A Market-Based Study of the Costs of Default*

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Abstract

Although the cost of financial distress is a central issue in capital structure and credit risk studies, reliable empirical estimates of its size are difficult to come by. This paper proposes a novel method of estimating the total costs of default from market values of defaulting firms. It is based on the idea that the jump in the combined market value of debt and equity upon the announcement of default reflects the total cost of default as well as the degree to which it is a surprise for investors. Using a large sample of firms with observed market prices of bonds, bank debt, and equity at default, in the base case we estimate the cost of default at 20.4% of the market value of assets. The costs vary from 12.8% for bond renegotiations to 28.8% for bankruptcies, and are substantially higher for investment-grade firms (28.1%) than for highly-levered firms (19.3%), which previous research focuses on.

Keywords: Default; Bankruptcy; Renegotiation; Costs of financial distress

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I. Introduction

The cost of financial distress is among the most important factors thought to affect corporate financing decisions. As such, it is a crucial parameter both in studies of capital structure and in models of corporate securities pricing. Nonetheless, there is a long-standing disagreement regarding the size of the costs associated with financial distress and default, particularly because indirect costs are notoriously difficult to estimate empirically. Remarkably, nearly all extant studies that use quantitative estimates of the cost of financial distress rely on just one systematic study, that of Andrade and Kaplan (1998), henceforth referred to as AK. AK's estimates are based on a sample of 30 highly-leveraged transactions (HLT) that became distressed between 1987 and 1992. Our paper proposes a novel alternative method of estimating the total costs of default for a much larger sample that is not limited to HLTs and covers a longer and more recent time period. In the base case, our unconditional estimate of total cost of default is 20.4% of the market value of assets. The costs vary from 28.8% for bankruptcies to 12.8% for bond renegotiations, and are substantially higher for firms originally rated investment grade (28.1%) than for highly-levered firms that AK focus on exclusively (19.3%).

The costs of financial distress include both direct and indirect components. While direct costs such as lawyers' fees are straightforward to estimate, they do not exceed a few percent of the firm value. Indirect costs of financial distress are both much more difficult to measure and also potentially much larger than direct costs.[1] Because financial distress (the inability to meet promised financial obligations) typically occurs simultaneously with economic distress (deteriorating economic fundamentals), the effect of "pure" financial distress on the firm value is difficult to identify empirically.

Andrade and Kaplan (1998) conclude that the total cost of financial distress for HLTs is likely to be in the 10% to 20% range.[2] AK's numerical estimates have been used in studies of capital structure (Graham (2000); Molina (2005); Almeida and Philippon (2007); Elkamhi, Ericsson, and Parsons (2010)), implementations of structural bond-pricing models (Eom, Helwege, and Huang (2004); Huang and Huang (2003)), calibrations of dynamic models of the levered firm (Miao (2005)), studies of the effect of macroeconomic variables on asset prices and capital structure (Bhamra, Kuehn, and Strebulaev (2010a, 2010b)), and other settings. Yet,

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[1] Estimates of direct bankruptcy costs range from 3.1% (Weiss (1990)) to 5.3% (Warner (1977)) to 6% (Altman (1984)) of the firm value prior to bankruptcy. Bris et al. (2006) find that bankruptcy costs are highly heterogeneous and sensitive to the measurement method used. Indirect costs of distress may arise, for example, due to managerial distraction, distortions in the customer-supplier relationship (Titman (1984)), losses from asset fire sales (Shleifer and Vishny (1992)), and agency costs of debt that are exacerbated in distress, including asset substitution (Jensen and Meckling (1976)) and debt overhang (Myers (1977)).

[2] Other empirical studies look at various components of distress costs, such as price discounts in asset fire sales (Pulvino (1998)), risk shifting behavior (Eisdorfer (2008)), the loss of market share in industry downturns (Opler and Titman (1994)), and the debt overhang problem (Franks and Sanzhar (2006)), but do not assess how they interact with each other.

as Andrade and Kaplan point out, the firms in their sample may have chosen to become highly levered because their distress costs were *unusually low.* As a result, for a typical firm AK's estimates may be biased downward, and applying them to non-HLTs may be problematic.[3]

The primary goal of this paper is to provide new estimates of total costs associated with default and bankruptcy for a sample of defaulted firms not limited to HLTs. We overcome the measurement problem by combining new data on market values of debt and equity for defaulted firms with a novel estimation approach that extends the event study methodology to events such as default announcements, which may be partially anticipated by investors long before they occur.

At the heart of the estimation approach lies the idea that investors anticipate default only partially, so that the announcement of default contains an element of surprise (Duffie and Lando (2001)). As a result, upon the announcement, the total market value of the firm's debt and equity jumps, and the size of the jump reflects both the cost of default and the degree to which it is unanticipated. If the market values of the firm's debt and equity just prior to and immediately after default are known, the cost of default can be uncovered by adjusting the change in the value of the firm (the firm-level price reaction to default) for the effect that investors' partial anticipation of the default announcement has on pre-default asset prices.

To understand better the intuition behind our approach, consider a firm for which all financial claims (such as debt and equity) are traded. The market value of the firm (i.e., the total value of its financial claims) equals the continuation value of its assets less the present value of expected default costs. Loosely speaking, $E + D = V - c \times q$, where V is the market value that the firm's assets would have if default were impossible, E and D are market values of debt and equity, c is the present value of the cost of default, and q is investors' estimate of the risk-adjusted default probability. As long default is not a certainty ($q < 1$), the market value of the firm's debt and equity incorporates default costs only partially up until the default announcement. At the moment of default, as the uncertainty is removed, the market value of the securities jumps to their "recovery" value $V - c$, which differs from the continuation value of assets by the full cost of default. The firm-level "price reaction" upon default equals $c \times (1 - q)$ and reflects the size of the cost of default, c, and the extent to which default is a surprise for investors.

The difficulty in estimating the total cost of default (the sum of both the anticipated and unexpected components) is that the continuation asset value is unobservable prior to default. Ceteris paribus, the less distressed the firm is, the less investors anticipate default, and the larger the firm-level price reaction upon

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[3] Because of the potential bias in AK's estimates, Leland (2004, 2007) adjusts them upward in an ad hoc manner, and uses 30% as an estimate of financial distress costs in his calibrations of structural credit risk models, instead of AK's indicated range of 10%–20%. His value is in fact close to our estimate of 28.1% for investment-grade firms.

default is for a given cost of default.[4] Therefore, by observing the market value of assets prior to default and by estimating investors' conditional default probability we can measure the anticipated component and, by extension, the total cost of default.

We apply this approach on a sample of 144 defaulted firms for which market prices of bonds, bank loans, and equity are observed both just prior to and shortly after default. In the base case, we find the mean (median) net cost of default at 20.4% (19.3%) of the market value of assets at default, ranging from –20% to 64% between the first and the last deciles. We also find that the costs of a distressed bond exchange amount to 12.8% of the market value of assets at default, whereas for bankruptcy filings they are as high as 28.8%. While these estimates are an order of magnitude larger than direct costs of bankruptcy, they are consistent with the observed average drop of 17.1% in the value of the firm at bankruptcy, coupled with investors' ability to anticipate default to a significant degree, which implies that the observed price reaction is substantially smaller than the total cost of bankruptcy. For highly levered (original-issue junk) firms default costs average 19.3%, which is similar to AK's estimates based on a sample of 30 HLTs. However, the costs are substantially higher (28.1%) for fallen angels (firms originally rated investment grade), which are likely to be more representative for studies of optimal capital structure. Although default costs are positive on average, in 28% of all defaults and in 19% of bankruptcy filings the market value of the firm increases, implying negative default costs. For these firms, the absence of default likely involves value-destroying activities, whereas default may precipitate a value-increasing shake-up. Finally, we find that ex ante, expected costs of default incorporated in observed firm values are around 1.1% for non-distressed firms, similar to estimates obtained by Elkamhi et al. (2010) based on AK's averages.

Few other studies attempt to estimate total firm-specific costs of financial distress. Cutler and Summers (1988) provide a case study of the Texaco/Pennzoil litigation, and find wealth destruction, which they attribute to costs of financial distress, of about $2.2 Billion, or 13% of the value of Texaco. In a recent paper based on time series of market prices of debt and equity, Korteweg (2010) estimates expected distress costs for highly levered firms between 15% and 30%. His estimates reflect both total ex post costs as well as the probability of distress, which is not identified separately. Elkamhi et al. (2010) find that, assuming total costs of financial distress of around 16% as in Andrade and Kaplan (1998), ex ante costs for nondistressed firms are in the order of 1% of the firm value, which is similar to our (firm-specific) estimates. Using structural estimation, Hennessy and Whited (2007) find implied bankruptcy costs between 8.4% and 15.1%. Assuming

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[4] For example, General Motors was virtually certain to file for bankruptcy on June 1, 2009, and when it did file on that day, its equity and debt prices barely moved. By contrast, if default is completely unanticipated, default costs can be measured using the traditional event study methodology (e.g., see Cutler and Summers (1988) for a case study of the Texaco-Pennzoil litigation).

that firms choose their capital structure according to the trade-off theory, Glover (2011) finds that observed leverage ratios imply default costs 45.5% for an average Compustat firm.

Overall, to date, Andrade and Kaplan (1998) remains the main source of numerical estimates for firm-specific ex post costs of financial distress. AK overcome the identification problem by focusing on 30 highly levered transactions that became distressed. Because their firms demonstrate above-average operating performance, AK conclude that they are financially distressed as a result of their high leverage, but not economically distressed. AK estimate the total change in the value of the firm between the onset of distress and its resolution, and attribute it to distress costs.

