Journal of Banking & Finance
Volume 27, Issue 6, June 2003, Pages 1001-1025

Pricing the risk of recovery in default with absolute priority rule violation

Haluk Unal, Dilip Madan, Levent Güntay

Show more

https://doi.org/10.1016/S0378-4266(02)00255-8
Get rights and content

Abstract

This paper proposes a simple approach to infer the risk-neutral density of recovery rates implied by the prices of the debt securities of a firm. The proposed approach is independent of modeling default arrival rates and allows for the violation of absolute priority rule. The paper demonstrates that a new statistic, the adjusted relative spread, captures risk-neutral recovery information in debt prices. Interest rates and firm tangible assets are shown to be significant determinants of the price of recovery. An application illustrates the pricing of credit derivatives written on the realized recovery rate.

Introduction

The risk-neutral density of recovery rates in default is a necessary input to pricing credit derivatives (Jarrow and Turnbull, 2000). In this paper we propose a method to extract the parameterized risk-neutral density of default conditional recovery rates from the optionality embedded in the prices of senior and junior debt of a firm. Our approach exploits the fact that relative prices of securities facing identical arrival risks but differing in their default conditional recovery rates are an important source of information on the price of recovery risk. Jarrow (2000) uses debt and equity prices to estimate simultaneously the risk-neutral default probability with constant recovery level. In contrast, our approach follows Madan and Unal (1998) and utilizes senior and junior debt prices to estimate risk-neutral recovery density as well as the risk-neutral default probability.

An important statistic developed in this paper that synthesizes recovery information from market prices is the adjusted relative spread (ARS). This is defined as the proportion of senior debt times the ratio of the difference between the prices of senior and junior debt to the difference between default-free and junior debt prices. We show that the ARS is free of default timing considerations, positively related to recovery levels and negatively related to the variance of the recovery distribution. Recognizing that senior recovery is aggregate recovery less that of the junior claimants, models for the ARS are completed on valuing recovery by the junior claimant conditional on default. Because the ARS equation is free of default timing risk, we term this equation the *pure recovery framework*. This equation is fundamental to market-based recovery investigations.

Implementation of the framework leads to the construction of a specific parameterized pure recovery model deriving a valuation formula for the default conditional recovery risk embedded in debt prices. Toward this end we follow Black and Cox (1976) and Stulz and Johnson (1985), and express the recovery rate to junior debt holders in terms of the payoff to a call option written on the aggregate default conditional recovery rate. We extend their approach by valuing this call option assuming absolute priority rule (APR) violation.[1] Hence, we are able to develop models for the market observed ARS in terms of the mean and variance of the aggregate recovery rate and parameters that capture APR violations. We show that an empirical model can be further developed by expressing the risk-neutral mean of aggregate recovery rate in default in terms of macro and firm specific variables.

Our empirical investigation follows two steps. First, we evaluate whether or not the cross-sectional variation in the ARSs reflects the variation of risk-neutral recovery rates. Noting that risk-neutral recovery rates are related to actual recovery rates adjusted downward for the effects of risk aversion, we anticipate that risk-neutral recovery rankings should be comparable to the rankings of physical recovery rates across firms, especially when risk-aversion adjustments are not firm specific. Hence, we compare ARS rankings with those obtained on the basis of actual recovery rates.

From the Lehman Brothers Fixed Income Data base we calculate ARSs for 28 firms identified from 10 different industries. With respect to actual recovery rates observed in practice we utilize Altman and Kishore (1996) estimates.[2] They report the estimates of the recovery rates on defaulted bonds stratified by standard industrial classification (SIC) sector. We show that both cross-sectionally and in the time series (for 48 consecutive months) rank orders based on ARSs agree with those based on actual recoveries. These findings confirm our basic contention that ARSs are capturing variations in risk-neutral recovery levels.

