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# The expected cost of default ☆

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ABSTRACT

The sample of observed defaults significantly understates the average firm's true expected cost of default due to a sample selection bias. I use a dynamic capital structure model to estimate firm-specific expected default costs and quantify the selection bias. The average firm expects to lose 45% of firm value in default, a cost higher than existing estimates. However, the average cost among defaulted firms in the estimated model is only 25%, a value consistent with existing empirical estimates from observed defaults. This substantial selection bias helps to reconcile the levels of leverage and default costs observed in the data.



## 1. Introduction

The cost of default is an essential component to understanding the joint behavior of default rates, credit spreads, and firms' optimal financing decisions. A common view in the finance literature, supported by empirical studies of defaulted firms, maintains that the average firm's cost of default is relatively low.[1] This conclusion plays a central role in the challenge faced by existing models to simultaneously explain the levels of leverage, credit spreads, and default rates observed in the data.

I show that estimates of default costs drawn from the sample of defaulted firms are subject to a significant selection bias. This selection bias is the result of firms and credit markets internalizing default costs when choosing leverage and pricing debt, respectively. All else equal, firms with a higher cost of default choose a lower level of leverage, making default less likely. Therefore, the firms that default ex post are disproportionately those with a low cost of default. Consequently, existing estimates of

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[1] Davydenko, Strebulaev, and Zhao (2012) estimate an average default cost of 21.7% of the market value of assets from a sample of 175 defaulted firms. This measure is intended to capture both direct and indirect costs. Estimates of direct bankruptcy costs are much smaller. Warner (1977), Weiss (1990), and Altman (1984) all find small direct costs of bankruptcy of 5.3%, 3.1%, and 6% of pre-bankruptcy firm value, respectively.

default costs, drawn from the sample of observed defaults, significantly understate the cost that the average firm expects to incur in default.

In this paper, I estimate firm-specific, expected default costs from a structural model. These costs, which are not subject to the selection bias, are the costs used ex ante by firms in setting their leverage and by credit markets in pricing debt. In my sample of 2,505 US public firms, the mean estimated cost of default is 45% of firm value (with a median of 37%), which is significantly higher than existing estimates obtained from the empirical sample of defaulted firms. However, this value does not have a direct empirical counterpart and, given the selection bias, this value should be larger than what is obtained from a sample of defaulted firms.

The striking result is that the estimated model produces an average default cost for the subset of defaulted firms of only 25%. This value, which is the model counterpart to the empirical sample of defaulted firms, is significant for two reasons. First, it implies a large selection bias. The average firm expects a cost of default nearly twice as large as the average inferred from the sample of defaulted firms. Second, and perhaps more important, this value is closely in line with existing estimates of average default costs from the empirical sample of defaulted firms.

A number of existing conclusions relating to leverage, credit spreads, and the importance of default costs rely on the assumption that the low observed default costs accurately reflect the costs faced by the broader population of firms. A central message of this paper is that many of these conclusions should be revisited. In particular, I show that accounting for heterogeneous default costs, and the sample selection bias that they induce, can significantly help in explaining some of the low leverage ratios observed in the data. In addition, the sample selection bias has significant implications for a wide class of credit risk models, not just the framework used in this paper.

Using the values for default costs reported in Andrade and Kaplan (1998) and tax benefits to debt estimated by Graham (2000), previous work has concluded that default costs are too low for a trade-off model of leverage to explain the low levels of leverage seen for many firms in the data. I show that, due to the sample selection bias, low observed default costs can be reconciled with low observed leverage ratios in a trade-off model of leverage. The estimated model is not only consistent with observed default rates and credit spreads, but also is able to match the cross section of leverage, including firms with low leverage, while still replicating the low observed default costs seen in the data.

In a broad sense, my work is related to a growing body of literature that considers the interactions of corporate financing decisions and asset prices. My approach to estimating firm-specific default costs and cash flow parameters is related to other recent papers estimating structural models.[2] A novel aspect of this paper is that I am able to estimate firm-specific parameters. In contrast, most related work estimates the parameters of a single representative firm.

More specifically, my work is related to a strand of empirical literature that seeks to measure the cost of distress or default. The existing literature has generally found the average default costs observed in the data to be relatively low. Andrade and Kaplan (1998) estimate distress costs of 10–23% of firm value for a sample of 31 highly leveraged transactions. Davydenko, Strebulaev, and Zhao (2012) estimate an average default cost of 21.7% of the market value of assets from a sample of 175 defaulted firms. Using a natural experiment resulting from asbestos litigation, Taillard (2010) isolates financial from economic distress and finds little of evidence of significant costs of financial distress.[3]

The relatively small average default costs observed in the data has led to the conclusion that many firms are too conservative in their choice of leverage. Miller (1977) notes that default and distress costs appear far too small, given estimated tax benefits to debt, to explain empirical leverage ratios. Graham (2000) estimates the tax benefits of debt up to 5% of firm value and concludes that from a trade-off model of leverage many firms appear, on average, under-levered.

Almeida and Philippon (2007) argue that default is more likely to occur in bad states when marginal utility is high. Using risk-neutral probabilities and the estimates of Andrade and Kaplan (1998), they conclude that firms are not, on average, under-levered. Elkamhi, Ericsson, and Parsons (2010) find that this calculation does not filter out economic shocks, which are unrelated to leverage, that drive the firm to default or distress. They show that, once the economic shocks are considered separately, the default cost estimates of Andrade and Kaplan (1998) are too low to account for the observed leverage ratios. The structural model that I use avoids this issue.

Using the marginal tax benefit estimates of Graham (2000), van Binsbergen, Graham, and Yang (2010) estimate firm-specific costs of debt under the assumption that firms are optimally levered. They conclude that approximately half of the cost of debt that they estimate is due to default or distress costs. My results suggest that, due to the sample selection bias, default costs account for a significantly larger component of a firm's total cost of debt.

Korteweg (2010) estimates the net benefits to leverage and, consistent with previous work, concludes that many firms are under-levered. Using firms at or near distress, he estimates distress costs of 15–30%. These firms at or near distress, however, are likely to be disproportionately those for which default costs were relatively low. George and Hwang (2010) also note that firms with high distress costs can be expected to choose low leverage to avoid distress. They argue that this provides an explanation for the distress risk and leverage puzzles observed in equity returns.

The model that I estimate is based on a class of structural models of capital structure and credit risk that build upon the seminal papers of Merton (1974) and Leland (1994).

[2] Recent examples include Hennessy and Whited (2007), Morellec, Nikolov, and Schürhoff (2012), and Nikolov and Whited (2010). The recent survey article of Strebulaev and Whited (2012) provides a very nice review of the corporate finance literature on dynamic models and structural estimation.

[3] Additional examples of work studying distress or default costs include Pulvino (1998), Franks and Torous (1989), Opler and Titman (1994), Gilson (1997), Ofek (1993), Asquith, Gertner, and Scharfstein (1994), Bris, Welch, and Zhu (2006), and Acharya, Bharath, and Srinivasan (2007).