Our estimation procedure offers several potential advantages. First, our sample includes not only original-issue junk firms (i.e., highly levered bond issuers), but also fallen angels that were rated investment grade at the time of bond issuance. By contrast, as AK note, firms in their sample may have chosen to become highly levered precisely because they have unusually low distress costs. Consistent with their conjecture, our evidence suggests that HLTs do have lower distress costs on average. Second, our estimates are based on the change in the observed market value of the firm around the announcement of default. By contrast, AK's estimates are based on the change in cash flow margins from before the onset of distress to its resolution, multiplied by the industry median ratio of the firm value to cash flow, plus 2% that they add to account for direct costs of bankruptcy based on other empirical studies. Such an approach may be less accurate when changes in cash flow margins are transitory and as such do not translate into a proportional shift in the market asset value; when cash flow multiples differ across firms within industry; or when the firm's direct costs of bankruptcy are unusually high or low. Third, most firms in our sample are distressed not only financially but also economically, which is a far more common situation than that of pure financial distress (Asquith, Gertner and Scharfstein (1994)). Because economic distress depletes firms' assets in the run-up to default, estimates of default costs are affected when expressed as a proportion of the value of assets. Fourth, as debt pricing data sets become more readily available, our procedure can be applied to larger and more recent samples, reducing noise in the estimates and facilitating cross-sectional analysis.

A potential limitation of the approach is that the default arrival may change investors' assessment of the continuation asset value, for example, because their estimates of the asset value prior to default were too optimistic. Absent theoretical guidance on this subject, in the base case we assume that the investors' estimate of the asset value just prior to default is unbiased. In robustness tests, we explore to what extent this issue can affect our quantitative estimates for the benchmark case. Another limitation of our approach is that it is based on the price reaction to the default event, and as such cannot be directly applied to measure costs of financial distress incurred by firms that do not default. A mitigating factor is that default events in our sample are not limited to payment interruptions or bankruptcy filings, but also include bond exchange offers. For comparison, of the 39 firms in AK's initial sample, 31 defaulted and the remaining 8 attempted to restructure their debt. Because in many situations our estimates exceed the total costs of financial distress for HLTs in AK's study, our results suggests that for a typical firm distress costs may be higher than previously thought.

Our estimation procedure can be viewed as a generalization of the event study methodology (e.g., Brown and Warner (1985)). Event studies look at the price reaction to various corporate announcements. They typically deal with potential information leakages that can affect market prices before the event by extending the observation window backwards. Unfortunately, this approach cannot be applied to studying the cost of default, because the *timing* of default itself is systematically related to the value of the firm. Our approach allows the timing of the event of interest (in our case, default) to depend endogenously on the quantity to be measured (in our case, the value of the firm's assets), and the possibility of the event to affect prices for an arbitrarily long time. The procedure can be applied to any defaulted firm with observed market prices of debt and equity, including those distressed both economically and financially.

The remainder of this paper is organized as follows. Section II discusses our estimation procedure. Section III describes the data. Univariate results are reported in Section IV, and regression analysis in Section V. Section VI concludes. The derivation of the equations can be found in the Appendix.

II. Estimating the costs of default

In this section, we describe the approach that we use to estimate the unobservable costs of default from observed market prices of debt and equity before and after default. Our estimation procedure is based on the idea, first introduced in models of risky debt by Duffie and Lando (2001), that the information that investors have about firms' economic fundamentals is noisy and incomplete. As a result, investors generally cannot conclude with certainty whether or not any given firm is so distressed that it is about to default in the next instant. Indeed, if investors had enough information to replicate the timing of managers' decision to default, then the announcement of default by the firm would never be a surprise. Hence, in the absence of sudden "jumps" in the fundamentals, by the time the firm defaulted, its debt and equity prices would have gradually converged to their post-default "recovery" values, and upon the announcement of default prices would not move even if default involved deadweight value losses.

Empirically, however, it is well known that upon default firms' assets exhibit large abnormal returns. Clark and Weinsten (1983) and Lang and Stulz (1992) document abnormal stock returns at bankruptcy of around –20% to –30%, whereas Warner (1977) finds that prices of public bonds of bankrupt railroads fall by 9.2% in the month of bankruptcy. These large price reactions to default mean that it is not perfectly anticipated by investors. Duffie and Lando (2001), Jarrow and Protter (2004) and Giesecke (2006) argue that investors are only partially informed about crucial parameters that determine the timing of default. They show that under certain assumptions these information imperfections imply that the assets of the distressed firm can be priced as if, conditional on information available to investors, default were a random event with a hazard rate that is a function of the firm's economic conditions. Observed debt and equity prices pre-default reflect both the "recovery" value that the firm's assets would have in default, and their "continuation" value in the absence of default, with the difference between the two arising because default is costly. By observing market values of firms immediately prior to default and their recovery values immediately after default, and by parameterizing the default hazard, one can solve for the implied continuation value that the firm's assets would have if default were never to occur. The net cost of default can then be found by subtracting the recovery value of the firm from the continuation value of assets.

A. A static illustration

To illustrate the key idea of our approach, consider a simple static example of a levered firm that has to make a single (and final) debt payment of B at time T. If the firm does not default on the debt payment, the value of its productive assets, also referred to as their "continuation" or unlevered firm value, will be equal to V. If it defaults, the "recovery" value of the assets L will generally be different. In a structural models of risky debt, such as Merton (1974), V has a natural interpretation as the present value of assets or asset-generated cash flows in the absence of any financing imperfections.

The net cost of default, c, is defined as the difference between the value of assets absent the possibility of default and their value in default: $c = V - L$. Default may be costly due to transactions costs of arranging a distressed bond exchange, legal fees in bankruptcy, lost sales due to customers' unwillingness to buy from a defaulted company, opportunity costs of management's time, expected asset fire sale discounts, and other factors. For some firms, default may also be beneficial (its net cost may be negative) if it precipitates a value-increasing shake-up, like a sale of the firm to higher-value users, which self-serving managers may resist in the absence of default.

In the base case, we assume that investors observe both V and L, and use them in conjunction with an estimate of the probability of default, q, to calculate the value of the firm's financial claims, such as debt and equity. The value of the firm, M, is the total value of all such claims. If investors believe that default is possible but not certain, M will depend both on V and on L. As econometricians, we observe the value of the firm prior to the scheduled payment, M, and, in case of default, its recovery value, L. Unlike the investors, we do not know the continuation value, V. Our task is to estimate the cost of default, $c = V - L$, from observed firm values.

Suppose that just prior to time T investors know both V and L but lack full information regarding some other important economic parameters that affect the firm's ability to make the required debt payment. For example, investors may be unsure if the firm has enough liquid assets to repay the debt, and if not, whether it will be able to raise the required cash from external sources. As a result of these information imperfections, up until the maturity of debt investors can neither be sure that the firm will make the debt payment, nor know with certainty that it will not. They determine the market values of debt and equity at T_{-} (i.e., just prior to time T) given their assessment of the risk-neutral probability of default q, which is conditional on the information available to them. Investors' estimate of q may be based, for instance, on the distance-to-default (a volatility-adjusted measure of market leverage based on the Merton (1974) model), the firm's accounting ratios (e.g., Altman's (1968) z-score), and other publicly available information.

In this setting, the market value of the firm at time T_{-}, i.e., the total value of its debt and equity, is the probability-weighted average of the continuation and recovery values of its assets:

$$M = V \times [1 - q] + L \times q. \tag{1}$$

Given this relationship, we can compute the cost of default implied by market prices as follows. First, we estimate investors' conditional default probability q, for example, from the behavior of credit spreads or from survival analysis of firms at risk of failure. Second, if the firm does default, we observe its recovery value L and its pre-default value M. These are, respectively, the total value of the firm's debt and equity immediately after default, and their value just prior. Third, we solve Equation (1) for the unobserved continuation value of assets V. Finally, we find the cost of default as $c = V - L$, which is the implied jump in the asset value that makes asset prices observed before default consistent with their recovery values, given investors' assessment of the likelihood of default.

Our approach can be interpreted as adjusting the observed firm price reaction upon default so as to undo the effect that partial anticipation of default has on pre-default asset prices. To see this, notice that

Equation (1) can be re-written as:

$$M - L = c \times (1 - q). \tag{2}$$

The left-hand side of this equation is equal to the (negative of the) jump in the firm value upon the announcement of default, i.e., the firm-level price reaction to default. The right-hand side equals the cost of default, $c = V - L$, times one minus investors' conditional probability of default. The term in the square brackets measures the extent to which default is a surprise. As long as default is partially anticipated, so that the conditional probability of default is positive, Equation (2) implies that (the negative of) the change in the firm value upon default is smaller than the cost of default. At the same time, the two are closely related, and the more default is a surprise for investors, the closer the price reaction is in magnitude to total default costs. The sign of the cost of default is always opposite to that of the observed firm price reaction.

Our estimation procedure can be viewed as a generalization of the event study methodology (e.g., Brown and Warner (1985)). If the event of interest (in our case, default) is partially anticipated by investors, the observed price reaction at the time of the event is the lower boundary for the total value effect of the event. Event studies deal with partial anticipation by extending the observation window backwards. Unfortunately, this approach cannot be applied to studying the cost of default, because investors may be factoring in the possibility of default for a long time prior to the actual announcement. Moreover, the firm's decision to default may be systematically related to the value of the firm. We overcome these difficulties associated with the event study design by evaluating investors' conditional probability of default, and adjusting pre-default asset prices accordingly.