We next investigate the determinants of expected risk-neutral recovery rates. In this exercise we specify the mean aggregate risk-neutral recovery rate as a function of risk-free interest rates and the level of the tangible assets of the firm. We estimate the pure recovery model for 11 firms using time series data. ARSs are significantly related to interest rates and firm tangible assets. Parameter estimates reflecting the APR violation vary significantly across firms indicating that APR violation is not expected uniformly for all firms. As expected, risk-neutral mean recovery rates for the sampled firms lie below the physical recovery rate for the respective industry. This finding suggests that recovery risk is actually being priced by the market participants. Methods employing physical recovery estimates in pricing credit risk are thereby called into question as underpricing the credit risk. Given the widespread prevalence of these procedures we suspect that credit risk is being seriously mispriced by a lack of attention on the issues of risk-neutral recovery modeling. Hence, it is essential for correct pricing of credit risk that efforts be made to learn about risk-neutral recovery using market prices with embedded optionalities.

An important application of risk-neutral density estimation is the pricing of options on the underlying risk. The pricing of puts on recovery is an important credit derivative of which the binary credit default swap is an example (Hull and White, 2000). We couple our estimates of risk-neutral recovery densities with estimates of default probabilities inferred directly from market prices to derive prices for put options written on realized recovery levels. The pricing of excess losses is an important activity in the evaluation of credit risk from a sound economic perspective. In this regard we offer an easily implementable market-based methodology.

The paper is organized as follows: Section 2 develops the pure recovery model. Section 3 provides evidence that the ARSs reflect the variation of physical recovery rates in defaulted bonds. Section 4 proposes an empirical specification for the pure recovery model and provides the model estimates. Section 5 presents the details and results on pricing recovery contingent options. Appendix A concludes the paper.

Section snippets

The pure recovery model

We present a general statistic termed the ARS that one may derive from market prices and employ as a fundamental variable in recovery modeling. This statistic is defined in Section 2.1. An explicit model for pricing recovery contingent options is developed in Section 2.2. This model forms the basis of empirical investigations into the risk-neutral recovery density. In Section 2.3 we briefly summarize the comparative static results with respect to the ARS.…

Adjusted relative spreads and physical recovery rates

The pure recovery model relates the ARS, a particular construct of market prices, to the distribution of risk-neutral recovery. This suggests that ARSs should be related to physical recovery levels as we expect that risk neutral and physical recovery rates are related. Our empirical analysis first investigates whether ARSs, are at all related to physical recoveries in default. Next we take up the full fledged estimation of the proposed pure recovery model.…

Empirical specification

The relative spread model of Eq. (23) may be adapted to analyze the conjectured dependence of recovery rates on the business cycle and on appropriate firm specific information. For such an exercise we denote by x_t a time series on a vector of macro and firm specific variables that are presumed to affect recovery levels. We then consider the model$\mu_t = \beta_0 + \beta' \mathbf{x}_t$,and summarize the model of Eq. (23) by the relation $\mathbf{ARS}_t = \Phi(\lambda, \theta, \mu_t, \sigma, \mathrm{p_s}) + \varepsilon_t$,where it is supposed that the error term represents uncorrelated…

Conclusion

This paper proposes a parsimonious way to extract the parameterized risk-neutral density of default conditional recovery rates from data on a firm's senior and junior debt prices, the level of the senior debt, tangible assets, and risk-free interest rates. This is an important advance in understanding the determinants of default spreads as there is little possibility of direct observation of the quantities of interest, given the absence of the occurrence of the event, ex ante.

The empirical…

Acknowledgements

We are grateful for the comments received from participants at the Bank Structure Conference at the Federal Reserve bank of Chicago, May 1998, VIII Tor Vergata Financial Conference, University of Rome, December 1999, Washington Area Finance Association Meetings, April 2001 and European Finance Association Meetings, Barcelona, August 2001. Earlier versions of this paper were circulated under the title "A Simple Approach to Estimate Recovery Rates with APR Violation from Debt Spreads."...

