Default Risk, Shareholder Advantage, and Stock Returns[*]

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Abstract

In this paper, we study the relationship between default probability and stock returns. Using the market-based measure of *Expected Default Frequency*™ (EDF™) constructed by *Moody's KMV*, we first demonstrate that higher default probabilities *are not necessarily* associated with higher expected stock returns, a finding that complements the existing empirical evidence. Adapting the setting of the Fan and Sundaresan (2000) model that explicitly considers the bargaining game between equity-holders and debt-holders of a firm in financial distress, we obtain a theoretical relationship between expected returns and default probability that resembles the empirically observed pattern. Our analysis indicates that the relationship between default probability and equity return tends to be (i) upward sloping for firms where shareholders are not likely to extract significant benefits from renegotiation (low "shareholder advantage") and (ii) humped and downward sloping for firms where shareholder advantage is strong. Moreover, this divergence in the relationship implies that distressed firms in which shareholders have a stronger advantage in renegotiation exhibit lower expected returns. We test these implications using several proxies for shareholder advantage and find results that are consistent with the model's predictions.

Keywords: Default Risk, Stock Returns, Debt Renegotiation, Bankruptcy, Liquidation.
JEL Classification Codes: G12, G14.

1   Introduction

Default risk usually refers to the likelihood that a levered firm will not be able to pay the contractual interest or principal on its debt obligations. Several studies have argued for a role of default risk in explaining some of the "anomalies" in the cross section of equity returns. The argument proposed by these studies rests on the conjecture that investors demand a positive premium for holding stocks of firms that face a high probability of default.[1]

Using various measures of the probability of default, the existing empirical literature has not produced consistent evidence to confirm the above conjecture. In fact, some studies have documented the opposite result, i.e., stocks of companies with a higher probability of default usually earn *lower* returns.[2] A prevalent interpretation of this empirical evidence is one of market mispricing, namely, investors are incapable of fully assessing the prospects of firms with high default probabilities and hence fail to demand a sufficient premium to compensate for the risk of default.

In this paper, we propose an economic mechanism that helps reconcile the conflicting interpretations of the link between returns and default probability. This mechanism relies on the effects of strategic interactions between equity holders and debt holders on equity returns. Our theoretical analysis and empirical evidence indicate that "shareholder advantage," i.e., the ability of shareholders to extract rents from their interactions with other claimholders, has a direct impact on the equity risk of firms with high default probability and helps account for much of the observed cross-sectional variations in the relationship between default probability and stock returns, above and beyond the known effects of size, book-to-market ratio and momentum.

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[1]For instance, Chan, Chen, and Hsieh (1985) show that a default factor constructed as the difference between high- and low- grade bond return can explain a large part of the size effect. Fama and French (1992) and Chen, Roll, and Ross (1986) document the power of a similarly defined default factor in explaining the cross section of stock returns. Chan and Chen (1991) justify the role of distress risk by arguing that the size premium is primarily driven by "marginal firms," i.e., firms with low market value, cash flow problems, and high leverage that are more sensitive to adverse economic fluctuations. Fama and French (1992) also link the book-to-market effect to the risk of distress. Moreover, Fama and French (1996) suggest that, if distress events are correlated across firms, a firm's "relative distress" can act as a state variable affecting investors' human capital and ultimately asset prices in the cross section. More recently, Vassalou and Xing (2004) argue that default risk is *positively* priced in the market and is associated with both size and value effects.

[2]Using both Altman (1968) *Z*-score and Ohlson (1980) *O*-score, Dichev (1998) documents a negative relationship between stock return and default probability. Griffin and Lemmon (2002) find that this pattern is stronger for firms with low book-to-market ratios. More recently, this pattern has been confirmed by Campbell, Hilscher, and Szilagyi (2005) using a hazard model to predict default probability. Furthermore, Avramov, Chordia, Jostova, and Philipov (2005) link momentum returns to credit deterioration.

We carry out our study in three steps. First, we revisit the empirical relationship between default probability and stock returns by directly employing a database of *Expected Default Frequencies*™ (EDF™) produced by *Moody's KMV*, which is widely used by financial institutions as a predictor of default probability. Using the EDF measure, we find that higher default probabilities do not consistently lead to higher expected stock returns. In particular, small firms and/or firms with low-priced stocks exhibit different behavior than large firms. While this finding complements the existing evidence, it is also suggestive of cross-sectional variations in the relationship.

Second, we show that the assessment of equity risk of default should take into account the potential recovery for *shareholders*, which is an outcome of the renegotiation between claim-holders in the event of financial distress. While a number of theoretical models have explicitly considered this strategic interaction in the context of optimal capital structure and credit spreads on corporate bonds,[3] to the best of our knowledge, our study is the first to show that this consideration is also important for explaining the puzzling behavior of stock returns. For this purpose, we adapt the model of Fan and Sundaresan (2000), whose parsimonious setup captures the essence of the bargaining game between debt-holders and shareholders and allows us to derive explicitly the link between default probability and expected stock returns.

Our analysis highlights the crucial role of *shareholder advantage*—defined as the combination of shareholders' bargaining power and the efficiency gained through bargaining—in the determination of equity returns.[4] We show that, within the context of the above model, the ability of shareholders with a stronger advantage to extract more value from renegotiation leads to lower risk for equity—relative to the risk of the assets—and hence lower expected returns, as the probability of default increases. On the other hand, for firms whose shareholders have a weak advantage, the model predicts a positive relationship between default probability and expected equity returns, consistent with the original intuition that default risk should be compensated

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[3]See, for example, Anderson and Sundaresan (1996), Mella-Barral and Perraudin (1997), Fan and Sundaresan (2000), Acharya, Huang, Subrahmanyam, and Sundaram (2004), and François and Morellec (2004).

[4]Shareholder advantage is best represented by the violation of the absolute priority rule (APR) during bankruptcy proceedings. However, in other instances of default, such as private workouts, where the absolute priority rule is not clearly defined, our concept of shareholder advantage still applies.

by a positive return premium. Our analysis indicates that, in the presence of shareholder advantage, default probability does not adequately represent the risk of default to equity, since higher default probability is also associated with a potential reduction in debt burden and hence in equity risk. In fact, the trade-off between the risk of default to equity and the likelihood of bargaining gains in renegotiation results in a hump-shaped relationship between expected returns and default probability.

Third, through the "lens" of our theoretical analysis, we take a fresher look at the data. We hypothesize that the negative relationship between default probability and expected returns is more pronounced for firms with (i) a large asset base, which can make their shareholders more powerful in renegotiations; (ii) low R&D expenditures, which, *ceteris paribus*, reduce the likelihood of a liquidity shortage and hence strengthen shareholders' bargaining position; and (iii) high liquidation costs—proxied by asset specificity—which give debt-holders a strong incentive for a negotiated settlement. On the other hand, the relationship turns positive for firms at the opposite extreme of these variables. Using these variables as proxies for shareholder advantage, we test our hypotheses through both a sub-portfolio analysis and a multivariate regression analysis.

Our empirical findings are consistent with the model's conjecture about the key role of shareholder advantage in determining the link between default probability and stock returns. In particular, returns decrease in EDF for firms with (i) large asset size and low R&D expenditure (proxies for high bargaining power) and (ii) high asset specificity—i.e., in a concentrated industry or with low asset tangibility (proxies for high bargaining surplus). Moreover, we find that the cross-sectional divergence in the relationship for firms with strong versus weak shareholder advantage is both statistically significant and economically meaningful.

There is a large body of work devoted to modelling default risk for valuing corporate debt, compared to the relatively thin literature on the link between default probability and stock returns.[5] Several recent theoretical papers also examine specific features of bankruptcy codes

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[5]See Duffie and Singleton (2003) for a comprehensive overview of the literature on credit risk and the pricing of corporate debt.

and their effects on the valuation of corporate debt.[6] None of these papers, however, focus on the relationship between stock returns and default probability examined in this paper. On the empirical side, Davydenko and Strebulaev (2006) investigate the significance of shareholders' strategic actions for credit spreads and find that while the effect is statistically significant, its economic impact on credit spreads is minimal.

In this paper we show that, conversely, the economic impact of shareholders' strategic actions can be very significant to *shareholders*, who would have received nothing in liquidation. Our study demonstrates that this economic mechanism can help explain the complex effect of default risk on stock returns and highlights the importance of strategic interactions in a setting where it matters the most—to the residual claimants.

The rest of the paper proceeds as follows. In Section 2, we review the existing empirical evidence on the relationship between default probability and stock returns and present our own empirical results. In Section 3, we explicitly derive the relationship between returns and default probability in the context of the Fan and Sundaresan (2000) model, and in Section 4 we test its empirical implications in the cross section. We conclude in Section 5. We provide technical details and describe the model simulation procedure in the Appendix.

2 Default probability and stock returns: empirical evidence

In this section, we first review the previous evidence in the literature on the relationship between stock returns and default probability. We then report the results of our own preliminary empirical investigation relying on the market-based measures of default probability obtained from *Moody's KMV* (MKMV hereafter).

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[6]See, for example, Broadie, Chernov, and Sundaresan (2004), Galai, Raviv, and Wiener (2003), François and Morellec (2004), and Paseka (2003). Alternatively, Von Kalckreuth (2005) proposes an explanation based on non-financial reward from corporate control.

2.1 Previous empirical evidence

Using Ohlson's (1980) O-score and Altman's (1968) Z-score to proxy for the likelihood of default, Dichev (1998) documents an inverse relationship between stock returns and default probability.[7] This result is confirmed by Griffin and Lemmon (2002), who argue that the phenomenon is driven by the poor performance of the firms with low book-to-market ratio and high distress risk, and attribute it to market mispricing of these stocks.

Campbell, Hilscher, and Szilagyi (2005) study the determinants of corporate bankruptcy using a hazard model approach, similar to that in Shumway (2001) and Chava and Jarrow (2002). Using the resulting forecast measure of default probability, they also find that firms with a high probability of bankruptcy tend to earn low average returns and suggest that this evidence is indicative of equity markets mispricing distress risk.

Hillegeist, Keating, Cram, and Lundstedt (2004) show that both O-score and Z-score are limited in their forecasting power and advocate the use of a measure based on the Black and Scholes (1973) and Merton (1974) option pricing framework, similar to the EDF measure provided commercially by MKMV. Vassalou and Xing (2004) construct a metric for default probability to mimic the EDF measure. They find that high-default-probability firms with a small market capitalization and a high book-to-market ratio earn higher returns than their low-default-probability counterparts and conclude that default risk is systematic and positively priced in stock returns. This result is contrary to the other evidence in the literature and has been challenged on the ground of return attribution.[8]

In the remainder of this section, we present our own evidence on the relationship between stock returns and default probability using a measure of default likelihood that relies on information included in market prices.

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[7]There is, however, a discernable hump in the relationship documented by Dichev (1998), which is not discussed in the paper.

[8]Da and Gao (2005) argue that some of the very high returns earned by small stocks with high default risk and a high book-to-market ratio are attributable to the illiquidity of these stocks.

2.2 Our empirical findings

2.2.1 Data and summary statistics

In our empirical investigation we use the *Expected Default Frequency* (EDF) obtained directly from MKMV. This measure is constructed from the Vasicek-Kealhofer model (Kealhofer (2003a,b)), which adapts the contingent-claim framework of Black and Scholes (1973) and Merton (1974) to make it suitable for practical analysis.[9]

To be included in our analysis using the EDF measure, a stock needs to be present simultaneously in the CRSP, COMPUSTAT, and MKMV databases. Specifically, for a given month, we require a firm to have an EDF measure and an implied asset value in the MKMV dataset; price, shares outstanding and returns data from CRSP; and accounting numbers from COMPUSTAT. We limit our sample to non-financial U.S. firms.[10] We drop from our sample stocks with a negative book-to-market ratio. Our baseline sample contains 1,430,713 firm-month observations and spans from January 1969 to December 2003.[11]

Summary statistics for the EDF measure are reported in Table 1. The average EDF measure in our sample is 3.44% with a median of 1.19%.[12] The table shows that there are time-series variations in the average as well as in the distribution of the EDF measure, and that the majority of the firms in our dataset have an EDF score below 4%.