B. Base-Case Dynamic Model

The static model ignores the fact that in reality debt payments are spread over time. As a result, if the firm does not default at time t, its value will still differ from the asset value V, as it will be affected by the possibility of default in the future. To account for this effect, one needs to specify investors' expectations about the future dynamics of the asset value and the default process.

In this subsection, we describe the dynamic model that our base-case estimates are based on. The model merges important features of both reduced-form and structural models of credit risk. At the same time, our approach is designed so as to minimize the reliance on a number of debatable assumptions of such models, such as default boundary conditions used in structural models.

B.1. The default hazard

The central assumption behind our approach is that investors cannot predict the timing of default precisely, because the information available to them is noisy and incomplete. We assume that, as a result, there exists a default hazard rate, which is a function of information available to investors.[5] Conditional on this information, default is a realization of a Poisson process stopped at its first jump. This approach to modeling default is common in reduced-form models of risky debt pricing (e.g., Duffie and Singleton (1999), Madan and Unal (1998)). However, most reduced-form models also assume that the default hazard is driven by some latent risk factors, inferred from the time-series behavior of credit spreads. In contrast, we explicitly specify the hazard rate as a function of observed firm characteristics.

To focus on the most important salient information available to investors, we assume that the hazard rate is a function of the firm's asset value and its outstanding debt. Specifically, under the real probability measure $\mathbb{P}$ the default hazard λ_t^P is:

$$\lambda_t^P = e^{\beta_0 + \beta_1 \log \frac{V_t}{B}}, \tag{3}$$

where V_t is the market value of assets, B is the face value of debt, and β_0 and β_1 are fixed parameters. The ratio of the market value of assets to the face value of debt measures the firm's economic solvency and captures the degree of economic distress that the firm is in. The assumption that this ratio is a sufficient statistic for default is standard in many structural models of credit risk, starting from Merton (1974) and Black and Cox (1976). This ratio is the main input for computing the distance-to-default and the EDF by Moody's/KMV, both of which are now widely used in academic literature and practical applications as a measure of the firm's default risk (e.g., Berndt *et al.* (2005)). Empirically, Davydenko (2010) shows that the ratio of the market value of assets to the face value of debt is by far the most powerful variable explaining the timing of default. Its explanatory power exceeds that of most other conventional default predictors (e.g., those entering Altman's (1968) z-score) put together, and in regression analysis most such factors are insignificant in its presence.[6] Hence, we are unlikely to lose much in accuracy by following structural models

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[5] Duffie and Lando (2001) are the first to introduce asymmetric information in a structural model. They show that the default process in their model can be described using a hazard rate. Giesecke (2006) generalizes the conditions under which a hazard rate exists in such models.

[6] The only exception is measures of asset liquidity, such as the current ratio, although their explanatory power is an order of magnitude lower than that of V_t/B. Such additional factors can be included as arguments of the default hazard if one specifies their future dynamics. Doing so results in the loss of model parsimony while increasing the potential for model misspecification. Nonetheless, we have estimated a model in which the hazard rate is a function of liquidity as well as V_t/B, under the assumption that liquidity ratios are expected to stay constant. While this modification affects the cross-section of cost estimates, its effect on reported averages is small.

in focusing on the asset-to-debt ratio exclusively.

To relate observed asset prices to investors' expectations about default, we need the mapping between the actual and the risk-neutral probability measures. For Poisson processes, the change of the probability measure affects the intensity of jump arrivals (see, e.g., Shreve (2004), as well as Gorbenko and Strebulaev (2010) for an application to finance). We therefore assume that under the risk-neutral measure $\mathbb{Q}$, default is also a doubly-stochastic process, and that its intensity is a constant multiple of the real-measure intensity,

$$\lambda_t^Q = \xi \lambda_t^P, \tag{4}$$

where $\xi \geq 1$ is the risk premium associated with default.

At this point, several observations on our specification are in order. Our model combines the tractability of a reduced-form model with the economic intuition of structural models, which predict that default is driven by deteriorating economic fundamentals. At the same time, it does *not* rely on two common structural assumptions that are easiest to challenge on empirical grounds. First, in contrast to structural models such as Black and Cox (1976), Leland (1994), and others, we do not assume that there is a sharp value-based default boundary separating defaulting and nondefaulting firms. Contrary to this assumption, Davydenko (2010) finds that some firms default while their asset value is still relatively high, and others manage to avoid default at very low asset values, so that the reliance on the assumption of a sharp boundary known in advance is not very accurate. Here, we specify default as a random event whose probability is a function of the same structural risk factor V_t/B, but with the added realistic feature that default is unpredictable for investors due to the presence of other risk factors that they do not observe. Second, we make no assumptions regarding how the firm's assets are divided between creditors and shareholders in default. While most structural models assume that the absolute priority rule (APR) is enforced in default, empirical studies of distressed reorganizations find that the APR is often violated in practice (e.g., Franks and Torous (1993)). Our approach is based on the aggregate value of assets, whereas their split between debt and equity is irrelevant for our purposes.

B.2. The pricing equation

To relate price reaction at default announcement to the cost of default, we proceed by specifying the risk-neutral dynamics of the continuation value of assets V_t and their recovery value, L_t. Following the standard assumptions in credit risk literature, we assume that V_t follows a geometric Brownian motion

$$dV_t = rV_t dt + \sigma V_t dW_t^{\mathbb{Q}}, \tag{5}$$

where r is the instantaneous risk-free rate, σ is the instantaneous volatility of the growth rate, and $dW_t^{\mathbb{Q}}$ is a Brownian motion defined on a filtered probability space $(\Omega, \mathcal{F}, \mathbb{Q}, (\mathcal{F}_t)_{t \geq 0})$. All parameters, as well as the face value of debt, B, are known constants. We also assume that the recovery value is a constant fraction of the asset value:

$$L_t = (1 - \alpha)V_t, \tag{6}$$

where α is the proportional cost of default.

Investors observe both V_t and L_t, and can compute the conditional risk-neutral default intensity λ_t^Q. Then, as shown in the Appendix, at any time t up to default (or maturity T, whichever comes first) the value of the firm can be expressed as:

$$M_t = L_t + (V_t - L_t)\mathbb{E}_t^Q \left[\frac{V_T e^{-r(T-t)}}{V_t} e^{-\int_t^T \lambda_u^Q \, \mathrm{d}u} \right], \tag{7}$$

where the expectation $\mathbb{E}^Q$ is conditional on all information available to investors.

This equation relates the market value of the firm to the continuation value of its assets and their recovery value. For a firm that is observed to default at time $t = \tau$, M_τ can be observed as the market value of the firm just prior to the announcement of default, and L_τ as its value immediately after. Thus, we can solve Equation (7) for V_τ, and compute the cost of default as $c \equiv \alpha V_\tau = V_\tau - L_\tau$.

It is important to emphasize the economic intuition of V in the context of our model and its impact on our empirical results. Specifically, V is the value of a copy-cat firm, identical to the firm that we observe, but which is free of default risk. In general, V may not coincide with the value of unlevered assets of the firm. One reason is that the tax benefits of debt are incorporated in V. Given that both before and after default most firms are loss-making with high debt levels (Gilson (1997)), and thus the expected present value of income taxes is very low, the effect of taxes on value can be separated from that of default costs.

Another, and more important, reason is that V may be affected by costs of financial distress, such as the opportunity costs of management's time spent on emergency measures, that the firm incurs even if it never defaults.[7] As such, the cost of default that we estimate may be lower than the full cost of financial

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[7] As an illustration, consider the analogy between financial distress and illness. When a person falls sick, he may or may

distress. A mitigating factor is that default events in our sample are not limited to payment interruptions or bankruptcy filings, but also include bond exchange offers. In this respect, it is interesting to note that our estimates of default costs are similar to or higher than those of Andrade and Kaplan (1998), whose estimates supposedly incorporate non-default costs of financial distress for HLTs. Of the 39 firms in AK's initial sample, as many as 31 defaulted, while the remaining 8 attempted to restructure their debt.

Similar to the static case of the previous subsection, Equation (7) implies a relationship between the cost of default $c = V_\tau - L_\tau$ and the firm-level price reaction to the default announcement, $M_\tau - L_\tau$:

$$\frac{M_\tau - L_\tau}{c} = \mathbb{E}_\tau^Q \left[\frac{V_T e^{-r(T-\tau)}}{V_\tau} e^{-\int_\tau^T \lambda_u^Q \,\mathrm{d}u} \right], \tag{8}$$

where the expectation term on the right-hand side parallels the "surprise" component of the default announcement in the Equation (2) of the static model. Essentially, this term is the probability of no default until maturity, adjusted for the expected growth in the firm's assets between time τ and maturity date.

C. Implementation

Our estimation procedure involves the following major steps. First, using a sample of defaulting and non-defaulting firms, we estimate the parameters of the hazard function under the real measure using survival analysis. Second, we transform the hazard rate to the risk-neutral measure by multiplying it by a risk premium as estimated in extant studies of credit spreads. Third, we solve Equation (7) for V.

A complicating factor is that λ_t^Q in Equation (7) is a function of V_t, which we do not know initially. To estimate jointly the parameters of the risk-neutral default hazard function and the asset values for our sample of firms, we use an iterative procedure, which is described below.

C.1. The iterative estimation procedure

Step 1. As an initial approximation for V_t, we choose $V_t^{(1)} = M_t$, i.e., we use the observed firm value as an initial guess for the continuation value of assets.

