Correlation of Default and Recovery Rates on Corporate Debt

By Bruce G. Stevenson

Does probability of default correlate to recovery rate?

The relationship between default rates and recovery rates on corporate debt has received considerable attention in recent years. Most observers highlight the correlation between annual default rates in the U.S. corporate bond market and the average annual recovery rates for such bonds.[1] This correlation has prompted a debate on how to capitalize the risk of loss in portfolios of commercial credit, including whether the forthcoming revision of the new accord on bank capital adequacy (Basel II) should include an incremental capital charge for "downturn LGDs (loss given default)."

A consensus appears to be emerging around the idea that there is a deterministic relationship between the probability of default ("PD") by an issuer of corporate debt (including borrowers from banks) and the LGD on the credit instrument (although some have challenged this notion[2]). For example, a number of mathematical models have been developed that rely on a systematic and deterministic relationship between these two variables,[3] often tied to expectation that PD and LGD are explicitly linked to macroeconomic forces.

In this article, I will demonstrate that it is possible to create a correlation between PD and LGD solely as the outcome of the rational behavior of commercial credit investors. This argument presupposes that recovery rates on defaulted debt (the inverse of LGD) are simply the result of the agreement on price between buyers and sellers, *if and when they trade defaulted debt*. Correlation between PD and LGD is the result of supply and demand of traded defaulted debt that govern its price.

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However, it does not follow that PD and LGD should be correlated among defaults *that are held by the original investor*. In this case, the LGD realized by such an investor will simply be the outcome of the cash flows realized on each asset. A correlation between PD and LGD may occur in such cases but it doesn't have to occur.

What Is LGD?

At the outset, it is useful to define LGD. According to Maclachlan (2004), LGD is best expressed as:

$$LGD = 1 - EAD^{-1}\sum C_t / (1 + r_t + \delta)^t \qquad (1)$$

in which EAD is the exposure at default, r is the risk-free rate of return, δ is a fixed risk premium and C_t is the cash flow at time t, including payments made by the borrower and cash generated from assets sales net of internal and external costs. For defaulted debt that is not traded, LGD thus is measured as the present value of principal payments made by the borrower or asset sales by the lender/investor, per equation 1. For defaulted debt that does have a secondary market, LGD can also be reflected in the trading price:

$$LGD = Par - Trading\ Price \qquad (2)$$

Is δ Fixed? An interesting question, which we explore later, is whether δ truly is fixed for an individual

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investor or whether it can vary. The answer will be important in our consideration of PD-LGD correlation. Certainly, even if each investor has his or her own, fixed risk premium, different investors may have different risk premiums. The average risk premium in the market will vary over time as the composition of investors in defaulted debt changes.

Trading of Defaulted Assets

The argument that a correlation of default rates and recovery rates should occur on traded assets is founded on the following line of logic:

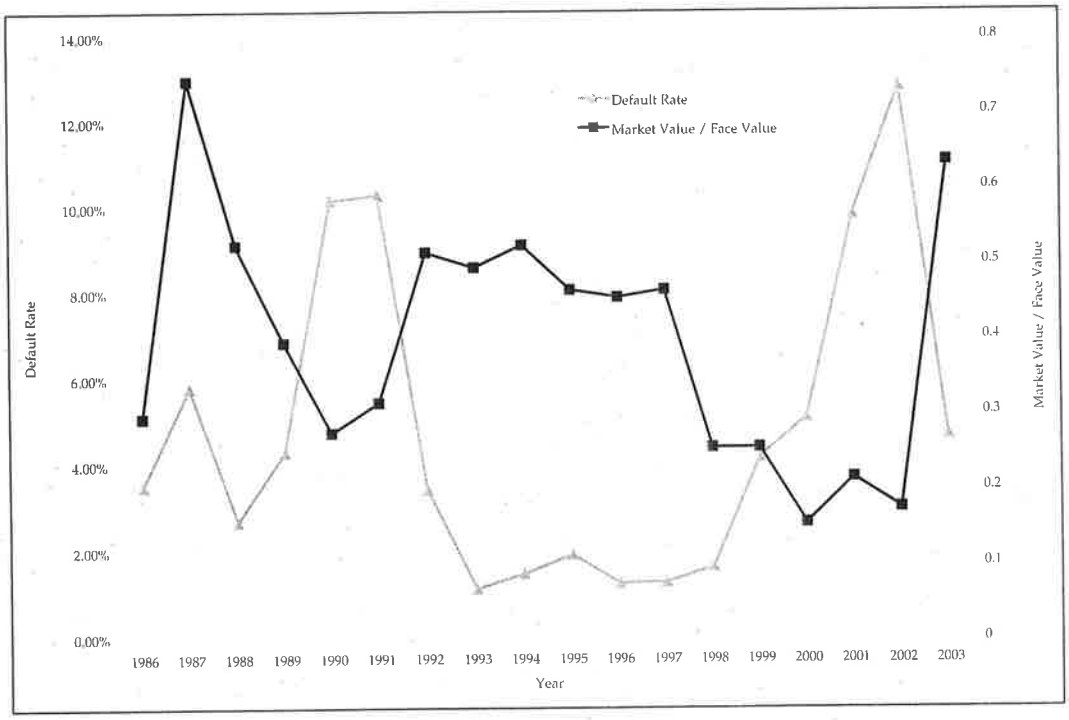
- The trading price on defaulted debt represents the point of agreement between buyer and seller. We can expect that potential buyers will bid on defaulted debt at prices that yield their expected rate of return. We can expect sellers to offer at a price that minimizes their losses. The resulting gap will be closed based on the motivations of one or both parties to move in the direction of the other.[4] Thus, a sale of a defaulted loan or bond represents agreement between the parties on the value of δ.
- Notably, the seller does not have to sell, especially if it is a bank with a defaulted loan. The seller can simply hold the asset for any cash flows that might be realized, and losses are simply the par value of the asset minus the present value of these payments, per equation 1. Banks have workout departments in order to maximize value on defaulted loans that they hold.
- With increasing risk in the market, such as elevated default rates, the uncertainty of short-term return increases for individual defaults, since repayments to the note holder become less certain. The result of such increased uncertainty is that bidders will apply larger discounts to their expectation of cash flows and thus bid at lower levels. In effect, δ will increase.
- If a motivated seller is willing to meet these aggressive bid prices, recoveries based on actual sales will be lower in riskier markets than in markets with less risk.
- In cases of actual trades then, we should expect to see a correlation between recovery rates (trading prices) and default rates (which create the supply of defaulted debt and are a form of market risk that is reflected in buyers' bid prices). In short, investor behavior will create a PD-LGD correlation for traded assets subject to varying levels of risk premiums. No other governing forces are required.

Let's look at these points.

Bid and Offer Prices on Defaulted Debt

The market for defaulted debt is not an actively traded market, in which bid and offer prices are

Exhibit 1 Defaulted U.S. Corporate Debt



Source: E.I. Altman, *Market size and investment performance of defaulted bonds and bank loans: 1987-2002*, 13 J. APPLIED FINANCE 2 (2003), at 43–53.

regularly quoted by dealers or market makers. Instead, it is an essentially private market, composed of bilateral transactions, that ebb and flow with levels of default in the market.

The two exceptions are the market for trading in defaulted U.S. corporate bonds and the much smaller market for trading in defaulted bank loans (United States only). We can gain a sense in the changes in market prices by looking at the change in the ratio of the market value of this debt to its face value (Exhibit 1). In general, this ratio moves inversely with the level of default rates for corporate debt (correlation coefficient = – 0.464), implying that market prices rise and fall partly with the supply of defaulted debt.

This natural relationship of supply, demand and price leads to an equally natural correlation of default rates and recovery rates. As default rates increase, the supply of defaulted debt increases. With a fixed demand for defaulted debt, prices should fall with the increased supply. As such, LGD will increase with increasing supply of defaulted debt.

Sell or Hold Defaulted Debt?

The holder of a defaulted loan or bond has two choices: hold the asset to receive recoveries of cash payments from the borrower or from the sale of collateral (if it is secured), as per equation 1, or sell the loan or bond to another investor, with the sale price determining the LGD, as per equation 2.

It is possible to create a correlation between PD and LGD solely as the outcome of the rational behavior of commercial credit investors.