Since the EDF measure is based on market prices, in order to mitigate the effect of noisy stock prices on the default score, we use an exponentially smoothed version of the EDF measure, based on a time-weighted average. Specifically, for default probability in month t, we use

$$\overline{EDF_t} = \frac{\sum_{s=0}^{5} e^{-s\nu} EDF_{t-s}}{\sum_{s=0}^{5} e^{-s\nu}}, \tag{1}$$

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[9]See Crosbie and Bohn (2003) for details on how MKMV implements the Vasicek-Kealhofer model to construct the EDF measure. In addition, as indicated by *Moody's KMV*, the EDF measure is constructed based on extensive data filtering to avoid the influence of outliers due to data errors, a sophisticated iterative search routine to determine asset volatility and access to a comprehensive database of default experiences for an empirical distribution of distance-to-default.

[10]Financial firms are identified as firms whose industrial codes (SIC) are between 6000 and 6999.

[11]We follow Shumway (1997) to deal with the problem of delisted firms. Specifically, whenever available, we use the delisted return reported in the CRSP datafile for stocks that are delisted in a particular month. If the delisting return is missing but the CRSP datafile reports a performance-related delisting code (500, 520–584), then we impute a delisted return of −30% in the delisting month.

[12]MKMV assigns an EDF score of 20% to all firms with an EDF measure larger than 20%.

where ν is chosen to satisfy $e^{-5\nu} = 1/2$, such that the five-month lagged EDF measure receives half the weight of the current EDF measure. The empirical results are reported based on $\overline{EDF_t}$, which we will still refer to as EDF for notational convenience. Our results, however, are robust to the use of the original EDF measure.

2.2.2 Equity returns and default probability

In this section we analyze the relationship between equity returns and default probability measured by EDF. As Table 1 illustrates, the EDF measure exhibits substantial variation over time. The time variation in the EDF score can cause problems if we want to compare the cross-sectional relationship between default probability and returns in different time periods. To avoid such problems, when linking returns to default probabilities we use the EDF *rank* in the cross section, instead of the EDF score itself.

Because the EDF measure is based on equity prices, there is a natural concern about a spurious relationship between EDF and stock returns. Several considerations can help alleviate this concern. First, the time-weighted EDF measure is not contemporaneous with the stock price as it is exponentially weighted through time. Second, our use of the ranking of EDF will mitigate any potentially mechanical link between EDF and returns. Third, since in all our empirical tests we control for return momentum, the possibility of a spurious correlation between EDF and returns is further reduced.

We start our analysis by forming portfolios of stocks according to each firm's EDF rank in month t. We then analyze the returns of these portfolios in month $t + 2$, i.e., we skip a month between portfolio formation and return recording. There are two reasons for this choice. First, as suggested by Da and Gao (2005), skipping a month is important to alleviate the microstructure issues that notoriously affect low-priced firms near default.[13] Second, skipping a month helps further alleviate the concern of detecting a spurious relationship between EDF and returns.

The results are presented in Table 2 where we report equally- and value-weighted portfolio returns when using both the full sample of stocks (Panel A) and the subsample of stocks with a

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[13]We also repeat our analysis with quarterly, instead of monthly, returns and obtain qualitatively similar results.

price per share higher than two dollars (Panel B). To isolate the effect of the EDF measure on stock returns from other characteristics known to affect stock returns, we follow the methodology suggested by Daniel, Grinblatt, Titman, and Wermers (1997) (DGTW henceforth) and adjust the return of each stock by subtracting the return of a benchmark portfolio that matches the stock's size, book-to-market ratio, and momentum (see also Wermers (2004)).[14] The sample period of DGTW-adjusted returns spans from June 1975 to June 2003 due to the availability of the benchmark portfolio returns. The adjusted returns are reported under the label "DGTW returns" in both panels of Table 2.

The first two rows of Panel A (full sample) demonstrate an intriguing pattern in the relationship between raw stock returns and measures of default probability. While equally-weighted portfolio returns are positively related to default probability, for value-weighted portfolio returns, this relationship is almost flat and slightly humped. With DGTW-adjusted returns, Panel A in Table 2 shows that the relationship for equally-weighted returns is now strongly positive and statistically significant, while the relationship for value-weighted returns remains mostly flat and slightly humped. The difference in the behavior of equally- and value-weighted portfolio returns is statistically significant both for raw returns and for DGTW-adjusted returns.

The difference between value- and equally-weighted returns is traditionally argued to be caused by the size effect. If the size effect is the only cause for this difference, then it should disappear in DGTW-adjusted returns. The fact that this difference persists and is even more significant with DGTW-adjusted returns suggests an additional effect that might be related to the size of a firm.

The results for both equally- and value-weighted portfolios with raw returns are similar to those obtained by Vassalou and Xing (2004), who use their own EDF-mimicking measure for default likelihood.[15] Vassalou and Xing (2004) claim that the pattern associated with the equally-weighted returns is indicative of positively priced default risk and dismiss the previous

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[14]We thank Kent Daniel and Russ Wermers for providing data on the benchmark portfolio returns.

[15]While Vassalou and Xing (2004) construct their own market-based default probability measure using the Merton (1974) model, we use the EDF measure directly obtained from MKMV. Because results can be heavily impacted by outliers in these measures due to data errors, by using MKMV's EDF measure directly we benefit from the extensive data cleaning and the rich empirical default database reflected in MKMV's EDF measure.

evidence of a negative association between stock returns and default probability as a result of imperfect, accounting-based measures of default likelihood. However, the distinct behavior of value- and equally-weighted portfolios reported in Panel A of Table 2 suggests caution in drawing conclusions concerning how default risk is priced.

To see the impact of extremely low-priced stocks on this return pattern, we report in Panel B the results obtained by excluding stocks with a price per share less than two dollars. The absence of low-priced stocks takes away the positive relationship between equally-weighted returns and EDF while keeping the result for value-weighted returns qualitatively similar. The difference between equally- and value-weighted returns is no longer statistically significant for DGTW returns, confirming the conjecture that the positive relationship for equally-weighted returns in Panel A is attributable to low-priced stocks. Compared with the results for the full sample in Panel A, this finding suggests that the DGTW correction for size/book-to-market/momentum works quite well for stocks in the subsample of stocks with a price greater than two dollars but fails to account for those low-priced stocks. Since stocks in distress are more likely to have low prices, these results imply that the effect of default is not subsumed by size, book-to-market ratio, and momentum.

To understand these potential cross-sectional variations in the relationship between equity returns and default probability, it is necessary to take a closer look at the microeconomic forces at play for firms facing financial distress. In the next section, we propose a plausible economic mechanism that produces predictions consistent with the patterns we observe in the data.

3 Default probability and stock returns: a theoretical model

The Merton (1974) model characterizes equity as a call option on the firm's assets and implicitly assumes that default equals liquidation. In reality, liquidation is only one of the possibilities open to a firm in financial distress, and it is usually a choice of the last resort. Frequently, firms choose to renegotiate outstanding debt either in a private workout or under the protection of the U.S. Bankruptcy Code (Chapter 11). Frequently, bankruptcy procedures allow for opportunistic behavior of claimholders and subsequent violation of the absolute priority rule (e.g., Franks and

Torous (1989), Weiss (1991), Eberhart, Moore, and Roenfeldt (1990), and Betker (1995)). In an attempt to understand the relationship between capital structure decision and debt pricing, Anderson and Sundaresan (1996), Mella-Barral and Perraudin (1997), Fan and Sundaresan (2000), Acharya, Huang, Subrahmanyam, and Sundaram (2004) explicitly evaluate corporate claims within a model that allows for out-of-court renegotiations, while François and Morellec (2004) develop a model to capture the unique features of Chapter 11 renegotiation (automatic stay and exclusivity period).[16]

In this section, we show how the strategic framework proposed by these theoretical models can be used to provide insights into the puzzling empirical relationship between default probability and stock returns documented earlier. The main intuition is that allowing for renegotiation provides room for strategic default, and shareholders can extract rents in the form of lower or deferred payments on their debt obligations in the process. This *shareholder advantage* is a function of their bargaining power and affects the riskiness of equity. The stronger shareholders' advantage in renegotiation is, the higher their rent extraction ability is, and the lower the risk and expected return of equity are.

We analyze the connection between default probability and return to equity by adapting the model of Fan and Sundaresan (2000), originally designed to study "the implication of the *relative bargaining power of claimants* on optimal reorganization and debt valuation" (p. 1050, their emphasis). As it will become clear, the implication of our analysis can also be obtained in the context of other models that allow for a bargaining game in renegotiation.

3.1   A model of strategic debt service

We first briefly review the basic elements of the renegotiation model of Fan and Sundaresan (2000) (FS hereafter). The model is set in continuous time and considers a firm which issues a single tranche of perpetual debt with a promised coupon c per unit time. The payment of the contractual coupon entails the firm to a tax benefit τc ($0 \leq \tau \leq 1$) that is lost during the

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[16]Other papers analyzing the effect of the bankruptcy codes on debt valuation include Acharya, Sundaram, and John (2005), Broadie, Chernov, and Sundaresan (2004), Galai, Raviv, and Wiener (2003), and Paseka (2003).

default period. There are dissipative liquidation costs, measured as a fraction α of the value of the assets upon liquidation, where equity-holders get nothing and debt-holders get a fraction $(1 - \alpha)$ of the firm's assets.[17] The asset value of the firm, V_t, follows the geometric Brownian motion

$$\frac{dV_t}{V_t} = (\mu - \delta)\, dt + \sigma\, dB_t, \tag{2}$$

where $\mu > \delta$ is the instantaneous rate of return on assets, δ is the payout rate, σ is the instantaneous volatility and B_t is a standard Brownian motion. With the tax-shield, the value of the firm is always larger than the value of the assets, V. Finally, the firm cannot sell assets to pay dividends, and the default-free term structure of interest rates is flat with a constant rate r per unit time.

Default occurs when the asset value falls below an endogenously determined threshold. At that point, shareholders stop making the contractual payments to bondholders but keep control of the firm, servicing the debt "strategically" until the asset value returns above this threshold (*strategic debt service*).[18] In default, a bargaining game ensues between the firm's claimants. The parties will bargain over the total value of the firm, $v(V)$, which is divided according to the equilibrium outcome of a Nash bargaining game between shareholders and debt-holders. More specifically, if $\widetilde{V}_S$ denotes the trigger point in asset value for which strategic debt service is initiated, for any $V \leq \widetilde{V}_S$ the firm value $v(V)$ is split between equity-holders and debt-holders as follows

$$\widetilde{E}(V) = \tilde{\theta} v(V), \quad \widetilde{D}(V) = (1 - \tilde{\theta}) v(V), \tag{3}$$

where $\widetilde{E}(\cdot)$ and $\widetilde{D}(\cdot)$ are the values of equity and debt, respectively, and $\tilde{\theta}$ is the sharing rule which maximizes the aggregate surplus of equity- and debt-holders in the following Nash bargaining

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[17]FS also consider extensions to allow for fixed liquidation costs and finite-maturity debt. We do not consider these extensions here to preserve analytical tractability while illustrating the basic intuition.