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not be expected to die. If he dies, the loss in the value of his life-time earnings due to death is similar to the loss in the firm value due to default, which we estimate. However, even if the probability of death as a result of the sickness is zero, the value of life-time earnings may still decrease if the person is less productive while ill. We do not observe this decline in value that is not due to death.

Step 2. We apply standard tools of parametric survival analysis (see, e. g., Kalbfleisch and Prentice (2002)) to estimate the parameters of the hazard function $\lambda_t^P\left(V_t^{(1)}\right)$ specified in Equation (3) using maximum likelihood for the whole sample of firms, including firm-month observations that do not correspond to default. This yields parameter estimates $\beta_0^{(1)}$ and $\beta_1^{(1)}$. We then map the actual hazard function into the risk-neutral one by using Equation (4):

$$\lambda_t^{Q\ (1)} = \xi e^{\beta_0^{(1)}} \left(\frac{V_t}{B}\right)^{\beta_1^{(1)}}.$$

Step 3. For firm-month observations that correspond to default, we solve Equation (7) for V_t using simulations.[8] In particular, this yields $V_\tau^{(2)}$, where $t = \tau$ is the month of default. The implied proportional default costs for each defaulted firm are thus $\alpha^{(2)} = 1 - L_\tau / V_\tau^{(2)}$.

Step 4. For all other observations we find $V_t^{(2)}$ from a modification of Equation (7) that uses α instead of L_t as input:

$$M_t = (1-\alpha)V_t + \alpha \mathbb{E}_t^Q\left[V_T e^{-r(T-t)} e^{-\int_t^T \lambda_u^Q\, \mathrm{d}u}\right]. \tag{9}$$

To do so, for non-defaulting firms we assume that the proportional cost of default is equal to the sample average of $\alpha^{(2)}$. For firm-month observations of defaulting firms for months before default, we use the firm-specific values of $\alpha^{(2)}$.

Step 5. We go back to step 2, and re-estimate the hazard rate coefficients using $V_t^{(2)}$. We repeat steps 2 through 4 until iteration k, at which all of $\beta_0^{(k)} - \beta_0^{(k-1)}$, $\beta_1^{(k)} - \beta_1^{(k-1)}$, and $V_\tau^{(k)} - V_\tau^{(k-1)}$ become less than $\epsilon = 10^{-4}$.

C.2. The choice of the model inputs

The variables that the model uses as inputs are computed as follows. Prior to default, the market value of the firm M_t is estimated as the total value of all bonds, bank debt, and common and preferred equity, as described in Davydenko (2010). Because of data limitations, these estimates are only available on a monthly basis. Hence, the value of the firm at default, denoted M_τ in Equation (8), is approximated by its value at the end of the last calendar month prior to default. Similarly, the recovery value of the firm L_τ is observed at the end of the calendar month of default. To separate the price reaction to default from the general

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[8] The details of our simulation algorithms are available upon request.

market movement in the month of default, we subtract the market return from the defaulted firm's return and adjust the recovery value of assets accordingly.

We calculate the volatility of the firm's assets σ as the standard deviation of monthly asset returns for the median firm in the industry, as follows. First, we estimate the standard deviation of each firm's monthly returns, as in Choi and Richardson (2008), excluding post-default months and firms with fewer than 10 consecutive monthly firm value observations. Second, we find the median asset volatility in each of Fama and French's 50 industries. The use of industry rather than firm-specific volatility estimates increases the number of usable observations and reduces noise. Moreover, because the median firm in the industry is typically not distressed, its firm and asset values are very close (see Davydenko (2010)). Therefore, asset volatility can be estimated as the volatility of the firm, which is much easier to measure, as it does not need to be adjusted for the unobserved expected default costs.

Debt maturity $T-t$ is the weighted average of maturities of all debt instruments, assuming that all bank debt has a maturity of one year. The face value of debt B is the total debt outstanding at the end of the previous fiscal quarter, as reported in Compustat. The payout ratio, δ, equals total debt and equity payouts in each quarter divided by the average book value of assets in that quarter. Finally, the risk-free rate r is the five-year constant maturity Treasury rate. The five year maturity is similar to the average debt maturity for firms at default, which is 4.43 years.

We choose ξ to reflect empirically observed ratios of risk-neutral to actual default probabilities. Driessen (2005) and Berndt *et al.* (2008) estimate average jump-to-default risk premia for high-quality firms of around 2. Berndt et al. find evidence that the default risk premium is lower for lower quality firms, consistent with the finding of Huang and Huang (2003) that default risk premia are considerably lower for riskier firms, at around 1.11 for B firms and 1.17 for BB firms (see Table VI in Berndt *et al.* (2008)). Hull, Predescu, and White (2005) estimate risk premia embedded in CDS spreads of 1.2 for B firms and 1.3 for CCC and lower-rated firms. Based on these studies, for our base case estimates we calibrate ξ so that the five-year default risk premium in our model is 1.2, which yields the ratio of risk-neutral to real hazard rates ξ equal to 1.3.[9] As the estimates of the default risk premia are generally acknowledged to lack precision, as a robustness check, we also report estimates for a range of values for ξ between 1.0 and 2.0.

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[9] Specifically, we calibrate the parameters of our model to match observed characteristics of low-quality firms, and then simulate the model 50,000 times under $\mathbb{P}$ and under $\mathbb{Q}$ for five years. We record the simulated default probabilities and vary ξ so that their ratio equals 1.2. The details of this exercise are available upon request.

III. Data description

A. Data sources and sample selection

We use a sample of firms with observed market values of equity, bonds, and bank loans that defaulted on their public bonds. Our sample is a subset of firms used by Davydenko (2010), who describes the construction of the data set in detail. To estimate the market value of firms' public debt, we use monthly quotes from Merrill Lynch bond trading desks for bonds included in the Merrill Lynch U.S. High Yield Master II Index (MLI) between December 1996 (the month the index was created) and March 2004. The MLI consists of speculative-grade bonds with par amounts of at least $100 million and remaining maturity of one year or more. Bank loan prices come from the LSTA/LPC Mark-to-Market Pricing Database, which includes monthly secondary market loan quotes, each obtained from several dealers. Mergent's Fixed Income Securities Database (FISD) is used for descriptive information on bonds, and Loan Pricing Corporation's *DealScan* provides information on bank loans and aggregate statistics describing the loan market. Information on types of outstanding debt, including the use of credit lines, is manually collected from 10-K filings. We use bond, loan, and equity prices in conjunction with the debt structure data to estimate market values of total debt and equity at the end of the last calendar month preceding default, and the calendar month of default (the latter is used to calculate the post-default value of the firm). The estimation procedure is described in detail in Davydenko (2010).

We construct our sample as follows. We start with all non-financial firms included in the MLI that have defaulted on their public bonds during the sample period, and select those for which bond quotes are available immediately before and immediately after the default event. We then manually merge these firms with Compustat, CRSP, FISD, and DealScan. Accounting data are from quarterly Compustat, and monthly equity prices are from CRSP. The final sample consists of 144 defaulted firms. The main reason why some firms that defaulted on their bonds during the sample period are missing from our sample is because a majority of defaulting firms are original-issue junk bond issuers, and many of those are private firms, such as post-LBO firms, for which data are not available publicly.

B. The sample of defaults

According to the definition of default used by the rating agency Moody's, bond defaults include bankruptcy filings and out-of-court workouts with bondholders through either a distressed bond exchange or payment delays or omissions.[10] Consequently, we do not study covenant violations or defaults on bank debt, nor do we look at unsuccessful bond exchanges, which fail because not enough bondholders are willing to participate. At the same time, rating agencies' definition of default includes all events that alter payments on public bonds compared to those specified in the original bond contract.

The main source of information on defaults is the Default Risk Service (DRS) database distributed by Moody's. For distressed exchanges, DRS reports the date of successful completion as the date of default, yet the price reaction we would like to study is realized at the time of the announcement of the exchange, which DRS does not report. For this reason, we collect information on announcement dates for distressed exchange offers from news reports in Factiva. We also use Factiva to determine the outcomes of defaults not available in DRS. Not all defaults in DRS are independent events, both because firms often default together with their wholly owned subsidiaries, which may also be bond issuers, and also because DRS often reports multiple default events within a short period of time. We deal with these issues by focusing on defaults by parent companies only, and by looking at the first default event rather than at the sequence of events. Finally, we classify defaults as 'formal bankruptcies' and 'out-of-court renegotiations' as follows. If the default event is a missed bond payment or a distressed exchange offer not followed by bankruptcy in the same calendar month, we classify the event as a renegotiation. Default events involving a bankruptcy filing over the next months are classified as bankruptcy reorganizations.

The composition of the sample by year of default and broad industry group is shown in Table I. One-third of the sample defaulted in year 2001, when the dotcom crash brought about exceptionally high default rates by historical standards. At the same time, the sample also covers relatively calm years, which allows us to study the effect of macroeconomic conditions on default costs. As can be seen from the table, defaults by telecom firms were particularly common during the sample period (23.6% of the sample), followed by wholesale and retail firms (16.7%) such as KMart and Fleming Cos. Among industrial manufacturers, bankruptcy filings by steel producers such as Bethlehem Steel were frequent. The sample also includes several bankrupt airlines, such as United and Delta.