References (19)

L.A. Weiss
Bankruptcy resolution: Direct costs and violation of priority of claims
Journal of Financial Economics (1990)

R.M. Stulz *et al.*
An analysis of secured debt
Journal of Financial Economics (1985)

J.R. Franks *et al.*
A comparison of financial recontracting in distressed exchanges and chapter 11 reorganizations
Journal of Financial Economics (1994)

E.I. Altman *et al.*
Do seniority provisions protect bondholders' investments?
Journal of Portfolio Management (1994)

E.I. Altman *et al.*
Almost everything you wanted to know about recoveries on defaulted bonds
Financial Analyst Journal (1996)

B.L. Betker
Management's incentives, equity's bargaining power, and deviations from absolute priority in Chapter 11 bankruptcies
Journal of Business (1995)

F. Black *et al.*
Valuing corporate securities: Some effects of bond indenture provisions
Journal of Finance (1976)

A.C. Eberhart *et al.*
Security pricing and deviations from the absolute priority rule in bankruptcy proceedings
Journal of Finance (1990)

A.C. Eberhart *et al.*
Does the bond market predict bankruptcy settlements
Journal of Finance (1992)

There are more references available in the full text version of this article.

Cited by (37)

Estimating the distribution of total default losses on the Spanish financial system

2014, Journal of Banking and Finance

> *Citation Excerpt :*
>
> …In more detail, this author focused on the meaning of the LGD and its role in the internal ratings based (IRB) approach, described the main factors that can drive LGDs, and discussed several approaches that can be applied to model and estimate the LGD. See also Carey (1998), Altman and Suggitt (2000), Amihud et al. (2000), Thorburn (2000), Unal et al. (2003), and Altman et al. (2005), among others, for details on the LGD main characteristics. As Schuermann (2004) stated in its Section 7, "the factors (or drivers or explanatory variables) included in any LGD model will likely come from the set of factors we found to be important determinants for explaining the variation in LGD.…

Show abstract

Is recovery risk priced?

2014, Journal of Banking and Finance

> *Citation Excerpt :*
>
> …Zhang arrives at economically meaningful results, assuming additionally that recovery rates are constant over time. Another approach, suggested by Madan and Unal (1998), Unal et al. (2003), Le (2007), and Song (2008), derives equations that are entirely free of either default or recovery risk. In the first case (Madan and Unal, Unal et al.), this is achieved by relating the priority of junior and senior debt holders' claims to proxies of issuers' capital structure.…

Show abstract

Transatlantic systemic risk

2013, Journal of Banking and Finance

> *Citation Excerpt :*
>
> …For example, stocks frequently trade at a non-zero price even after the underlying firm has defaulted on debt payments. This effect points at violations of the absolute priority rule, which has been documented by Unal et al. (2003). On the other hand, CDS might also reflect factors other than the underlying entity's default risk.…

Show abstract

Predicting LGD distributions with mixed continuous and discrete ordinal outcomes

2020, International Journal of Forecasting

Show abstract

The Term Structure of Expected Recovery Rates

2018, Journal of Financial and Quantitative Analysis

The cross section of recovery rates and default probabilities implied by credit default swap spreads

2014, Journal of Financial and Quantitative Analysis

Recommended articles (6)

Research article

The advantage of relative priority regimes in multi-class multi-server queueing systems with strategic customers

Operations Research Letters, Volume 45, Issue 5, 2017, pp. 498-502

Show abstract

Research article

On the linear-quadratic regulator problem in one-dimensional linear fractional stochastic systems

Automatica, Volume 50, Issue 1, 2014, pp. 282-286

Show abstract

Research article

Data revisions and periodic properties of macroeconomic data

Economics Letters, Volume 120, Issue 2, 2013, pp. 139-141

Show abstract

Research article

How interdependent are Eastern European economies and the Euro area?

The Quarterly Review of Economics and Finance, Volume 58, 2015, pp. 18-31

Show abstract

Research article

Increasing marginal costs are strategically beneficial in forward trading

Economics Letters, Volume 119, Issue 2, 2013, pp. 109-112

Show abstract

Research article

No free lunch: Fundamental tradeoffs in macroeconomic policy

Economic Analysis and Policy, Volume 51, 2016, pp. 104-121

Show abstract

View full text