[18]FS also consider a second type of exchange offer occurring during debt workouts, i.e., *debt-equity swaps*, in which shareholders offer debt-holders a fraction of the firm's equity in replacement of their original debt obligations and leave the control of the firm in the hands of debt-holders. While in the absence of taxes, the case of debt-equity swap is equivalent to that of strategic debt service, in the presence of taxes strategic debt service is the dominating alternative since shareholders can capture the future tax benefits that are foregone in the debt-equity swap. We will, hence, limit our analysis to the case of strategic debt service.

game

$$\tilde{\theta}^* = \arg\max \left[\tilde{\theta}v(V) - 0\right]^{\eta} \left[(1 - \tilde{\theta})v(V) - (1 - \alpha)V\right]^{1-\eta}$$

$$= \eta\left(1 - \frac{(1-\alpha)V}{v(V)}\right). \tag{4}$$

In the above game, η represents the bargaining power of shareholders and $1 - \eta$ the bargaining power of bondholders. The shareholders' surplus from bargaining is $\tilde{\theta}v(V) - 0$, because the alternative to bargaining is liquidation, in which case shareholders receive nothing. The bondholders' surplus from bargaining is $(1 - \tilde{\theta})v(V) - (1 - \alpha)V$, since the alternative entails a dissipative liquidation cost, α.

As the equilibrium sharing rule (4) illustrates, shareholders receive more of the renegotiation surplus when their bargaining power η is higher and when the liquidation cost α is larger. The effect of bargaining power on the sharing rule is obvious. The role of liquidation costs is more subtle. The parameter α captures the loss of asset value that shareholders can potentially impose on creditors. This cost may be inflicted either through liquidation that occurs when negotiations fail or through the cost of legal battles in a bankruptcy court, or both. Hence, a high liquidation cost generates a stronger incentive for debt-holders to participate in the bargaining game, and thus indirectly increases shareholders' bargaining power.

3.1.1 Valuation

The valuation of claims follows standard techniques of contingent claim analysis (see, for example, Dixit and Pindyck (1994)). Proposition 3 in FS gives the following value for equity,

$$\widetilde{E}(V) = \begin{cases} V - \frac{c(1-\tau)}{r} + \left[\frac{c(1-\tau)}{(1-\lambda_1)r} - \frac{\lambda_1(1-\lambda_2)\eta}{(\lambda_2-\lambda_1)(1-\lambda_1)}\frac{\tau c}{r}\right]\left(\frac{V}{\widetilde{V}_S}\right)^{\lambda_1} & \text{if } V > \widetilde{V}_S, \\ \theta^* v(V) & \text{if } V \leq \widetilde{V}_S, \end{cases} \tag{5}$$

where θ^* is the optimal sharing rule from the Nash bargaining game (4), $\widetilde{V}_S$ is the endogenous level of asset values that triggers strategic debt service,

$$\widetilde{V}_S = \frac{c(1-\tau+\eta\tau)}{r}\frac{-\lambda_1}{1-\lambda_1}\frac{1}{1-\eta\alpha}. \tag{6}$$

$v(V)$ is the total firm value,

$$v(V) = \begin{cases} V + \frac{\tau c}{r} - \frac{\lambda_2}{\lambda_2-\lambda_1}\frac{\tau c}{r}\left(\frac{V}{\widetilde{V}_S}\right)^{\lambda_1} & \text{if } V > \widetilde{V}_S, \\ V + \frac{-\lambda_1}{\lambda_2-\lambda_1}\frac{\tau c}{r}\left(\frac{V}{\widetilde{V}_S}\right)^{\lambda_2} & \text{if } V \leq \widetilde{V}_S, \end{cases} \tag{7}$$

$\lambda_1 = \left(\frac{1}{2} - \frac{r-\delta}{\sigma^2}\right) - \sqrt{\left(\frac{1}{2} - \frac{r-\delta}{\sigma^2}\right)^2 + \frac{2r}{\sigma^2}} < 0$, and $\lambda_2 = \left(\frac{1}{2} - \frac{r-\delta}{\sigma^2}\right) + \sqrt{\left(\frac{1}{2} - \frac{r-\delta}{\sigma^2}\right)^2 + \frac{2r}{\sigma^2}} > 1$.

From equation (5), the value of equity, when the firm is not in default $(V > \widetilde{V}_S)$, is equal to its asset value V net of debt plus an adjustment term, which accounts for tax shields and the probability of default.[19] After renegotiation, the proceeds to equity-holders are given by $\theta^* v(V) = \eta(v(V) - V) + \eta\alpha V$, following equation (4) for the optimal sharing rule θ^*. Since $v(V)-V > 0$, the proceeds $\theta^* v(V)$ are hence increasing in the bargaining power η and liquidation costs α. Equity value and endogenous default threshold are increasing in bargaining power and/or liquidation costs (equations (5) and (6)).

Both public bonds and bank debt usually come with covenants which require, at minimum, that the borrower honor the payment obligations specified in the debt contract. FS extend their bargaining model to consider the case in which hard cash flow covenants are in place. Under hard cash flow covenants, if the firm is not able to meet the contractual obligation on the debt, the debt-holders will take over or liquidate the firm. As FS show, the main effect of introducing hard cash flow covenants in a debt renegotiation model is to separate *strategic default*, which leads to bargaining in debt renegotiation, from *liquidity default*, that results in forced liquidations. Liquidity default triggered by hard cash flow covenants may be thought of as a special case of strategic default where shareholders have no bargaining power.

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[19]The quantity $(V/\widetilde{V}_S)^{\lambda_1}$ is the Arrow-Debreu price of a security that pays one dollar in the event that V ever reaches the threshold $\widetilde{V}_S$.

3.1.2 Equity returns and default probability

For its empirical relevance, we are most interested in the connection between equity returns and default probability. In order to analyze this relationship, we need to derive both the expected returns on equity and the cumulative default probability implied by the above model.

The closed-form expression for equity value in (5) is our starting point for deriving implications of the bargaining game for expected returns on equity. The quantity in the FS model that closely resembles the MKMV EDF measure is the probability of hitting the renegotiation boundary $\widetilde{V}_S$ in (6) under the *true* probability measure governing the underlying process V. In the following proposition, we formally derive the expected returns and default probability implied by the FS model.

Proposition 1 *Under the assumptions of the FS model, the annualized t-period continuously compounded expected return on equity is given by*

$$r^E_{(0,t]}(V_0) = \frac{1}{t} \log \left(\frac{\mathbb{E}_0(\widetilde{E}(V_t))}{\widetilde{E}(V_0)} \right), \tag{8}$$

where $\mathbb{E}_0(\widetilde{E}(V_t))$, derived in equation (A3) of Appendix A, is the conditional expectation at $t = 0$ under the true probability measure of the asset value process in (2). The time 0 cumulative real default probability $\Pr_{(0,T]}$ over the time period $(0,T]$ is given by

$$\Pr_{(0,T]}(V_0) = \mathcal{N}\left(h(T)\right) + \left(\frac{V_0}{\widetilde{V}_S} \right)^{-\frac{2\gamma}{\sigma^2}} \mathcal{N}\left(h(T) + \frac{2\gamma T}{\sigma\sqrt{T}} \right), \tag{9}$$

with $\gamma = \mu - \delta - \frac{1}{2}\sigma^2 > 0$, $h(T) = \frac{\log\left(\widetilde{V}_S/V_0\right) - \gamma T}{\sigma\sqrt{T}}$ and $\mathcal{N}(\cdot)$ the cumulative standard normal function.

Proof: See Appendix A.

Equations (8) and (9) represent the theoretical counterparts of the empirically observed equity returns and default probability, respectively.

The model shows that shareholder advantage in default redistributes cash flows across the firm's claimants. This redistribution affects equity value and expected return. In addition, shareholder advantage, which is exogenous to the model, also impacts the default probability. Note that the risk profile of equity is affected through this "cash flow channel" and not through a missing "default risk factor" in the pricing kernel. By construction, the contingent claim model we use is silent about the pricing kernel which determines the value of the underlying assets in (2).[20]

3.2 Empirical implications

The empirical analysis in Section 2 highlighted a complex relationship between default probability and equity returns. Given that we were able to obtain these two quantities explicitly within a plausible model of the default process, we can now analyze the implications of the model.

As Proposition 1 illustrates, the link between expected returns and default probability is multi-dimensional, since both quantities are determined by a common set of variables and parameters. Instead of arbitrarily fixing a set of parameters and deriving an analytical relationship between expected returns and default probability, we simulate firms in the cross section by selecting different initial asset value V_0, coupon rate c, asset growth rate μ, and asset volatility σ, in order to match the distribution of these quantities in the data. We then compute the expected return and default probability for each firm, according to equations (8) and (9), respectively. Finally, we classify each firm in quintiles according to their default probability and, for each quintile, we report the equally-weighted expected return. Details of the simulations are contained in Appendix B.

The main objective of this exercise is to highlight the role of the bargaining power coefficient η and of the liquidation cost coefficient α in determining how default probability and expected returns are related to each other. An important caveat to this exercise is that, since both

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[20]We do not examine in this paper the effect of shareholder advantage on bond prices which is discussed in Fan and Sundaresan (2000) and empirically explored in Davydenko and Strebulaev (2006). Note, however, that because debt renegotiation can be efficiency enhancing in the presence of liquidation costs, the benefits to shareholders do not necessarily come at the expense of bondholders. This intuition seems consistent with the evidence in Davydenko and Strebulaev (2006).

bargaining power and liquidation costs can potentially be endogenous variables, we cannot make a sensible causality statement about the relationship between default probability and equity returns. More specifically, since higher shareholders' bargaining power can affect the payoff to lenders, it may affect the level and the terms of the firm's debt and, in turn, the probability of default itself. To fully account for such endogeneity, we would need to extend the model to consider the optimal capital structure decision, a worthy objective which is beyond the scope of the current paper. In the spirit of the Merton (1974) model which inspired the construction of the MKMV EDF measure, we instead take the debt level as given and analyze, in a partial equilibrium setting, the strategic effects of debt workout on equity returns.

In Figure 1 we plot the simulated relationship between expected returns and default probability. The horizontal axis reports probability of default quintiles, while the vertical axis reports the annualized average returns on equity in each quintile. To match our empirical results, in the figure we take the horizon t for returns to be one month and the horizon T for the default probability to be one year. Panel A analyzes the effect of the bargaining power coefficient η on the relationship of interest while keeping the liquidation cost at a constant level ($\alpha = 0.5$). Panel B, on the other hand, considers the effect of a changing level of liquidation cost α while assuming equal bargaining power ($\eta = 0.5$) between claimants.

The left graph in Panel A shows the relationship between expected returns and default probability when shareholders have no bargaining power ($\eta = 0$), and default triggers immediate liquidation. In this case the relationship is monotonically increasing and "explodes" when default becomes certain, because shareholders are getting nothing in the event of default. Therefore, a higher probability of default is associated with higher risk to shareholders, and the liquidation cost does not play any role in either the default boundary or the default probability.

Things change dramatically when shareholders have some bargaining power, as the right graph of Panel A demonstrates. The three sets of bars shown here refer to situations when shareholders have (i) low bargaining power ($\eta = 0.2$, darker bars); (ii) the same bargaining power as debt-holders ($\eta = 0.5$, middle bars); and (iii) high bargaining power ($\eta = 0.8$, lighter bars).[21]

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[21]Empirical evidence, e.g., Eberhart, Moore, and Roenfeldt (1990), finds that the amount recovered by shareholders in bankruptcy proceedings is usually less than 25% of the asset value. Since, in the absence of taxes, the

Figure 1: Default probability and expected returns

For each decile of default probability within a year, the graph reports the average annual realized return obtained by simulating the FS model. We draw 50 values each of c, μ, and σ for a total of 125,000 firms. Simulation details are provided in Appendix B. The left figure in Panel A is obtained by assuming no bargaining power for shareholders, while the right figure in the same panel analyzes three different levels of bargaining power while fixing the liquidation cost at the level $\alpha = 0.5$. Panel B reports the case of three different levels of liquidation costs while fixing the bargaining power at $\eta = 0.5$.