[TABLE I HERE]

Table II reports the number of sample defaults by the type of default. As Panel A shows, 38.2% of firms

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[10] Moody's defines bond default as "any missed or delayed disbursement of interest and/or principal, bankruptcy, receivership, or distressed exchange, where (i) the issuer offered bondholders a new security or package of securities that amount to a diminished financial obligation (such as preferred or common stock, or debt with a lower coupon or par amount), and (ii) the exchange had the apparent purpose of helping the borrower avoid default"(Keenan, Shtogrin, and Sobehart (1999), p. 10). Standard and Poor's adopts a similar definition; the minor differences pertain to grace period defaults and defaults on preferred stock.

default by filing for bankruptcy, 51.4% miss or delay a bond payment, and 10.4% complete a distressed bond exchange. Panel B reports the incidence of bankruptcy in the sample. It shows that 17.6% of bond payment defaults result in a bankruptcy filing within the same calendar month. Overall, the proportion of bankruptcy filings in our empirical analysis is 47.2%, whereas 52.8% of the sample defaults do not involve immediate bankruptcy. We refer to these defaults as renegotiations or out-of-court workouts. This subsample of "workouts" includes bond exchange offers, which are bona fide bond contract renegotiations, but also comprises missed or delayed bond payments not followed by a bankruptcy filing within the same month. Payment defaults reduce the value of creditors' cash flow compared to those specified in the bond contract, and as such constitute a de facto out-of-court debt restructuring. Although not shown in the table, about half of successful distressed exchanges and a large majority of payment defaults eventually lead to bankruptcy within two years. Finally, panel C shows eventual outcomes of default, with successful emergence from Chapter 11 being the most common outcome by far.

[TABLE II HERE]

Table III reports general descriptive statistics for defaulted firms. As many as 87.5% of defaulting firms are original-issue junk-bond issuers, meaning that none of their outstanding bonds have ever had an investment grade rating, and only 12.5% are "fallen angels." Thus, although our sample is not limited to HLTs by design, it is nonetheless dominated by them, as is any random sample of firms that default on their bonds. The firms in the sample are larger in size than a typical Compustat firm, because all of them issue public bonds. They appear distressed based on measures of profitability and liquidity. Table III also reports various statistics on the debt structure of defaulted firms. About 62% of their debt is in bonds. Their weighted average debt maturity is around 4 years, which is somewhat lower than is typical for bond issuers, because most firms that end up in default were perceived as risky at the time when bonds were issued.

[TABLE III HERE]

IV. Univariate analysis

A. Asset returns at default

As discussed in Section II, the cost of default is proportional to (the negative of) the change in the market value of the firm upon default. The observed firm-level price reaction to the announcement of default is at the heart of our estimates of the cost of default.

Table IV documents a large negative market-adjusted asset return in the month of default for a typical firm. The mean (median) firm-level return in the month of default is –12% (–8.4%). Such a large price reaction implies that investors are not fully informed about all factors that determine the timing of default, so that the announcement of default contains a significant element of surprise (Duffie and Lando (2001)). It is this incompleteness of information that allows us to use pre-default prices in order to estimate the continuation value of assets, and with it, the costs of default. The table also shows that the value of the firm falls much more for bankruptcies (by 17.1% on average) than for nonbankruptcy bond defaults (7.5%).

The magnitude of the return on individual classes of assets (bonds, loans, and equity) in Table IV is inversely related to the seniority of the asset: For the median firm, the equity return in the month of default is –23.3%, the loan return is only –4.1%, and the return on bonds falls in between, at –14.5%. This ranking is to be expected, given that payoffs in default are increasing with seniority. For very distressed firms that have not yet defaulted, the value of junior claims such as equity comes mostly from the option value on the firm's recovery, which is greatly reduced in default. In contrast, banks usually have a senior claim on the firm's assets in bankruptcy, and hence loan prices do not fall nearly as much.

Table IV also shows that asset returns at default are highly heterogenous, ranging from –44.7% to +12.6% between the first and the last deciles. Moreover, the value of the firm *increases* upon default for 28% of firms, including 19% of bankruptcies and as many as 37% of non-bankruptcy bond defaults. A positive price reaction at default means that, even though there may be administrative costs of renegotiation and bankruptcy, the net cost of default is negative for these firms. Interestingly, Andrade and Kaplan's (1998) estimates of distress costs are also negative for 8 out of 30 firms, or 27% of their sample. In the absence of default and reorganization, the status quo for such firms likely involves value destruction in ongoing operations, which makes default good news for investors. Consistent with this conjecture, Andrade and Kaplan (1998) find that an important component of costs of financial distress is firms' tendency to delay reorganization, which appears value-destroying. Similarly, Davydenko and Rahaman (2008) find that a large number of firms that are worth more dead than alive are able to avoid reorganization or delay it for years, while financing ongoing losses by liquidating assets such as inventories and receivables. For such firms, default may increase value, for instance, by precipitating a change in management (Gilson (1989)).

[TABLE IV HERE]

As part of our procedure, we estimate the real-measure hazard rate of default as a function of the asset-to-debt ratio, V_t/B, which summarizes the firm's solvency. For the base case, assuming the default risk premium of $\xi = 1.3$, the estimated hazard function is

$$\lambda_t = e^{-2.56-3.24\log\frac{V_t}{B}} = 0.0776\left(\frac{V_t}{B}\right)^{-3.24}. \tag{10}$$

As expected, the risk of default increases steeply as the firm becomes more insolvent.

B. The cost of default

Table V reports our estimates of default costs for different values of the risk premium parameter ξ. Under the base-case scenario, the mean (median) cost of default is 20.4% (19.3%) of the market value of assets just prior to default. Default costs are highly heterogenous, varying from –20.5% at the first decile to +63.8% at the tenth decile. As can be seen from the table, our estimates are not particularly sensitive to the assumed value of the default risk premium, changing by only four percentage points when ξ is doubled from 1.0 to 2.0.

Average bankruptcy costs are more than twice as large as costs of nonbankruptcy bond defaults, 28.8% versus 12.8%. Our estimates of total bankruptcy costs are much larger than direct costs of bankruptcy such as lawyers' fees, which are typically found to be within several percentage points of the firm value (e.g., Altman (1984); Weiss (1990)).[11] These findings confirm that indirect costs of financial distress are substantially larger than direct costs. The following factors contribute to the substantial size of these estimates. First, default usually occurs at advanced stages of insolvency, so that the market value of assets just prior to default on average is only 66% of the face value of debt (Davydenko (2010)). This implies that the denominator of our estimates of the cost-to-value ratio is substantially lower that that in AK's study of firms that are not economically distressed. Second, on average, the value of the bankrupt firm falls by over 17% in the month

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[11] It should be noted that previous studies express bankruptcy costs as a proportion of the book value of assets, whereas our estimates are normalized by market asset values, which at default average only 0.46 of the book value. Nonetheless, even after adjusting for the differences in the denominator, our estimates of total bankruptcy costs far exceed the direct costs found in aforementioned studies.

of bankruptcy alone, which provides a lower bound on total bankruptcy costs. Third, bankruptcy filings are usually at least partially anticipated by investors, which means that firm values prior to default already incorporate some of the bankruptcy costs, so that the price reaction to the bankruptcy announcement is only a fraction of the total cost of bankruptcy. Indeed, our estimates imply that the observed price reaction is only about half of the total costs of default, while the other half is already incorporated in the pre-default firm value.

[TABLE V HERE]

Our estimates of the cost of default are at the upper bound of the 10% to 20% range that Andrade and Kaplan (1998) indicate as the likely band for total costs of financial distress for HLTs. One contributing factor is that our sample is not limited to firms that self-select to become highly levered. Panel A of Table VI compares highly-levered firms (also known as original-issue junk issuers, because they are rated speculative grade at the time when bonds are issued) with those for fallen angels, which have lower leverage ratios at the time when bonds are issued, but are subsequently downgraded to junk status. The mean cost of default for highly-levered firms is 19.3%, whereas for fallen angels it is 28.1%, about 45% higher. Regressions reported in Section V show that these differences persist or increase when we control for other determinants of default costs. Thus, AK's estimates of distress costs may indeed be biased downward due to their use of HLTs. Moreover, our sample averages are also to a large extent driven by original-issue junk firms, as they comprise a large majority of firms observed to default. If our estimates are to be used to compute ex ante expected default costs for non-distressed investment-grade firms, it may be more appropriate to use average costs of 25%–30% instead of 15%–20%.

Panels B and C of Table VI report default costs by year of default and by industry. They are highest in the relatively calm year of 1998, and below average in 2001, when default rates peaked. These findings are surprising in light of the extant evidence that recovery rates on corporate debt are inversely related to aggregate default rates (Altman et al. (2005)) and industry conditions (Acharya et al. (2007)). We explore the effect of systematic factors on the costs of default in more detail in Section V.

Finally, panel D compares default costs for different outcomes of default, which are known to us ex post. Although investors do not know the eventual outcome when default is first announced, they can be expected to guess it correctly on average. The most instructive result is the contrast between default costs for firms that eventually emerge from bankruptcy (20.4%) and those which are eventually liquidated or sold (33.8%).

One interpretation of these estimates is that liquidations are substantially costlier than going-concern reorganizations. An alternative possibility is that the way the firm is reorganized in bankruptcy is endogenous, so that firms that are costlier to reorganize end up in liquidation, while those for which reorganization is feasible are preserved as a going concern and subsequently emerge from bankruptcy. Interestingly, the average estimated net cost of a successful bond exchange is slightly negative, indicating that such renegotiations are value-increasing overall, perhaps because default serves as a wake-up call for managers and precipitates a value-increasing shakeup.

