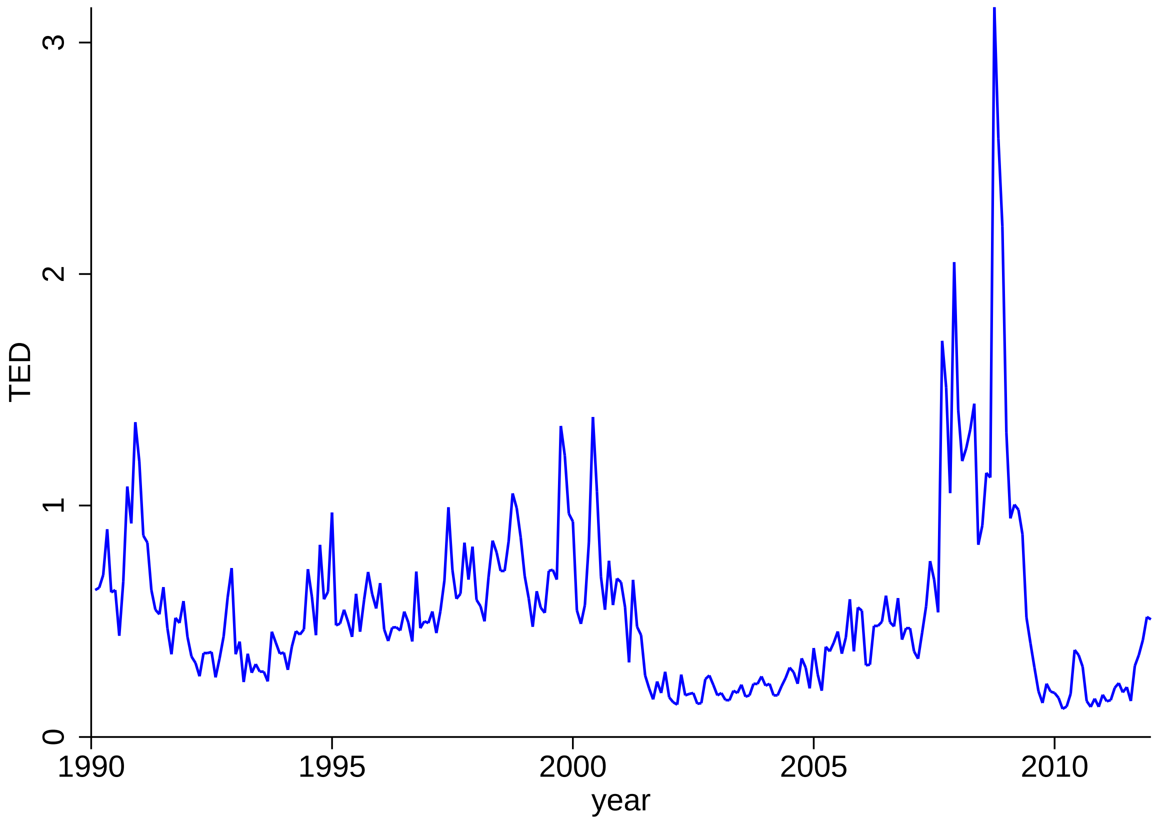

Figure 2: **Time series of the TED spread.** This figure plots the monthly time series of TED spread. The unit of the TED spread is percentage.