Panel A: Effect of bargaining power η
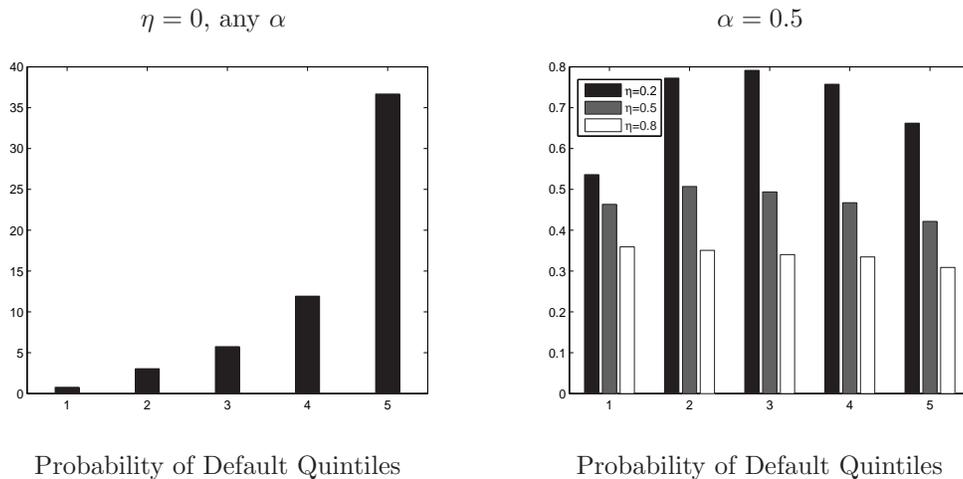
Panel B: Effect of liquidation cost α
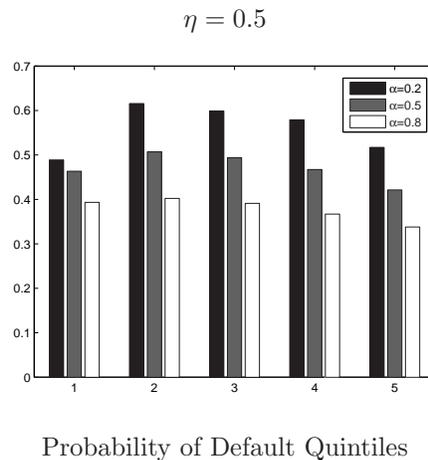
sharing rule $\tilde{\theta}$ in (4) is equal to $\eta\,\alpha$, the choice of parameters η and α in Figure 1 implies that the share of asset received by shareholders in renegotiation for the bulk of our simulated firms is less than 25%.

Two patterns clearly emerge from this figure. First, in the presence of shareholder bargaining power, the relationship between equity return and default probability is hump-shaped, and for sufficiently high bargaining power, the relationship between expected return and default probability becomes downward sloping. This pattern is markedly different from the case of little or no shareholders' bargaining power discussed above. Second, keeping everything else constant, high bargaining power is associated with low expected returns.

The hump shape in the relationship is the result of the trade-off between the leverage effect of the debt and the "de-leverage" effect of shareholder advantage. At low levels of default probability, the likelihood of strategic renegotiation is remote. The leverage effect of debt determines the default risk of equity and leads to a positive relationship between default probability and expected returns. As the firm approaches the (endogenous) default boundary, shareholder advantage plays an increasingly important role. The benefits shareholders can extract in renegotiation with debt-holders reduce the effective leverage of equity. Hence, for firms with strong shareholder advantage, equity risk and expected returns decrease at high levels of default probability. In this case, default probability no longer captures adequately the equity risk associated with default. For sufficiently high shareholder advantage, this risk reduction effect dominates the leverage effect of debt—even at low levels of default probability—leading to a (mostly) downward sloping relationship.

Panel B of Figure 1 demonstrates the relationship between default probability and expected returns as the level of liquidation costs changes while the bargaining power of claimholders is fixed at a common level $\eta = 0.5$. The three sets of bars represent the cases of (i) low liquidation costs ($\alpha = 0.2$, darker bars); (ii) medium liquidation costs ($\alpha = 0.5$, middle bars); and (iii) high liquidation costs ($\alpha = 0.8$, lighter bars). The patterns emerging from this figure are similar to the ones obtained earlier by varying η for a given α, and the hump shape is now pervasive across all levels of liquidation costs. This is not surprising given that, in the solution of the optimal sharing rule (4) for the Nash bargaining game, the liquidation cost coefficient α enters with the same sign as the bargaining power coefficient η, and hence a larger liquidation cost has a similar effect as a larger shareholders' bargaining power.

Our analysis so far suggests the following testable empirical predictions:

Hypothesis 1 *The relationship between default probability and expected returns should be (i) upward-sloping for firms with minimal shareholder advantage or (ii) hump-shaped and downward sloping for firms with substantial shareholder advantage. I.e., firms with weak shareholder advantage should exhibit a significantly different relationship from firms with strong shareholder advantage.*

Hypothesis 2 *For a given default probability, expected returns should be lower for firms in which (i) shareholders have stronger bargaining power and/or (ii) the economic gains from renegotiation, i.e., liquidation costs, are larger.*

Hypothesis 2 is complementary to Hypothesis 1 and the implication of the latter can be used to refine the prediction of the former. In particular, since Hypothesis 1 implies a divergent behavior in the relationship between default probability and returns across firms with different levels of shareholder advantage, it also implies that the return difference between firms with strong and weak shareholder advantage predicted by Hypothesis 2 should be more pronounced at high levels of default probability when shareholders are more likely to effectively exercise their advantage.

The discussion of cash flow-based covenants in Section 3.1.2 allows us to further refine the above hypotheses. Since in the presence of binding cash flow-based covenants default triggers liquidation, the implication for the relationship between default probability and expected returns is qualitatively similar to the case of no shareholders' bargaining power. This suggests that when cash flow-based covenants are binding, a positive relationship between default probability and expected returns is more likely.

4 Empirical analysis

The theoretical argument presented above predicts that for firms in which shareholders are capable of obtaining a large advantage, expected returns are declining or hump-shaped in default

probability, while for firms in which shareholders are disadvantaged, a higher probability of default is associated with a higher probability of liquidation and hence a higher expected return. In this section we examine the consistency of these theoretical predictions in the data.

4.1 Data construction

The model developed in the previous section identifies shareholder advantage as the result of shareholders' bargaining power and liquidation costs. The first step in our empirical analysis is to construct reasonable proxies for these two theoretical concepts.

4.1.1 Shareholders' bargaining power

We use two proxies for shareholders' bargaining power: (i) a firm's asset size and (ii) its ratio of R&D expenditure to assets.

Small firms, because of information asymmetry, usually have a concentrated group of debt-holders, mostly banks, which may have an advantage in monitoring the firm (see, e.g., Diamond (1991) and Sufi (2005)). This concentration of, and close monitoring by, creditors severely weakens shareholders' bargaining power in the event of financial distress. Consistent with this notion, Franks and Torous (1994) and Betker (1995) find that firm size is a persistent determinant of deviation from the absolute priority rule for a sample of workouts and bankruptcies.

In our test, we measure firm size by the market value of assets instead of the market value of equity for two reasons. First, this corresponds closely to the theoretical formulation, as the bargaining is over the remaining assets. Second, this can mitigate the potential bias caused by small equity values of firms close to bankruptcy even though they have a substantial asset base and a diffuse group of debt-holders. The market value of assets is obtained from MKMV and is available on a monthly basis. It is calculated, together with the EDF measure, as a function of the market value of equity, outstanding liability, and historical default data. We have also used the book value of assets from COMPUSTAT as an alternative measure of asset size and obtained qualitatively similar results, which are omitted here for brevity.

The second measure we use to proxy for shareholders' bargaining power is the ratio of R&D expenditure to assets. As it has been documented in the literature, firms with high costs of research and development are particularly vulnerable to liquidity shortage in financial distress (e.g., Opler and Titman (1994)). This implies that these firms are more likely to encounter cash flow problems that can put them in a disadvantaged bargaining position with creditors. As discussed in Section 3.1.1, the presence of cash-flow based covenant precludes debt renegotiation and effectively reduce shareholders' bargaining power to nil. In our test, the variable is calculated as a ratio of a firm's R&D expense (COMPUSTAT item #46) to the book value of assets. To allow time for accounting information to be incorporated into stock prices, we attribute the R&D ratio computed at the end of fiscal year t to the one-year period starting from July of year $t + 1$.

4.1.2 Liquidation costs

We use two proxies for liquidation cost: (i) the concentration of a firm's industry and (ii) the degree of tangibility of its assets.

The existing literature suggests that the specificity of a firm's assets is important in determining a firm's liquidation value in bankruptcy (e.g., Acharya, Sundaram, and John (2005)). If a firm's assets are highly specific, or unique, then they are likely to suffer from "fire-sale" discounts in liquidation auctions (Shleifer and Vishny (1992)). This motivates us to choose the Herfindahl index, which captures the degree of industry concentration, as our first proxy for asset specificity. We use the Herfindahl index on sales, defined as

$$Hfdl_j = \sum_{i=1}^{I_j} s_{i,j}^2, \tag{10}$$

where $s_{i,j}$ represents the sales of firm i as a fraction of the total sales in industry j, and I_j is the number of firms belonging to industry j.[22] To compute the above quantity, at the end of each fiscal year t we first categorize firms according to the two-digit SIC code classification and

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[22]We have also used the Herfindahl index on asset values, which is constructed similarly, and obtained similar results.

obtain their sales data from COMPUSTAT (item #12). The choice of a two-digit SIC code for industry classification is motivated by the necessity to have an appropriate measure of the market for asset liquidation. Under the two-digit SIC code classification, the average number of industries each year in our sample period (1969–2003) is 75, the median number of firms in an industry per year is 82, and three-quarters of the industries have more than 14 firms.[23] We then apply the calculated Herfindahl index to the one-year period starting from July of year $t + 1$.

Our second firm-level proxy for asset specificity is the asset tangibility measure introduced by Berger, Ofek, and Swary (1996), who use proceeds from discontinued operations of a sample of COMPUSTAT firms in the period 1984–1993 to evaluate the expected asset liquidation value. This measure has recently been used by Almeida and Campello (2005) to investigate the effect of financial constraints on corporate investments. Berger, Ofek, and Swary (1996) find that a dollar of book asset value generates, on average, 71.5 cents in exit value for total receivables, 54.7 cents for inventory, and 53.5 cents for capital. We compute the tangibility measure by using these coefficients for the firms in our sample:

$$Tang = 0.715 \times Receivables + 0.547 \times Inventory + 0.535 \times Capital, \tag{11}$$

where *Receivables* is COMPUSTAT item #2, *Inventory* is item #3 and *Capital* is item #8. As in Berger, Ofek, and Swary (1996) we add value of cash holdings (item #1) to the tangibility measure and scale it by the total book asset value. An increase in asset tangibility means a reduction in liquidation cost and hence lower shareholder advantage.