[TABLE VI HERE]

C. Ex ante and marginal costs of default

When investors realize that default is possible, expected default cost affect the value of the firm even prior to default. We measure the expected costs of default as the difference between the continuation value of assets and the observed value of the levered firm. Panels A and B of Table VII report our estimates for nondistressed firms (which we assume are those whose weighted-average debt price is above 90¢ per $1 of face value) and for firm-month observations just preceding default. The mean (median) estimate for nondistressed firms is 1.07% (0.52%) of the value of assets in the base case, and does not exceed 2% even for large assumed values of the default risk premium. These estimates are generally similar to the findings of Elkamhi et al. (2010). Elkamhi et al. calibrate the structural model by Leland and Toft (1996) under the assumption that total ex post costs of financial distress are 16.5% (which they borrow from Andrade and Kaplan (1998)). They find that average expected default costs are generally below 1% of the firm value, and conclude that these estimates are too low to offset the likely tax benefits of debt financing.

Panel B of Table VII shows that the effect of expected default on the firm value increases substantially as firms become more distressed and the probability of paying the cost of default increases. For firms on the brink of default, expected default costs equal 11.32% of the value of assets. For comparison, recall that the mean total cost of default is 20.4%, and the drop in the firm level at default averages 12%. These statistics imply that by the time the firm defaults, slightly more than half of its total cost of default is already incorporated in its debt and equity prices.

[TABLE VII HERE]

V. Regression analysis

A. Regressions on firm-specific variables

This section reports cross-sectional regressions of the cost of default on various firm-specific and industry- and economy-wide factors. To control for differences between defaults that do and do not involve a bankruptcy filings, all regressions include the *bankruptcy dummy*, which equals one for defaults followed by bankruptcy within the same calendar month, and zero otherwise. Because default costs may include a fixed component, we use the logarithm of the firm's book assets to control for firm size. In this subsection, we also use year dummies to account for systematic variations in default costs, as well as industry dummies to control for the unobserved heterogeneity across industries. The role of systematic factors is documented in the next subsection.

Table VIII shows that bankruptcy costs are significantly larger than the costs of non-bankrupt defaults. The estimated difference is close to 20% of the market value of assets, and remains highly statistically significant in all specifications. By contrast, firm size is typically insignificant, although the negative coefficient for size found in 5 out of the 7 regression specifications is consistent with Andrade and Kaplan (1998), who document a fixed component in the costs of financial distress for their sample of distressed HLTs.

Regressions (2) to (4) look into the effect of debt structure complexity. Gertner and Scharfstein (1991) show that coordination problems among public bondholders can result in investment inefficiencies in distressed firms, which contribute to costs of financial distress. One implication is that the more complex the public bond structure is, the harder it is to renegotiate debt contracts with public bondholders, and the higher the cost of financial distress. By contrast, the higher the proportion of bank debt, the easier it is to renegotiate, and the lower the cost of distress. Empirical studies such as Gilson, John, and Lang (1990) and Asquith, Gertner and Scharfstein (1994) find that measures of the complexity of the firm's debt structure, including the proportion of bank debt and the number of public bonds outstanding, affect the way the firm is reorganized in distress.

Column (2) shows that a higher proportion of bank debt is associated with lower default costs. This result is similar to what Andrade and Kaplan (1998) find for their sample of 30 HLTs. Banks appear to facilitate restructuring in distress and reduces the cost of default, consistent with the results of Asquith, Gertner and Scharfstein (1994). By contrast, (the log of) the number of public bonds in column (3) is positively correlated with the cost of default, as coordination problems and renegotiation frictions are larger for firms with more complex debt structures. This finding is again consistent with empirical studies of distressed reorganizations such as Gilson, John, and Lang (1990) and Asquith, Gertner and Scharfstein (1994). However, this variable is negative and significant in Andrade and Kaplan's (1998) regressions of the costs of financial distress. The significance of the number of bonds may be due to its strong association with the size of the firm, which may affect distress costs in a nonlinear way. To account for this possibility, following Gilson, John, and Lang (1990) we also compute the *normalized number of bonds* as the number of bonds divided by total debt. This variable measures the complexity of the bond structure per dollar of debt. Column (4) of Table VIII shows that this variable is positively correlated with default costs and significant at the 10% level.

We also look at whether the costs of default are related to the tangibility of the firm's assets. Firms with substantial fixed assets, which are relatively easy to sell in distress, can be expected to have lower costs of reorganization than firms whose assets consist mostly of growth options, human capital, and intellectual know-how. To test for this possibility, we regress our estimates of default costs on the ratio of the firm's property, plant, and equipment to book assets. Alderson and Betker (1996) find this variable to be the best accounting-based proxy for (the lack of) liquidation costs. However, regression (5) shows that for our estimates, although the coefficient is negative, it is not statistically significant. In untabulated regressions, we use the proportion of intangible assets and the ratio of R&D to sales as alternative proxies for asset tangibility, but they also come out insignificant in our sample.

Finally, regression (6) suggests that original-issue junk firms (i.e., levered bond issuers that were never rated investment grade) have lower default costs than do fallen angels. This result is consistent with AK's conjecture that estimates of distress costs based on highly-levered transactions only may be biased downwards due to the sample selection bias.

Overall, regressions in Table VIII suggest that default costs are higher for bankruptcies than for renegotiations, and also higher for fallen angels than for junk firms. Moreover, they appear increasing in the debt structure complexity and decreasing in the proportion of bank debt in the capital structure. However, only for the bankruptcy dummy are the results robustly statistically significant across specifications.

[TABLE VIII HERE]

B. The role of systematic factors

It is well documented that recovery rates on defaulted corporate debt are inversely correlated with the aggregate default rate in the economy (e.g., Altman et al. (2005)). This correlation is often interpreted as evidence that default costs rise during periods of economy-wide stress. Shleifer and Vishny (1992) point out that when a financially distressed firm needs to sell its assets, other firms in the same industry are likely to be distressed at the same time. Thus, asset fire-sales may result in value losses because the assets may have to be sold to deep-pocketed industry outsiders who are not their most efficient users. Although the existence of fire-sale discounts has been documented for distressed airlines by Pulvino (1998), the extent to which industry conditions affect total costs of financial distress is an open question, in particular because distress costs estimates are rarely available. Andrade and Kaplan (1998) regress their estimates of distress costs on industry equity returns and find that, though the correlation between the two is negative, it is not statistically significant.

Given the dearth of estimates of total distress costs, Acharya *et al.* (2007) test Shleifer and Vishny's (1992) prediction using debt recovery rates as a proxy. The logic behind this approach is that, for a given level of assets just prior to default, recovery asset values are a decreasing function of the cost of default. Indeed, assuming that equityholders get nothing in liquidation, the weighted-average recovery rate on the firm's debt is

$$\frac{L_\tau}{B} = \frac{V_\tau - (V_\tau - L_\tau)}{B} = \frac{V_\tau}{B}\left(1 - \frac{c}{V}\right), \tag{11}$$

where, as in Section II, B is the face value of debt, V_τ is the market value of assets just prior to default, L_τ is their recovery value in default, and $c \equiv V_\tau - L_\tau$ is the cost of default. The ratio V_τ/B is the firm's "default boundary" (expressed as a proportion of the face value of debt), which summarizes the firm's solvency at the time of default. The default boundary is high for firms that default early in distress and low for firms that delay default until advanced stages of distress. When the timing of default is fixed, Equation (11) shows that debt recovery rates decrease in the cost of default expressed as a proportion of the value of assets. Acharya *et al.* (2007) find that recovery rates are low when the firm's industry is in distress, which they interpret as evidence in favor of Shleifer and Vishny's (1992) prediction.

However, a procyclical default boundary can also potentially explain their evidence even if the cost of default is insensitive to industry conditions. Recent models by Bhamra, Kuehn, and Strebulaev (2010) and Chen (2010) predict that the value-based default boundary is lower in economy-wide downturns, while Davydenko (2010) presents empirical evidence that the default boundary is indeed procyclical. We study the effect of macro and industry conditions on default costs in regressions reported in Table IX. To facilitate comparisons with extant studies, the table also presents regressions of debt recovery rates.

Regressions (1) through (4) confirm that recovery rates are low when aggregate default rates are high and when the firm's industry experiences a downturn. Regression (1) uses the annual aggregate rate of default on rated bonds in the U.S., published by Moody's (Hamilton *et al.* (2007)). Consistent with Altman et al. (2005) and others, the correlation between default rates and recovery rates is strongly negative. However, regression (5) shows that the effect of the default rate on the cost of default is not statistically significant. In unreported regressions, we use the default rate on junk bonds only, as opposed to all rated bonds, and obtain very similar results. Comparing regressions (1) and (5), it appears that the effect of the economy-wide default rate on debt recoveries is due to systematic variations in the default boundary rather than in the cost of default.

Regressions (2) through (4) confirm the findings of Acharya *et al.* (2007) that industry conditions are strong determinants of debt recoveries. Regressions (2) and (3) use, respectively, the median profitability and the median equity return as a proxy, where industries are defined according to their 3-digit SIC codes. Acharya *et al.* (2007) assume that an industry is in distress when the equity return of the median firm is less than –30%. Consistent with their findings, column (4) shows that industry distress is associated with lower recovery rates.

However, in sharp contrast with recovery rates, columns (6) to (8) show that these same variables are typically not statistically significant in regressions of estimated costs of default. Thus, although industry conditions may be an important determinant of price discounts in asset fire-sales (Pulvino (1998)) as suggested by Shleifer and Vishny (1992), their effect on the total cost of default appears minor. Taken together, the regressions in Table IX, as well as regressions of the default boundary reported by Davydenko (2010), imply that the correlation between industry conditions and economy-wide default rates with debt recoveries is due to their effect on the timing of default (the procyclical default boundary), rather than on the cost of default. Put differently, recovery rates are low in downturns not because default costs are high, but rather because firms are more insolvent and have fewer assets to cover their liabilities by the time they default.