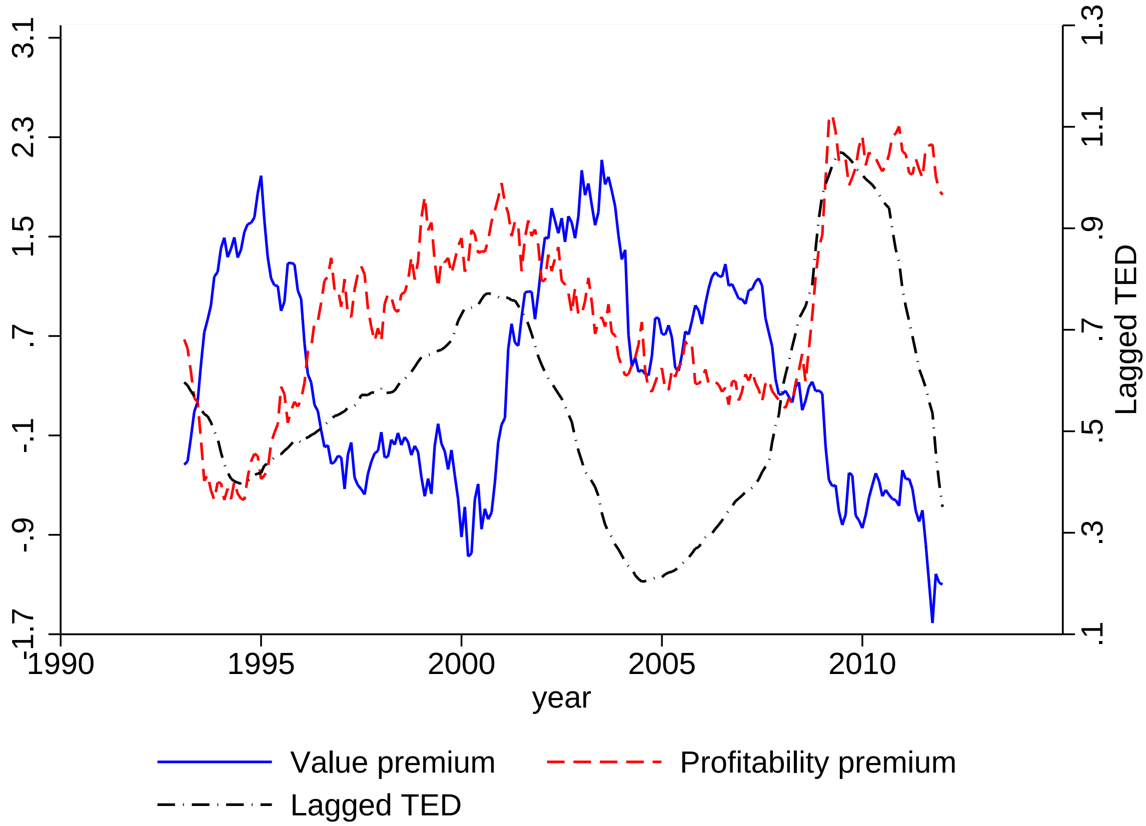

Figure 3: **Value premium, profitability premium, and credit conditions.** This figure plots the trailing three-year average of monthly CAPM-adjusted value/profitability premium (the left scale) and lagged TED spread (the right scale). The unit of the TED spread and the value/profitability premium is percentage.

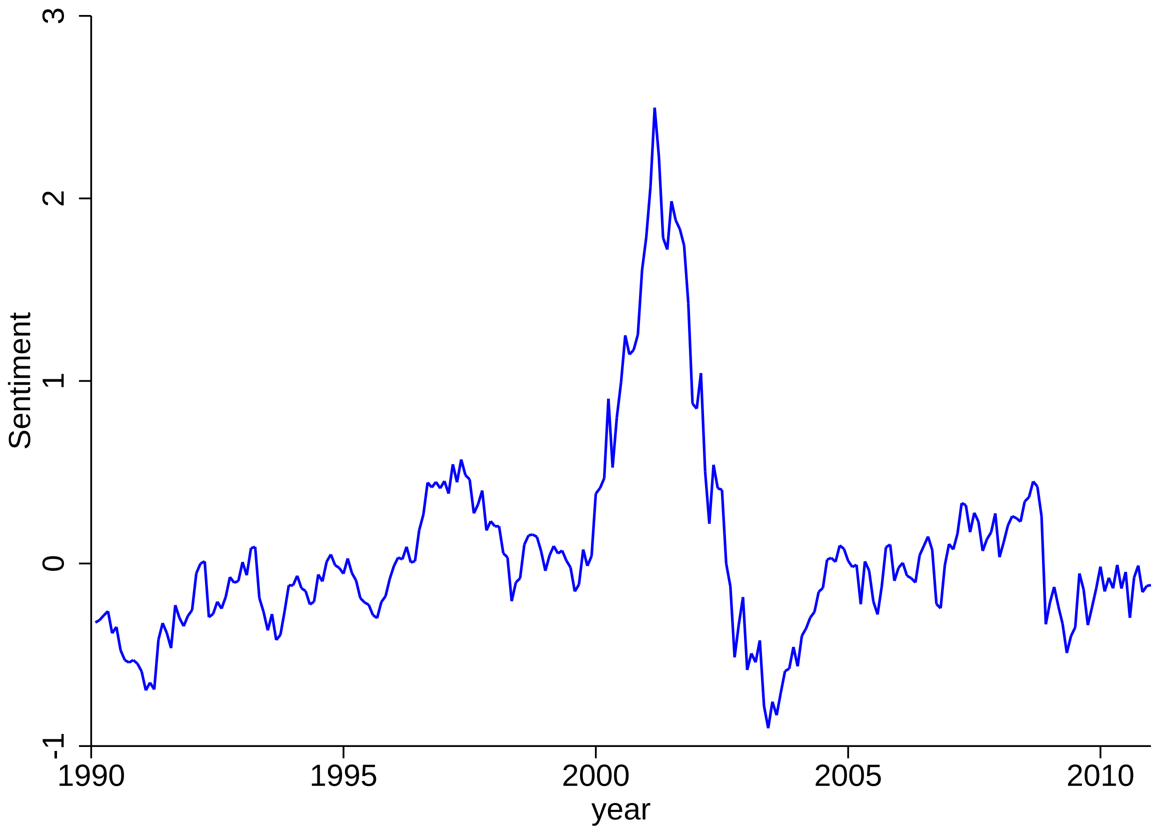

Figure 4: **Time series of the sentiment index.** This figure plots the monthly time series of the Baker and Wurgler (2006) sentiment index.