4.2 Results from sub-portfolio analysis

We examine the relationship between returns and default probability (EDF) for subsets of stocks grouped by one of the shareholder advantage characteristics described above. Specifically, in each month we form portfolios by sorting stocks into quintiles according to their exponentially weighted EDF measures over the preceding six-month period and, independently, into

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[23]Both the three- and four-digit SIC code classifications provide excessively "fine" industry classifications, since they can artificially put similar companies into different industries. Under the four-digit SIC code, the median number of firms in an industry is two, while 25% of industries have one firm or less. For the three-digit SIC code classification, the median number of firms in an industry is six, while twenty-five percent of industries have only two firms or less.

terciles according to one of the following characteristics: (i) asset size, (ii) R&D expense ratio, (iii) Herfindahl index of sales, and (iv) asset tangibility, all calculated based on the respective accounting numbers at the end of the prior fiscal year. We then calculate the value-weighted monthly return in the second month after portfolio formation, i.e., we skip a month before accumulating returns, to avoid potential liquidity issues and a possible artificial correlation between the EDF measure and equity return. For each of the sub-portfolios our main quantity of interest will be the time series average of returns. In addition to raw monthly returns, we also calculate the DGTW-adjusted returns to control for the known effects of size, book-to-market ratio, and momentum. The main results from this analysis are reported in Tables 3 and 4. Because the theoretical predictions of the previous sections are obtained from simulated data that are free from any size, book-to-market and momentum effect, we report only DGTW-returns for brevity.[24] The next two sections describe the results from our test of the two Hypotheses developed in Section 3.2.

4.2.1 Stock returns versus default probability

Hypothesis 1 predicts a positive relationship between default probability and expected returns for firms with minimal shareholder advantage ("Low ADV") and a hump-shaped or negative relationship for firms with substantial shareholder advantage ("High ADV"). In order to test this prediction, in Panel A of Table 3, we analyze the "slope" of the relationship between equity returns and EDF—i.e., the difference $\text{ret}^{\text{high EDF}} - \text{ret}^{\text{low EDF}}$ between the returns in the high and low EDF quintiles—for both column "High ADV" and column "Low ADV." The last column ("High−Low") computes the difference between the slope in the high and low ADV cases. Hypothesis 1 predicts that such difference should be negative.

Panel B in Table 3 complements the analysis in Panel A by computing directly the Spearman rank correlation between the DGTW-adjusted returns and EDF.[25] Hypothesis 1 predicts

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[24]The entire set of results is available from the authors upon request.

[25]Because rank correlations based on five data points are not statistically reliable, to perform such a test, we work with EDF deciles, instead of quintiles.

negative correlations in the "High ADV" column and positive correlations in the "Low ADV" column.

Asset Size

The row labelled "Asset size" in Panel A of Table 3 reveals a positive association (0.30% monthly) between DGTW-adjusted returns and EDFs for small firms and a negative relationship for large firms (−0.47%). The divergence in the relationship—i.e., the difference in slopes—is −0.77%, statistically significant at the 5% level. Although these results are broadly consistent with the model predictions, the statistical significance seems lacking, especially for the slope in the relationship between equity return and default probability within each asset-size sub-sample. In an unreported analysis, we repeat the same exercise using deciles of the EDF measure, instead of quintiles, and find improvement in statistical significance. The slope in the high ADV case (large asset size) decreases to −1.02% and the slope in the low ADV case (small asset size) increases to 0.73%, both statistically significant at the 10% level. The difference in the slopes is −1.74%, significant at the 1% level.

From Panel B, we note that the Spearman rank correlation between return and EDF is negative (−0.82) for large firms and positive (0.81) for small firms, both statistically significant at the 1% level. These results provide further support for the conjecture that, *ceteris paribus,* shareholders of larger distressed firms have stronger bargaining power and hence face lower equity risk than shareholders of smaller distressed firms.

R&D expenditures

The second row of Table 3 shows that the difference in returns between high and low EDF firms is negative (−0.42%) for firms with low R&D expense ratio and positive (0.78%) for firms with high R&D expense. The difference in the slopes of the relationship for the high and low R&D expenditure firms is statistically significant at the 1% level, consistent with Hypothesis 1. A further confirmation of this hypothesis comes from the sign of the rank correlations in Panel B.

For firms with low R&D expenditures, such correlation is -0.82 (significant at the 1% level), while it is 0.67 (significant at the 1% level) for firms with high R&D expense ratio.

As we discussed earlier, binding cash flow-based covenants of debt diminish the bargaining power of shareholders. Our proxy for the possibility of cash flow shortfall is the R&D expenditure ratio. Shareholders of firms with high R&D expenditures are hence more likely to have lower bargaining power in debt renegotiation. This effect should be particularly acute for firms with low cash holdings. To specifically test this intuition, we divide the sample into two subsamples: firms with low and high cash holdings. The results are reported as subcases of the "R&D expenditures" category.[26] Specifically, in each month, we sort stocks independently along three dimensions: five EDF quintiles, three R&D terciles, and two cash holdings groups, and measure the average value-weighted returns of these thirty portfolios over time. The table shows that for firms with low cash holdings and high R&D expense ratios, the positive relationship between EDF measures and returns for high R&D firms is strong and statistically significant (1.04%, significant at the 5% level), confirming the intuition that firms with greater R&D expenditures are more vulnerable to liquidity default. On the contrary, in the subsample of firms with high cash holdings, the R&D effect all but disappears.

Industry concentration

The results concerning industry concentration in Panel A of Table 3 show a significant downward sloping relationship between returns and EDF for firms in highly concentrated industries (High ADV), where the liquidation cost due to potential fire sales is high. On the other hand, we cannot reject the hypothesis of no relationship for the case of low industry concentration (Low ADV). Consistent with Hypothesis 1, there is a statistically significant negative difference (-0.57%) between the slope in the relationship for firms with high and low Herfindahl indices. The rank correlations of Panel B provide further support to Hypothesis 1, showing a strong negative relationship between EDF and returns for firms in highly concentrated industries and a lack of association otherwise.

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[26]Cash holdings are defined as cash (COMPUSTAT item #1) divided by book asset (item #6).

Liquidation of a firm's assets depends not only on the presence of potential bidders within an industry for the assets but also on the capacity of the industry, i.e., whether possible buyers within the same industry have the capability of bidding for the assets at the time.[27] In a high-growth industry, the distress a firm experiences is likely to be idiosyncratic, and hence its asset sale should be more affected by the number of potential bidders in the industry. Therefore, the effect of industry concentration should be more pronounced in the subsample with high sales growth. On the other hand, for industries with low, and possibly negative, sales growth, the capacity constraint faced by competitors in the same industry may overshadow the effect of industry concentration.

To address this point, we examine the role of the Herfindahl index in two subsamples, one with low industry sales growth and another with high industry sales growth.[28] Specifically, we sort firms independently in three dimensions: five EDF quintiles, three industry concentration terciles, and two industry sales growth groups, and measure the average returns of the thirty portfolios of stocks over time. Consistent with the intuition above, for industries with high sales growth, the "discriminatory power" of the Herfindahl index is stronger than that in the full sample. In fact, the difference in slopes is -0.95%, compared to -0.57% for the full sample. Moreover, for low-growth industries such difference is insignificant, and the effect of the Herfindahl index essentially disappears.

Asset tangibility

Using the asset tangibility measure defined in (11) as a firm-level proxy for asset specificity, Panel A of Table 3 shows that, for the entire sample, firms with low asset tangibility, and hence high liquidation costs (high ADV), tend to have a downward sloping relationship between stock returns and the EDF measure. On the contrary, firms with high asset tangibility tend to have a positive relationship. Although none of the slopes in these relationships is statistically significant, the difference in these relationships (-0.76%) is statistically significant at the 5%

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[27]We thank Matt Spiegel for this insight.

[28]To compute sales growth, at the end of fiscal year t, we divide the total sales of an industry (COMPUSTAT item #12) by its total sales in the previous fiscal year. As before, we use a two-digit SIC industry classification. We then apply the obtained sales growth to the one-year period starting from July of year $t + 1$.

level. Moreover, the rank correlations in Panel B show a strong negative relationship for firms with low asset tangibility, consistent with the predictions of Hypothesis 1.

For a growing industry, intangible assets, such as brand names and patents, are just as valuable as tangible assets for peer companies in the same industry. For a declining industry, however, the marginal value of tangible assets is much greater than that of the intangibles. Therefore, the asset tangibility measure, which is a gauge of the expected liquidation value of assets, is a particularly useful indicator of liquidation costs for a distressed firm in a troubled industry. To test this intuition, we sort firms independently in three dimensions: five EDF quintiles, three asset tangibility terciles, and two industry sales growth groups, and measure the average returns of the thirty portfolios of stocks over time. The results for firms in low-growth industries, reported as subcases of the "Asset tangibility" class in Panel A, show indeed a stronger role for asset tangibility, as firms with low asset tangibility exhibit a significant downward sloping relationship between stock return and default probability. Moreover, the difference in the slopes between high and low tangibility is larger, in absolute value (-0.86), and more significant than in the full sample (-0.76). On the other hand, for firms in high-growth industries, the difference in slopes is insignificant, and asset tangibility becomes less relevant as a measure of liquidation costs.

4.2.2 Stock returns given default probability

Hypothesis 2 predicts that, for a given default probability, expected returns should be lower for firms with stronger shareholder advantage. To test this prediction, we use a similar methodology as in Table 3. Specifically, for each quintile of EDF we take the difference $\text{ret}^{\text{high ADV}} - \text{ret}^{\text{low ADV}}$ between the returns in the higher and lower terciles of each shareholder advantage (ADV) proxy. Table 4 reports such difference for the lowest EDF quintile ("Low EDF" column) and for the highest EDF quintile ("High EDF" column). Hypothesis 1 and Hypothesis 2 jointly imply that the return difference between high and low ADV firms is likely to be more significantly negative for firms in the high EDF quintiles than for firms in the low EDF quintiles.

The results reported in Table 4 are strongly supportive of these predictions. The return difference between high and low ADV is always negative and statistically significant in the "High EDF" column, while all the entries in the "Low EDF" column are statistically indistinguishable from zero, with the exception of the asset tangibility proxy. In particular, within firms with high EDFs: (i) small firms outperform large firms by a statistically significant amount (0.76% per month); (ii) firms with high R&D expense ratios earn monthly returns 1.32% higher than those with low R&D expense ratios; (iii) firms with low Herfindahl indices earn 0.60% more, per month, than stocks with high Herfindahl indices;[29] and (iv) firms with lower asset tangibility earn a monthly return 1% higher than firms with lower asset tangibility.

Notice also that these results are robust to the further stratification represented by the subsamples of low/high cash holdings (R&D expenditures) and low/high sales growth (industry concentration and asset tangibility) described in the previous section. For the case of R&D expenditures, the predictions of Hypothesis 2 are confirmed in the subsample of low cash holdings and rejected otherwise, consistent with the fact that R&D expenditures act as a better measure of bargaining power when firms are facing liquidity constraints, as argued above. Similarly, for the case of industry concentration, the predictions of Hypothesis 2 are confirmed in the subsample of high sales growth but not in the low sales growth subsample. For the asset tangibility case, we note that both the high and low sales growth subsample maintain statistical significance in the high EDF spectrum. However, both the magnitude and the statistical significance of the return difference between high and low tangibility is reduced in the case of high sales growth, consistent with the argument that asset tangibility is a poorer measure of liquidation costs in a growing industry.

In summary, the evidence emerging from our sub-portfolio analysis is consistent with the predictions of the strategic bargaining model developed in Section 3. Shareholder advantage, in its multiple manifestations as either the bargaining power in debt renegotiation with creditors or the threat of imposing liquidation and bankruptcy costs on debt-holders, plays a crucial role in the link between default probability and stock returns, and its economic effect is significant.