[TABLE IX HERE]

VI. Conclusions

Using a novel estimation method in conjunction with data on market values of defaulted firms, we estimate that the total cost of default is around 20% of the market value of assets. Default costs are higher for bankruptcy filings than for informal renegotiations, and higher for fallen angels than for highly-levered bond issuers. They are highly heterogenous, and negative for 28% of all bond defaults, including 19% of bankruptcies. Complex debt structures increase default costs, whereas the use of bank debt decreases them. In contrast to recovery rates, default costs are not significantly related to industry conditions or aggregate default rates. Although our estimates of ex post costs of default are somewhat larger than those documented previously for HLTs, ex ante expected default costs in the absence of distress remain small relative to plausible estimates of tax benefits of debt financing.

Appendix: Derivation of the pricing equation

In what follows, all probabilities are under the risk-neutral measure Q. We assume that:

1. The market value of the firm's productive assets V_t (i.e., the continuation value of the firm) follows a geometric Brownian motion
$$dV_t = rV_t dt + \sigma V_t dW_t, \tag{A1}$$
2. Default is doubly stochastic process, so that conditional on knowing the history of the risk factor, default time is the first jump of a heterogenous Poisson process with conditional risk-neutral intensity λ_t.
3. The "recovery" value of the firm L_t (i.e., its value in a hypothetical default at time t) is a constant fraction of its continuation value:
$$L_t = (1-\alpha)V_t. \tag{A2}$$

If the firm does not default by the maturity date T, then its value at maturity equals the all-equity asset value, V_T. If the firm defaults some time prior to maturity, then the of assets at maturity is $L_T = (1-\alpha)V_T$. Conditional on no prior default, the market value of the firm M_t for $t \leq T$ can be expressed as

$$M_t = e^{-r(T-t)} E_t \left[V_T 1_{\{\tau \geq T\}} + (1-\alpha) V_T 1_{\{\tau < T\}} \right]. \tag{A3}$$

Rearranging the above equation and using the fact that $V_t = e^{-r(T-t)} E_t[V_T]$ yields:

$$\begin{aligned} M_t &= e^{-r(T-t)} E_t \left[V_T 1_{\{\tau \geq T\}} + (1-\alpha) V_T (1 - 1_{\{\tau \geq T\}}) \right] \\ &= e^{-r(T-t)} E_t \left[(1-\alpha) V_T \right] + E_t \left[\alpha V_T e^{-r(T-t)} 1_{\{\tau \geq T\}} \right] \\ &= (1-\alpha) V_t + \alpha E_t \left[V_T e^{-r(T-t)} E_T [1_{\{\tau \geq T\}}] \right] \\ &= (1-\alpha) V_t + \alpha E_t \left[V_T e^{-r(T-t)} e^{-\int_t^T \lambda_u(V_u)\, du} \right], \end{aligned} \tag{A4}$$

which is Equation (9) of the main text. The last step uses the fact that at time t we know $\tau > t$ and conditional on the information up to T, the default process is an inhomogeneous Poisson process stopped at its first jump. Hence, $E_T[1_{\{\tau \geq T\}}]$ is the non-default probability and we have

$$E_T[1_{\{\tau \geq T\}}] = e^{-\int_t^T \lambda_u(V_u)\, du}. \tag{A5}$$

Since $L_t = (1-\alpha)V_t$, Equation (A4) can be re-arranged as

$$M_t = L_t + (V_t - L_t) E_t \left[\frac{V_T e^{-r(T-t)}}{V_t} e^{-\int_t^T \lambda_u(V_u)\, du} \right], \tag{A6}$$

which is Equation (7) of the main text.

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Table I. Sample composition

Panel A reports the number of unique firms in our sample. The sample consists of firms that defaulted on their public bonds between January 1997 and April 2004. Wholly owned subsidiaries defaulting essentially together with their parent companies are not counted separately. Default events within two years are counted as one default. Default events are bond payment omissions (including those rectified within the grace period), distressed bond exchanges, and bankruptcy filings. Panel B reports the industry composition of the sample of defaulted firms.

	No. of firms	% of sample
Panel A: Number of defaults by year		
1997	4	2.8%
1998	11	7.6%
1999	19	13.2%
2000	18	12.5%
2001	48	33.3%
2002	22	15.3%
2003	18	12.5%
2004	4	2.8%
Panel B: Industry composition		
Consumer goods	21	14.6%
Business equipment	7	4.9%
Steel	7	4.9%
Other manufacturing	17	11.8%
Telecommunications	34	23.6%
Wholesale and retail trade	24	16.7%
Transportation	6	4.2%
Energy & Utilities	11	7.6%
Other industries	17	11.8%
All	144	100.0%

Table II. Default events, bankruptcy, and outcomes

This table reports the incidence of bankruptcy filings and the eventual outcome of default for sample firms, by the type of the first default event (bankruptcy filing, payment omission, or distressed bond exchange). Panel A gives the total number of defaults by the first default event. Panel B reports the number of bankruptcy filings following the first default event, if any. Panel C reports the eventual outcomes of default. Wholly-owned subsidiaries defaulting essentially together with their parent companies are not counted separately. Default events happening within two years are counted as one default. "Still in bankruptcy" refers to firms that have not emerged from bankruptcy as of July 2007.

	First default event			
	Bankruptcy filing	Distressed exchange	Payment default	Total
Panel A: First default events				
Total number of defaults	55	15	74	144
	38.2%	10.4%	51.4%	
Panel B: Bankruptcies and out-of-court renegotiations				
Bankruptcies	55	0	13	68
	100.0%	0%	17.6%	47.2%
Renegotiations	-	15	61	76
		100%	82.4%	52.8%
Panel C: Eventual outcomes of default				
Creditors paid in full	-	4	-	4
		5.4%		2.8%
Bond exchange completed	-	1	9	10
		1.4%	60.0%	6.9%
Emerged from bankruptcy	45	55	4	104
	81.8%	74.3%	26.7%	72.2%
Acquired or liquidated	10	11	2	23
	18.2%	14.9%	13.3%	16.0%
Unclear	-	3	-	3
		4.1%		2.1%

Table III. Descriptive statistics

This table reports descriptive statistics for firms at default. *Profit margin* is the ratio of the pretax income to sales. *EBIT* is the sum of pretax income and interest expenses. *% negative net income* is the proportion of firms for which net income is negative. *Interest coverage ratio* is the ratio of EBITDA, calculated as the sum of pretax income, interest expense, and depreciation, to the interest expense. *Quick ratio* is the sum of cash and accounts receivable divided by current liabilities. *Current ratio* is the ratio of current assets to current liabilities. *Original-issue junk* firms are those whose outstanding bonds were never rated investment grade.

	Mean	Median	Std.dev.	N
Total assets ($ Mil.)	2,665	979	6,639	144
Sales/TA	0.247	0.195	0.244	142
Market leverage ratio	0.871	0.914	0.120	144
Industry asset volatility	0.291	0.275	0.082	144
Profit margin	-108%	-23%	250%	140
EBIT/Total assets	-0.114	-0.024	0.297	136
% negative net income	91.5%			142
Interest coverage ratio	-2.941	-0.171	7.040	135
Quick ratio	0.560	0.362	0.597	144
Current ratio	0.978	0.770	0.839	144
% original-issue junk	87.5%			144
Short-term/Total debt	0.182	0.040	0.285	143
Debt maturity	4.36	3.95	2.19	144
Coupon rate	10.4%	10.3%	3.0%	141
Bonds/Total debt	0.620	0.620	0.229	144
No. of bond issues	3.72	2.00	5.97	144

Table IV. Asset returns at default and debt recovery rates

This table reports statistics on market-adjusted returns for different asset classes in the month of default, as well as debt recovery rates. *Total return* is the weighted-average return on common and preferred equity, loans, and bonds, in the calendar month of default, less the return on the market. *Debt return* is the weighted-average return on loans and bonds, calculated similarly. Returns on bonds, bank debt, and equity are also adjusted for the market return. *Debt recovery rate* is the weighted average market price in cents on the dollar, of all of the firm's outstanding debt instruments, at the end of the calendar month of default.

	Mean	Median	Std.dev.	10%	90%	Return > 0
Panel A: All defaults, N=144						
Total return	-12.0%	-8.4%	24.0%	-44.7%	12.6%	0.28
Equity return	-15.9%	-23.3%	55.0%	-71.1%	35.4%	0.26
Debt return	-12.1%	-8.0%	22.4%	-43.0%	12.3%	0.28
Bond return	-18.7%	-14.5%	30.3%	-57.3%	19.3%	0.25
Bank debt return	-5.4%	-4.1%	18.1%	-28.1%	10.0%	0.34
Debt recovery rate	48.5%	44.0%	20.9%	23.5%	74.8%	
Panel B: Renegotiations, N=76						
Total return	-7.5%	-5.4%	19.9%	-37.5%	14.5%	0.37
Equity return	-4.9%	-13.2%	48.8%	-51.1%	43.1%	0.36
Debt return	-7.7%	-5.6%	20.5%	-37.2%	13.8%	0.36
Bond return	-9.5%	-8.4%	28.0%	-47.3%	25.3%	0.37
Bank debt return	-3.3%	-2.3%	16.4%	-22.2%	10.0%	0.39
Debt recovery rate	48.5%	44.0%	20.9%	23.5%	74.8%	
Panel C: Bankruptcy filings, N=68						
Total return	-17.1%	-12.3%	27.2%	-51.2%	7.8%	0.19
Equity return	-28.1%	-35.7%	59.2%	-84.5%	10.3%	0.15
Debt return	-17.0%	-11.0%	23.5%	-53.7%	9.1%	0.19
Bond return	-29.0%	-28.8%	29.7%	-68.3%	7.1%	0.12
Bank debt return	-7.7%	-7.2%	19.7%	-33.7%	11.6%	0.28
Debt recovery rate	40.4%	37.3%	20.0%	16.6%	66.5%	

Table V. Estimates of the costs of default

This table reports our estimates of the costs of default as a percentage of the market value of assets at the end of the last calendar month prior to default, for different assumed levels of the risk premium, ξ.

	Mean	Median	Std.dev.	10%	90%
Panel A: All defaults, N=144					
Base case: Risk premium = 1.3	20.4%	19.3%	30.5%	-20.5%	63.8%
Risk premium = 1.0	18.9%	18.3%	30.4%	-20.1%	62.1%
Risk premium = 1.2	19.9%	19.1%	30.5%	-19.9%	63.3%
Risk premium = 1.5	21.2%	19.7%	30.7%	-19.5%	64.7%
Risk premium = 2.0	22.8%	21.4%	31.3%	-18.2%	66.7%
Panel B: Renegotiations, N=76					
Base case: Risk premium = 1.3	12.8%	10.2%	29.7%	-27.5%	58.1%
Risk premium = 1.0	11.6%	9.2%	29.4%	-26.6%	56.3%
Risk premium = 1.2	12.4%	9.8%	29.6%	-26.7%	57.6%
Risk premium = 1.5	13.5%	10.7%	29.8%	-28.3%	59.2%
Risk premium = 2.0	14.9%	12.0%	30.7%	-26.6%	61.4%
Panel C: Bankruptcy filings, N=68					
Base case: Risk premium = 1.3	28.8%	27.9%	29.4%	-12.3%	72.5%
Risk premium = 1.0	27.2%	25.8%	29.4%	-12.3%	71.2%
Risk premium = 1.2	28.3%	27.4%	29.4%	-11.7%	72.1%
Risk premium = 1.5	29.8%	28.8%	29.5%	-13.7%	73.3%
Risk premium = 2.0	31.7%	31.6%	29.9%	-12.7%	74.7%

Table VI. Default costs for different firms

This table reports the cost of default, expressed as a proportion of the market value of the firm's assets at the end of the last calendar month preceding default, for different groups of firms, for the base case of $\xi = 1.3$.

	Mean	Median	Std.dev.	N
Panel A: Statistics by bond issuer type				
Fallen angels	28.1%	24.8%	26.0%	18
Original-issue junk firms	19.3%	15.5%	31.1%	126
Panel B: Statistics by year				
1997	10.4%	11.5%	21.9%	4
1998	37.2%	37.8%	31.9%	11
1999	22.1%	25.8%	28.5%	19
2000	26.5%	30.4%	24.8%	18
2001	14.9%	10.2%	35.8%	48
2002	26.4%	28.2%	29.6%	22
2003	14.7%	10.6%	22.3%	18
2004	5.7%	4.1%	24.6%	4
Panel C: Statistics by industry				
Consumer goods	21.2%	23.7%	25.9%	21
Business equipment	1.6%	-6.9%	32.8%	7
Steel	56.6%	57.1%	19.2%	7
Other manufacturing	18.2%	19.0%	24.3%	17
Telecommunications	17.7%	12.7%	34.6%	34
Wholesale and retail trade	27.7%	32.6%	31.4%	24
Transportation	13.8%	9.1%	17.0%	6
Energy & Utilities	13.3%	9.6%	28.4%	11
Other industries	16.1%	20.9%	31.3%	17
Panel D: Statistics by default outcome				
Creditors paid in full	25.0%	17.4%	31.9%	4
Bond exchange completed	-6.8%	-4.9%	20.1%	10
Emerged from bankruptcy	20.4%	21.7%	28.8%	104
Acquired or liquidated	33.8%	30.6%	35.0%	23

Table VII. Ex ante (expected) default costs

This table reports expected default costs prior to default. Expected default cost is the difference between the continuation value of assets and the market value of the firm, expressed as a proportion of the market value of assets. In panel A, average expected default costs are calculated for each firm over all months in which the weighted average debt price is above 90 cents on the dollar. This procedure results in $N = 107$ firm means. The reported statistics are for this sample of firm means. In panel B, expected costs are measured for each firm at the end of the last calendar month preceding default.

	Mean	Median	Std.dev.	10%	90%
Panel A: Nondistressed firms, N=107					
Base case: Risk premium = 1.3	1.07%	0.52%	2.29%	-1.32%	4.56%
Risk premium = 1.0	0.75%	0.27%	1.76%	-1.05%	3.28%
Risk premium = 1.2	0.96%	0.43%	2.12%	-1.23%	4.12%
Risk premium = 1.5	1.30%	0.70%	2.63%	-1.65%	5.44%
Risk premium = 2.0	1.86%	1.16%	3.44%	-2.11%	7.55%
Panel B: Firms at default, N=144					
Base case: Risk premium = 1.3	11.32%	7.97%	16.78%	-12.23%	42.92%
Risk premium = 1.0	9.53%	6.63%	15.96%	-14.83%	40.21%
Risk premium = 1.2	10.74%	7.56%	16.56%	-12.92%	42.09%
Risk premium = 1.5	12.39%	9.08%	17.25%	-11.23%	44.49%
Risk premium = 2.0	14.46%	11.99%	18.52%	-10.43%	48.24%

Table VIII. Regressions on firm-specific factors

The dependent variable is the base-case estimate of the cost of default, expressed as a proportion of the market value of assets pre-default. *Bankruptcy dummy* is a dummy variable that equals one for defaults followed by bankruptcy in the same calendar month, and zero otherwise. *Norm. no. of bonds* is the number of outstanding bonds divided by total debt. *PPE/Book assest* is the ratio of net property, plant, and equipment to total assets. *Original-issue junk* is a dummy variable that equals one for firms that have never had an investment-grade rating, and zero otherwise. Values of t-statistics are reported in parentheses. Coefficients marked ***, **, and * are significant at the 1%, 5%, and 10% significance level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Bankruptcy dummy	0.19***	0.19***	0.21***	0.21***	0.23***	0.18***	0.20***
	(3.61)	(3.70)	(3.97)	(3.94)	(4.33)	(3.53)	(3.68)
Log(Book assets)	-0.014	0.00037	-0.069**	0.016	-0.021	-0.039	-0.0066
	(-0.66)	(0.017)	(-2.18)	(0.62)	(-0.97)	(-1.56)	(-0.20)
Bank loans/Total debt		-0.26**					-0.17
		(-2.14)					(-1.28)
Log(No. of bonds)			0.11**				
			(2.28)				
Norm. no. of bonds				28.8*			12.9
				(1.94)			(0.75)
PPE/Book assets					-0.016		
					(-0.14)		
Original-issue junk						-0.18*	-0.11
						(-1.83)	(-1.08)
Const.	-0.0045	0.073	0.35	-0.27	0.0049	0.078	0.35
	(-0.022)	(0.35)	(1.36)	(-1.09)	(0.023)	(0.39)	(1.23)
Industry effects	Yes	Yes	Yes	Yes	No	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	144	144	144	144	140	140	144
R^2	0.227	0.254	0.258	0.249	0.267	0.178	0.247

Table IX. The effect of industry conditions and economy-wide default rates

The dependent variable in regressions (1) to (4) is the weighted average recovery rate on all of the firm's debt instruments, measured as the market value of the firm's debt at the end of the calendar month of default divided by its face value. The dependent variable in regressions (5) to (8) is the base-case estimate of the cost of default expressed as a proportion of the market value of assets pre-default. *Default rate* is the proportion of public bonds that default in each calendar year, as reported by Moody's. *Industry profitability* is the profit margin of the median firm in the same 3-digit SIC industry. *Industry returns* is the equity return of the median firm in the same 3-digit SIC industry. *Industry in distress* is a dummy variable which equals one if the industry return is below –30%, and zero otherwise. Values of t-statistics are reported in parentheses. Coefficients marked ***, **, and * are significant at the 1%, 5%, and 10% significance level, respectively.

	Dependent variable = recovery rate				Dependent variable = default costs			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Bankruptcy dummy	-0.10***	-0.079**	-0.090**	-0.094***	0.17***	0.18***	0.16***	0.16***
	(-2.95)	(-2.22)	(-2.53)	(-2.65)	(3.33)	(3.48)	(2.99)	(3.03)
Log(Book assets)	0.032**	0.021	0.021	0.020	-0.017	-0.023	-0.012	-0.011
	(2.27)	(1.45)	(1.52)	(1.45)	(-0.79)	(-1.09)	(-0.57)	(-0.54)
Default rate	-0.060***				0.00046			
	(-3.50)				(0.018)			
Industry profitability		0.39**				-0.40		
		(2.18)				(-1.53)		
Industry returns			0.21***				-0.16*	
			(3.51)				(-1.80)	
Industry in distress				-0.13***				0.082
				(-3.90)				(1.57)
Const.	0.43***	0.30***	0.39***	0.40***	0.24	0.33**	0.18	0.18
	(4.55)	(2.94)	(4.04)	(4.24)	(1.64)	(2.24)	(1.24)	(1.22)
N	144	140	132	132	144	140	132	132
R^2	0.129	0.079	0.135	0.152	0.074	0.105	0.091	0.085