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[29]Our results also are consistent with the findings of Hou and Robinson (2005) that firms in more concentrated industries earn lower returns, after controlling for size, book-to-market ratio and momentum.

4.3 Results from multivariate regression analysis

To further examine the evidence we have presented thus far, we now turn to a regression analysis. While the sub-portfolio analysis presents a non-parametric examination of the cross-sectional difference in the relationship between default probability and stock returns, a regression analysis provides a structural and multivariate view of this cross-sectional difference and further illuminates the role of shareholder advantage. We carry out our analysis using the methodology of Fama and MacBeth (1973): first, in each month, we regress monthly returns on a set of firm characteristics, and then we average the time-series of regression coefficients and calculate corresponding t-statistics, which are adjusted for auto-correlation and heteroscedasticity (Newey and West (1987)).

The explanatory variable associated with default probability is the *rank* of a firm's EDF, normalized between 0 and 1.[30] Similarly, for the characteristics that proxy for shareholder advantage, we use a firm's rank (normalized between 1 and 10) for the Herfindahl index, the tangibility measure, and the R&D expense ratio. The asset value and the book-to-market ratio are represented by their natural logarithmic values. The set of independent variables also contains characteristics, such as beta (obtained from CRSP), book-to-market ratio, and momentum measured by past six-month returns, that are known to affect returns. We do not include the equity market capitalization, because it is highly correlated with the asset size. The main test of our hypotheses rely on examining the interaction terms between the EDF rank with asset size, ranks for the Herfindahl index, tangibility measure, and R&D expense ratio, respectively.

Table 5 presents pairwise Pearson correlation coefficients between these explanatory variables. There is a significantly negative correlation between the asset size and the EDF rank variable. The EDF rank variable is also substantially correlated with the book-to-market ratio and with momentum measured by past six-month returns. The Herfindahl index rank is not

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[30]This variable is constructed by ranking firms in each month according to their EDF score. In case several firms have the same score we assign the median rank to all the firms with the same EDF score. Then all ranks are normalized to be between 0 and 1. We use EDF rank instead of the EDF measure itself to mitigate the problem due to its skewed and time-varying distribution.

substantially correlated with other variables except for the R&D rank variable, while the R&D rank variable is also significantly correlated with the book-to-market ratio. The tangibility rank is negatively correlated with asset size and positively correlated with the R&D rank. Interestingly, the tangibility measure has very little correlation with the Herfindahl index, implying that these two measures capture different facets of asset specificity. These correlations suggest that it is important to examine the respective roles of these proxies in a multivariate regression. We report the results from both univariate and multivariate regressions in Table 6.

Model 1 in Table 6 is the basic benchmark known in the literature—although we replace the equity size with asset size without qualitatively affecting the results—presented to facilitate comparisons with other models in the table as well as with the above portfolio results. The result is consistent with those established in the literature: size enters with a significant and negative coefficient and the book-to-market ratio has a significant and positive coefficient. Model 2 shows that the likelihood of default also matters, but it has a marginally significant negative relation with stock returns, consistent with our empirical evidence presented earlier. The inclusion of default probability does not qualitatively impact the effects of other characteristics except for strengthening the size effect. Models 3 through 6 present evidence on the five individual proxies for shareholder advantage used in the sub-portfolio analysis. The interaction terms in these models are all statistically significant. Combined with the coefficient for the EDF rank variable, these results represent a conditional dependence of stock returns on default probability. For instance, Model 3 implies that for firms with an asset size less than $\exp(0.1026/0.0058) = \$48$ million, their stock returns will generally have a positive relationship with its EDF rank. For firms with a larger asset base, this relation will turn negative. Individually, these results are all consistent with those presented in Tables 3 and 4.

Finally, Model 7 in Table 6 provides a multivariate examination of the individual variables that we have used separately so far. The result shows that these variables capture different aspects of shareholder advantage in financial distress, as each variable maintains its statistical significance in the multivariate context. The only exceptions are the interaction effects of the Herfindahl index and of the asset tangibility measure, which diminish in magnitude while still

retaining statistical significance at the 10% level. In summary, the results from our regression analysis further demonstrate the multifaceted nature of the effect of shareholder advantage on stock returns. Moreover, the results indicate that once shareholder advantage is accounted for, the relationship between stock returns and default probability is positive.

4.4   Robustness tests

To check the robustness of our results, we carry out additional tests along two dimensions. First, we verify that the results we presented above are not sensitive to the holding period over which returns are measured. This is an important concern because many stocks with high default risk are not very liquid, and, therefore, illiquidity may bias returns. Because of this concern, the reported results so far are based on the returns in the second month after the formation of portfolios, i.e., we skip a month before we measure the return. However, we verify that our reported results are qualitatively similar, even if we use the return in the month immediately after portfolio formation. This is also true if we form portfolios every quarter, instead of every month, and measure returns over the following quarter.

The second dimension along which we check the robustness of our results is to examine additional proxies related to the strategic interaction between shareholders and creditors that have been used in the literature. Several variables are related to the ones that we have used. These include book value of assets, as opposed to the (implied) market value of assets, and the ratio of R&D expenditure to total capital expenditure, as opposed to the ratio of R&D expenditure to total assets. All of these variables produce qualitatively similar results with respect to their counterparts discussed earlier. In addition, we also examine book-to-market equity, book-to-market *asset* ratio, and Tobin's Q as alternative measures of liquidation cost and obtain results that are similar to the ones reported in the literature (Griffin and Lemmon (2002)).

5 Conclusion

Using the market-based EDF measure of *Moody's KMV* as an indicator of default probability, we analyze the relationship between default probability and equity returns. Complementing the evidence in existing studies, we find that, in general, expected returns are not positively related to default probability.

We argue, however, that such a result is not necessarily an indication of market failure in properly assessing the risk-return trade-off. We show how these patterns can be consistent with a model in which shareholders of financially distressed firms are capable of extracting benefits from debt renegotiation that can be efficiency enhancing. Specifically, through a simple strategic bargaining model built on Fan and Sundaresan (2000), we show that the opportunity for equity-holders of distressed firms to renegotiate and extract benefits, in violation of the absolute priority rule, is essential for explaining the counter-intuitive empirical regularity without upsetting proper risk-return trade-offs. In general, firms in which shareholders have a higher advantage earn lower returns, after controlling for size, book-to market ratio and momentum. Moreover, these returns are usually decreasing with default probability. On the contrary, firms in which shareholders have little or no bargaining power exhibit higher returns which tend to increase with default probability.

Our empirical investigation, using a variety of proxies for shareholder advantage, has provided consistent support for the cross-sectional implications of our model. Moreover, we have documented that the economic significance of shareholder advantage is substantial.

Our study is among the first to systematically examine the effect of strategic interaction between equity-holders and debt-holders on equity returns and illustrates the importance of considering such features in the analysis of expected returns on equity. Our findings not only help to reconcile some of the puzzling evidence documented in the empirical literature, but also, perhaps more importantly, indicate that to fully understand the dynamics of returns around such exceptional corporate events as defaults and liquidations, it is essential to acknowledge and properly account for the role of shareholder advantage in distressed firms.

Appendix

A Proof of Proposition 1

Let $\mathbb{P}$ be the probability measure governing the dynamics of asset values in (2). Straightforward application of Itô's lemma yields

$$V_t = V_0 e^{\left(\mu - \delta - \frac{1}{2}\sigma^2\right)t + \sigma(B_t - B_0)}, \tag{A1}$$

where B_t is a standard Brownian motion under $\mathbb{P}$. Hence, V_t is log-normally distributed with mean $V_0 e^{(\mu-\delta)t}$ and variance $V_0^2 e^{2(\mu-\delta)t}\left(e^{\sigma^2 t} - 1\right)$. The expected value of $\mathbb{E}_0(\widetilde{E}(V_t))$ is given by

$$\mathbb{E}_0(\widetilde{E}(V_t)) = \int_0^\infty \widetilde{E}(V_t) f(V_t) dV_t, \tag{A2}$$

where $f(V_t)$ is the log-normal density of V_t. From the expression (5) for the value of equity, using a suitable change of variables to deal with integrals involving log-normal distributions, we arrive at the following expression,

$$
\begin{aligned}
\mathbb{E}_0(\widetilde{E}(V_t)) \;=\; & \eta\alpha V_0 e^{(\mu-\delta)t}\mathcal{N}\left(h(t) - \sigma\sqrt{t}\right) - \eta\frac{\lambda_1}{\lambda_2 - \lambda_1}\frac{\tau c}{r}\left(\frac{V_0}{\widetilde{V}_S}\right)^{\lambda_2} e^{\lambda_2(\gamma - \lambda_2)t}\mathcal{N}\left(h(t) - \lambda_2\sigma\sqrt{t}\right) \\[2mm]
& + V_0 e^{(\mu-\delta)t}\mathcal{N}\left(-h(t) + \sigma\sqrt{t}\right) - \frac{c(1-\tau)}{r}\mathcal{N}\left(-h(t)\right) \\[2mm]
& + \left[\frac{c(1-\tau)}{(1-\lambda_1)r} - \frac{\lambda_1(1-\lambda_2)\eta}{(\lambda_2-\lambda_1)(1-\lambda_1)}\frac{\tau c}{r}\right]\left(\frac{V}{\widetilde{V}_S}\right)^{\lambda_1} e^{\lambda_1(\gamma - \lambda_1)t}\mathcal{N}\left(-h(t) + \lambda_1\sigma\sqrt{t}\right),
\end{aligned} \tag{A3}
$$

with $\gamma = \mu - \delta - \frac{1}{2}\sigma^2$, $h(t) = \frac{\log\left(\widetilde{V}_S/V_0\right) - \gamma t}{\sigma\sqrt{t}}$ and $\mathcal{N}(\cdot)$ the cumulative standard normal function.

The cumulative default probability over $(0,T]$ is defined as follows:

$$\Pr_{(0,T]} = 1 - \Pr\left\{\inf_{0 < t \leq T} V_t \geq \widetilde{V}_S \,\Big|\, V_0 > \widetilde{V}_S\right\}. \tag{A4}$$

Let $X_t = \log(V_t)$. By (A1), X_t follows the following arithmetic Brownian motion

$$dX_t = \gamma dt + \sigma dB_t, \quad X_0 = \log(V_0), \tag{A5}$$

where $\gamma = \mu - \delta - \frac{1}{2}\sigma^2$. The probability in (A4) is equivalent to the following:

$$\Pr_{(0,T]} = 1 - \Pr\left\{ \inf_{0<t\leq T} X_t \geq \log(\widetilde{V}_S) \,\Big|\, X_0 > \log(\widetilde{V}_S) \right\}. \tag{A6}$$

Let $y = \log(\widetilde{V}_S)$. After some simple manipulation we can write

$$\Pr_{(0,T]} = 1 - \Pr\left\{ \sup_{0<t\leq T} -(X_t - X_0) \leq X_0 - y \mid X_0 > y \right\}. \tag{A7}$$

This probability can be computed from the hitting time distribution of the Brownian motion (Harrison, 1985, equation (11), p. 14) and is equal to

$$\Pr_{(0,T]} = \mathcal{N}\left(\frac{y - X_0 - \gamma T}{\sigma\sqrt{T}} \right) + e^{\frac{2\gamma(y - X_0)}{\sigma^2}} \mathcal{N}\left(\frac{y - X_0 + \gamma T}{\sigma\sqrt{T}} \right). \tag{A8}$$

Replacing $y = \log(\widetilde{V}_S)$ and $X_0 = \log(V_0)$, we arrive at equation (9). ∎

B   Simulations details

Below we provide a detailed description of our choice of parameters.

1. *Return and EDF horizon.* We choose the return horizon to be one month and the default probability horizon to be one year to match the design of our empirical study.

2. *Risk-free rate.* In the model, the risk-free rate, r, refers to the instantaneous short rate. We select r to be 4% per annum, to roughly match the typical value of the short rate. We have verified that the results are not qualitatively sensitive to the choice of this parameter.

3. *Corporate tax rate.* The corporate tax rate, τ, is set to 35%, which is the highest of the four basic federal tax rates on income for "C corporations," according to the IRS. We have also verified that the results are not qualitatively sensitive to the choice of this parameter.

4. *Payout rate.* The payout rate, δ, is set to 4% per annum, consistent with the historical average of dividend yield (1927–2001). We have verified that the simulation results are qualitatively similar under different specifications of this parameter.

5. *Coupon rate.* To mimic the cross section of possible coupon rates, c, we run simulations by drawing c from a uniform distribution with support $[0.05, 0.10]$. The support is chosen to capture the spectrum of possible coupon rates ranging from AAA-rated bonds to high-yield bonds.

6. *Asset volatility.* We use *Moody's KMV* estimates of asset volatility, σ, to obtain the empirical distribution and draw σ from this distribution.

7. *Asset growth rate and initial asset value.* The selection of the asset growth rate, μ, has to satisfy the condition $\mu > \delta + \frac{1}{2}\sigma^2$, in order to guarantee that the long run probability of default is between zero and one (see equation (9)).[31] Given this restriction and the notorious difficulty in estimating expected returns, μ is chosen in conjunction with the

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[31]Note that, in our model, equity risk is still measured by "beta"—where beta represents a measure of exposure to any priced risk in the state variable V. Because the risk premium is exogenous to our model, there is a one-to-one mapping between expected returns and beta. A choice of μ is equivalent to selecting a β from the underlying distribution.

initial value of the asset V_0 in order to match the magnitude of empirically observed default probabilities. In our simulation, we draw μ from a symmetric "tent-like" distribution centered around $2\left(\delta + \frac{1}{2}\sigma^2\right)$ and with support $\left[\delta + \frac{1}{2}\sigma^2, 3\left(\delta + \frac{1}{2}\sigma^2\right)\right]$. To guarantee that we do not draw firms that are already in default, the initial asset value V_0 is chosen in each simulation from a uniform distribution with support $[V_S, V_S + 1.25]$, where V_S is the endogenous default threshold defined in equation (6). The value 1.25 is chosen to obtain model-generated default probabilities that closely match the empirically observed EDF measures.

In our simulations, we draw 50 values each of σ, μ, and c from the above mentioned distributions, for a total of 125,000 firms. We consider four values of η: $\{0, 0.2, 0.5, 0.8\}$, and three values of α: $\{0.2, 0.5, 0.8\}$. The median EDF measure observed in our data is 1.19% (see Table 1). Our choice of asset growth rate μ and initial asset value V_0 described in point 7 above, together with the other parameter choices, produces model-generated EDFs whose median across the full sample of simulated firms is equal to 1.13%, close to the observed median of 1.19%.

Table 1: Summary statistics of the EDF measure

Our sample period spans from January 1969 to December 2003. At the beginning of every three-year interval (starting from January 1970), the table reports the number of firms in our sample, the mean, standard deviation, median, and first and third quartile of the EDF distribution. EDF quantities are expressed in percent units.

Month	# Firm	Mean	Std.	Median	Quart 1	Quart 3
Jan-70	1,455	1.19	1.76	0.56	0.17	1.50
Jan-73	1,894	2.00	3.20	0.83	0.23	2.25
Jan-76	2,945	3.87	4.77	2.06	0.88	4.58
Jan-79	3,149	2.57	4.21	0.97	0.31	2.56
Jan-82	3,116	3.19	4.60	1.42	0.59	3.40
Jan-85	3,566	3.21	5.17	0.98	0.34	3.18
Jan-88	3,745	4.25	5.83	1.68	0.48	5.02
Jan-91	3,627	5.48	7.11	1.80	0.37	8.08
Jan-94	3,916	2.73	4.56	0.85	0.22	2.82
Jan-97	4,541	2.72	4.61	0.78	0.18	2.82
Jan-00	4,246	3.68	5.11	1.53	0.52	4.26
Jan-03	3,572	5.23	6.52	2.03	0.59	7.39
Full Sample	1,430,713	3.44	5.22	1.19	0.35	3.75

Table 2: Equity returns and default probability

At the end of each month t from June 1969 to October 2003, we sort stocks into quintiles based on their weighted EDF measures (1). We then record the returns of these portfolios in the month $t+2$, i.e., two months after the portfolio formation. In the table we report the time series averages of returns of these portfolios. Both equally-weighted and value-weighted quantities are reported. The "High−Low" column is the difference between a quantity of the high EDF quintile and that of the low EDF quintile, and the t-value is the t-statistic of this difference. EW−VW represents the difference in the slopes between equally- and value-weighted returns. In each panel we report results with both raw returns and with returns adjusted with the methodology suggested by Daniel, Grinblatt, Titman, and Wermers (1997) (DGTW-adjusted returns). The sample period of DGTW-adjusted results spans from June 1975 to June 2003 due to the availability of the DGTW benchmark portfolio returns. * indicates statistical significance at the 10% level, ** at the 5% level, and *** at the 1% level.

| | Low | | EDF | | High | | |
	1	2	3	4	5	High−Low	t-value
Panel A: Full sample							
Raw returns							
EW	1.14	1.23	1.26	1.25	1.65	0.51	1.50
VW	0.96	1.11	1.08	0.95	0.82	−0.14	−0.38
EW−VW						0.65***	3.66
DGTW returns							
EW	0.03	0.08	0.08	0.09	0.74	0.72***	2.95
VW	−0.01	0.07	−0.02	−0.18	−0.23	−0.22	−0.84
EW−VW						0.94***	5.79
Panel B: Stocks with price ≥ \$2							
Raw returns							
EW	1.14	1.22	1.23	1.19	1.05	−0.09	−0.38
VW	0.97	1.05	1.11	0.95	0.82	−0.15	−0.48
EW−VW						0.05	0.35
DGTW returns							
EW	0.04	0.06	0.04	0.03	−0.11	−0.15	−1.07
VW	0.01	0.03	−0.02	−0.12	−0.33	−0.34*	−1.72
EW−VW						0.19	1.52

Table 3: Stock Returns versus EDF

At the beginning of each month t we form 15 portfolios of firms based on EDF quintiles and, independently, on terciles of the chosen proxy for shareholder advantage (ADV)—Asset size, R&D expenditures, Industry concentration, and Asset tangibility. In month $t + 2$ we record the value-weighted raw and DGTW-adjusted return on each of these 15 portfolios and compute the time series mean over the entire sample (1975–2003). In Panel A we report the difference between DGTW-adjusted monthly returns in the high and low EDF quintiles, $\mathrm{ret}^{\mathrm{high\ EDF}} - \mathrm{ret}^{\mathrm{low\ EDF}}$. Column "High ADV" displays the differences for portfolios of firms in the top tercile of the shareholder advantage measure, while column "Low ADV" reports the differences for portfolios in the bottom tercile of the measure. Panel B reports Spearman rank correlations between returns and EDF deciles. * indicates statistical significance at the 10% level, ** at the 5% level, and *** at the 1% level.

	High ADV	Low ADV	High−Low
Panel A: $\mathrm{ret}^{\mathrm{high\ EDF}} - \mathrm{ret}^{\mathrm{low\ EDF}}$			
Bargaining power			
- Asset Size	-0.47	0.30	-0.77^{**}
- R&D expenditures	-0.42	0.78^{*}	-1.19^{***}
Low cash holdings	-0.51	1.04^{**}	-1.55^{***}
High cash holdings	-0.08	0.52	0.60
Liquidation costs			
- Industry concentration	-0.59^{**}	-0.02	-0.57^{*}
High sales growth	-0.72	0.23^{**}	-0.95^{**}
Low sales growth	-0.34	-0.28	-0.06
- Asset tangibility	-0.46	0.30	-0.76^{**}
Low sales growth	-0.48^{*}	0.40	-0.86^{***}
High sales growth	-0.42	0.05	-0.47
Panel B: Rank Correlations			
Bargaining power			
- Asset Size	-0.82^{***}	0.81^{***}	
- R&D expenditures	-0.85^{***}	0.67^{**}	
Liquidation costs			
- Industry concentration	-0.81^{***}	0.08	
- Asset tangibility	-0.83^{***}	0.22	

Table 4: Stock Returns given EDF

At the beginning of each month t we form 15 portfolios of firms based on EDF quintiles and, independently, on terciles of the chosen proxy for shareholder advantage (ADV)—Asset size, R&D expenditures, Industry concentration, and Asset tangibility. In month $t+2$ we record the value-weighted raw and DGTW-adjusted return on each of these 15 portfolios and compute the time series mean over the entire sample (1975–2003). In Panel A we report the difference between DGTW-adjusted returns in the highest and lowest ADV tercile, $\text{ret}^{\text{high ADV}} - \text{ret}^{\text{low ADV}}$. Column "High EDF" displays the differences for portfolios of firms in the top EDF quintile, while column "Low EDF" reports the differences for portfolios in the bottom EDF quintile. * indicates statistical significance at the 10% level, ** at the 5% level, and *** at the 1% level.

	$\text{ret}^{\text{high ADV}} - \text{ret}^{\text{low ADV}}$	
	Low EDF	High EDF
Bargaining power		
- Asset Size	0.01	-0.76^{**}
- R&D expenditures	-0.13	-1.32^{***}
Low cash holdings	-0.01	-1.57^{***}
High cash holdings	-0.29	-0.89
Liquidation costs		
- Industry concentration	-0.03	-0.60^{*}
High sales growth	-0.07	-1.02^{***}
Low sales growth	-0.05	-0.11
- Asset tangibility	-0.24^{*}	-1.00^{***}
Low sales growth	-0.12	-0.98^{***}
High sales growth	-0.25	-0.71^{**}

Table 5: Correlations among independent variables used in regressions

In this table, we report the time-series average of the cross-sectional correlation coefficients between independent variables used in the regression analysis. *Beta* is calculated at the end of the previous year and obtained from CRSP; *Ln(AVL)* is the natural log of a firm's implied market value of assets at the end of month t, provided by *Moody's KMV*; *Ln(BM)* is the natural log of a firm's book-to-market ratio; *Ret* $(-6, -1)$ is the six-month average monthly returns from month $t-5$ to month t; *EDF* is a normalized EDF rank variable between 0 and 1 obtained in month t; *R&D* is the rank of R&D expense ratio of a firm measured at the previous fiscal year end ranging from 1 to 10; *Hfdl* is the rank of Herfindahl index 10 of a firm measured at the previous fiscal year end ranging from 1 to 10, and *Tang* is the rank of the asset tangibility measure (11) of a firm measured at the previous fiscal year end ranging from 1 to 10.

	Beta	Ln(AVL)	Ln(BM)	Ret$(-6,-1)$	EDF	R&D	Hfdl	Tang
Beta	1.0000							
Ln(AVL)	0.2014	1.0000						
Ln(BM)	−0.2271	−0.1095	1.0000					
Ret$(-6,-1)$	−0.0455	0.0634	0.0678	1.0000				
EDF	−0.0735	−0.4661	0.2111	−0.1126	1.0000			
R&D	0.1937	−0.0716	−0.3024	0.0274	−0.0619	1.0000		
Hfdl	−0.0874	0.1043	−0.0149	0.0024	−0.0322	−0.2278	1.0000	
Tang	0.0678	−0.2405	−0.1708	0.0191	−0.0827	0.2795	−0.0824	1.0000

Table 6: EDF and stock returns: Regression analysis

This table presents the results from the Fama-MacBeth regression analysis of the cross-sectional variation of the relationship between EDF measures and stock returns. For each model, we first run a cross-sectional regression every month from June 1969 to October 2003. Next, we calculate and report the time series averages and Newey-West adjusted t-statistics of regression coefficients. We also report the time-series average of the adjusted R^2 for each model. For cross-sectional regressions, the dependent variables are monthly returns measured in month $t+2$, and the independent variables are as follows: $Beta$, calculated at the end of the previous year and obtained from CRSP; $Ln(AVL)$, the natural log of a firm's implied market value of assets at the end of month t, provided by $Moody's KMV$; $Ln(BM)$, the natural log of a firm's book-to-market ratio; Ret $(-6, -1)$, the six-month average monthly returns from month $t-5$ to month t; EDF, a normalized EDF rank variable between 0 and 1 obtained in month t; $R\&D$, the rank of R&D expense ratio of a firm measured at the previous fiscal year end ranging from 1 to 10; $Hfdl$, the rank of Herfindahl index of a firm measured at the previous fiscal year end ranging from 1 to 10; $Tang$, the rank of asset tangibility index measured at the previous fiscal year end ranging from 1 to 10; and the interaction terms of $Ln(AVL)$, $R\&D$, $Hfdl$, and $Tang$ with EDF, respectively. $*$ indicates statistical significance at the 10% level, $**$ at the 5% level, and $***$ at the 1% level.

Models	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Beta	−0.0009	−0.0007	0.0001	−0.0024*	−0.0007	−0.0011	−0.0018
t-stat	−0.58	−0.55	0.08	−1.86	−0.50	−0.88	−1.44
Ln(AVL)	−0.0014**	−0.0019***	0.0005	−0.0012***	−0.0017***	−0.0017***	0.0012**
t-stat	−2.32	−4.36	1.25	−3.02	−4.18	4.28	2.75
Ln(BM)	0.0041***	0.0045***	0.0047***	0.0053***	0.0044***	0.0045***	0.0057***
t-stat	5.41	5.68	5.94	7.42	5.37	5.98	7.86
Ret(−6,−1)	0.0207*	0.0179	0.0208*	0.0194*	0.0175	0.0166	0.0195*
t-stat	1.67	1.59	1.86	1.75	1.54	1.50	1.77
EDF		−0.0051	0.1026***	−0.0107***	0.0040	−0.0154***	0.0926***
t-stat		−1.60	5.62	−3.12	0.97	−3.98	4.55
R&D				0.0001			0.0002
t-stat				0.32			0.55
Hfdl					0.0007***		0.0005**
t-stat					4.74		2.65
Tang						−0.0006***	0.0002
t-stat						−2.98	1.01
Ln(AVL)×EDF			−0.0058***				−0.0054***
t-stat			−6.14				−5.36
R&D×EDF				0.0019***			0.0017***
t-stat				4.44			3.72
Hfdl×EDF					−0.0016***		−0.0008*
t-stat					−5.28		−1.89
Tang×EDF						0.0021***	0.0006*
t-stat						6.41	1.87
Average Adj. R^2	0.0388	0.0430	0.0461	0.0548	0.0492	0.0471	0.0559

References

Acharya, V., J. Huang, M. G. Subrahmanyam, and R. K. Sundaram, 2004, "When Does Strategic Debt Service Matter?," *Economic Theory*, forthcoming.

Acharya, V., R. K. Sundaram, and K. John, 2005, "Cross-Country Variations in Capital-Structures: The Role of Bankruptcy Codes," Working Paper, London Business School and Stern School of Business, New York University.

Almeida, H., and M. Campello, 2005, "Financial Constraints, Asset Tangibility and Corporate Investment," *Review of Financial Studies*, forthcoming.

Altman, E. I., 1968, "Financial Ratios, Discriminant Analysis and the Prediction of Corporate Bankruptcy," *Journal of Finance*, 23, 589–609.

Anderson, R. W., and S. M. Sundaresan, 1996, "Design and Valuation of Debt Contracts," *Review of Financial Studies*, 9, 37–68.

Avramov, D., T. Chordia, G. Jostova, and A. Philipov, 2005, "Momentum and Credit Rating," Working Paper, University of Maryland.

Berger, P., E. Ofek, and I. Swary, 1996, "Investor Valuation and Abandonment Option," *Journal of Financial Economics*, 42, 257–287.

Betker, B., 1995, "Management's Incentive, Equity Bargaining Power and Deviation from Absolute Priority," *Journal of Business*, 68, 161–184.

Black, F., and M. Scholes, 1973, "The Pricing of Options and Corporate Liabilities," *Journal of Political Economy*, 81, 637–659.

Broadie, M., M. Chernov, and S. M. Sundaresan, 2004, "Optimal Corporate Securities Values in the Presence of Chapter 7 and Chapter 11," Working Paper, Columbia Business School.

Campbell, J. Y., J. Hilscher, and J. Szilagyi, 2005, "In Search of Distress Risk," Working Paper, Harvard University.

Chan, K., and N. Chen, 1991, "Structural and Return Characteristics of Small and Large Firms," *Journal of Finance*, 46, 1467–1484.

Chan, K., N. Chen, and D. Hsieh, 1985, "An Exploratory Investigation of the Firm Size Effect," *Journal of Financial Economics*, 14, 451–471.

Chava, S., and R. Jarrow, 2002, "Bankruptcy Prediction with Industry Effects," Working Paper, Cornell University.

Chen, N., R. Roll, and S. A. Ross, 1986, "Economic Forces and the Stock Market," *Journal of Business*, 59, 383–403.

Crosbie, P. J., and J. R. Bohn, 2003, "Modeling Default Risk," *Moody's KMV*, Available at http://www.defaultrisk.com/pp_model_35.htm.

Da, Z., and P. Gao, 2005, "Default Risk and Equity Return: Macro Effect or Micro Noise?," Working Paper, Kellogg School of Management, Northwestern University.

Daniel, K., M. Grinblatt, S. Titman, and R. Wermers, 1997, "Measuring Mutual Fund Performance with Characteristic-Based Benchmarks," *Journal of Finance*, 52, 1035–1058.

Davydenko, S. A., and I. A. Strebulaev, 2006, "Strategic Actions and Credit Spreads: An Empirical Investigation," *Journal of Finance*, forthcoming.

Diamond, D., 1991, "Monitoring and Reputation: The Choice Between Bank Loans and Privately Placed Debt," *Journal of Political Economy*, 99, 689–721.

Dichev, I. D., 1998, "Is the Risk of Bankruptcy a Systematic Risk?," *Journal of Finance*, 53, 1131–1147.

Dixit, A. K., and R. S. Pindyck, 1994, *Investment Under Uncertainty*, Princeton University Press, Princeton, N.J.

Duffie, D., and K. J. Singleton, 2003, *Credit Risk*, Princeton University Press.

Eberhart, A. W., W. Moore, and R. Roenfeldt, 1990, "Security Pricing and Deviation from Absolute Priority Rule in Bankruptcy Proceedings," *Journal of Finance*, 45, 1457–1469.

Fama, E. F., and K. R. French, 1992, "The Cross-Section of Expected Stock Returns," *Journal of Finance*, 47, 427–465.

Fama, E. F., and K. R. French, 1996, "Multifactor Explanations of Asset Pricing Anomalies," *Journal of Finance*, 51, 55–84.

Fama, E. F., and J. MacBeth, 1973, "Risk, Return and Equilibrium: Empirical Tests," *Journal of Political Economy*, 71, 606–636.

Fan, H., and S. M. Sundaresan, 2000, "Debt Valuation, Renegotiation, and Optimal Dividend Policy," *Review of Financial Studies*, 13, 1057–1099.

François, P., and E. Morellec, 2004, "Capital Structure and Asset Prices: Some Effects of Bankrupcty Procedures," *Journal of Business*, 77, 387–411.

Franks, J. R., and W. N. Torous, 1989, "An Empirical Investigation of U.S. Firms in Renegotiation," *Journal of Finance*, 44, 747–779.

Franks, J. R., and W. N. Torous, 1994, "A Comparison of Financial Reconstructuring in Distressed Exchanges and Chapter 11 Reorganizations," *Journal of Financial Economics*, 35, 349–370.

Galai, D., A. Raviv, and Z. Wiener, 2003, "Liquidation Triggers and the Valuation of Equity and Debt," Finance 0305002, Economics Working Paper Archive, Washington University at St. Louis.

Griffin, J. M., and M. L. Lemmon, 2002, "Book-to-Market Equity, Distress Risk and Stock Returns," *Journal of Finance*, 57, 2317–2336.

Harrison, M. J., 1985, *Brownian Motion and Stochastic Flow Systems*, John Wiley and Sons, New York, N.Y.

Hillegeist, S. A., E. K. Keating, D. P. Cram, and K. G. Lundstedt, 2004, "Assessing the Probability of Bankruptcy," *Review of Accounting Studies*, 9, 5–34.

Hou, K., and D. T. Robinson, 2005, "Industry Concentration and Average Stock Returns," *Journal of Finance*, forthcoming.

Kealhofer, S., 2003a, "Quantifying Credit Risk I: Default Prediction," *Financial Analysts Journal*, January/February, 30–44.

Kealhofer, S., 2003b, "Quantifying Credit Risk II: Debt Valuation," *Financial Analysts Journal*, May/June, 78–92.

Mella-Barral, P., and W. Perraudin, 1997, "Strategic Debt Service," *Journal of Finance*, 52, 531–556.

Merton, R. C., 1974, "On the Pricing of Corporate Debt: The Risk Structure of Interest Rates," *Journal of Finance*, 29, 449–470.

Newey, W. K., and K. D. West, 1987, "A Simple, Positive Semi-Definite Heteroskedasticity and Autocorrelation Consistent Covariance Matrix," *Econometrica*, 55, 703–708.

Ohlson, J., 1980, "Financial Ratios and the Probabilistic Prediction of Bankruptcy," *Journal of Accounting Research*, 18, 109–131.

Opler, T., and S. Titman, 1994, "Financial Distress and Corporate Performance," *Journal of Finance*, 49, 1015–1040.

Paseka, A., 2003, "Debt Valuation with Endogenous Default and Chapter 11 Reorganization," Working Paper, University of Arizona.

Shleifer, A., and R. W. Vishny, 1992, "Liquidation Values and Debt Capacity: A Market Equilibrium Approach," *Journal of Finance*, 47, 1343–1366.

Shumway, T., 1997, "The Delisting Bias in CRSP Data," *Journal of Finance*, 52, 327–340.

Shumway, T., 2001, "Forecasting Bankruptcy More Accurately: A Simple Hazard Model," *Journal of Business*, 74, 101–124.

Sufi, A., 2005, "Information Asymmetry and Financing Arrangements: Evidence from Syndicated Loans," Working Paper, Massachusetts Institute of Technology.

Vassalou, M., and Y. Xing, 2004, "Default Risk in Equity Returns," *Journal of Finance*, 59, 831–868.

Von Kalckreuth, U., 2005, "A 'Wreckers Theory' of Financial Distress," Deutsche Bundesbnk Discussion Paper Series 1: Economic Studies, No. 40.

Weiss, L. A., 1991, "The Bankruptcy Code and Violations of Absolute Priority," *Journal of Applied Corporate Finance*, 4, 71–78.

Wermers, R., 2004, "Is Money Really 'Smart'? New Evidence on the Relation Between Mutual Fund Flows, Manager Behavior, and Performance Persistence," Working Paper, University of Maryland.