The motivation of the seller is a function of his or her perception of the size of future cash flows on the defaulted asset (C in equation 1) and the uncertainty of those cash flows (δ in equation 1). If the seller is more optimistic than the bidder (seller's estimate for C is higher or value for δ is lower), the seller will hold. If the seller is more pessimistic (C is lower or δ is higher) or the seller's view matches that of a bidder, we can expect a sale.

If the seller's view matches that of a bidder (agreement on C and δ), the seller can be expected to hold, since transaction costs associated with the sale will effectively lower C. For example, Maclachlan (2004) shows that, for defaulted loans to small and medium enterprises, the discount rate (δ) is close to the contractual interest rate on the loans. As such, a potential seller has an incentive to hold the debt since the uncertainty of cash flows is very modest.

Kelhoffer *et al.* (2005) demonstrated that ultimate recovery rates on defaulted corporate debt often typically are higher than the recoveries implied by trading prices 30 days following default.[5] The market risk premium, thus, can be higher than the actual volatility of cash flows warrants. Loan workouts, then, are an exercise in value optimization.

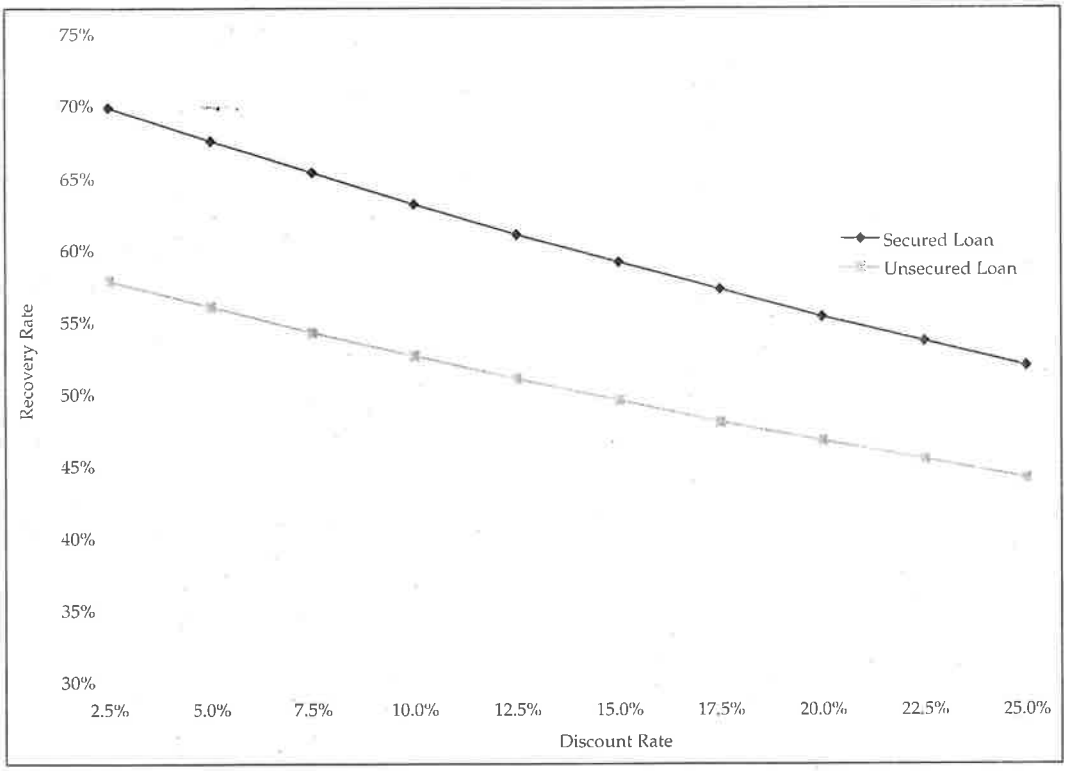
Risk Premiums on Defaulted Debt

As shown above, the correlation between default rate and LGD is a natural consequence of supply of, and demand for, defaulted debt. Risk premiums (δs) can remain constant and this correlation will still occur.

However, we expect that risk premiums change with market conditions, such as increasing default risk,[6] and such changes will enhance the correlation between default rate and LGD. For example, the number and type of potential investors in defaulted debt will vary with the credit cycle, causing the average risk premium in the market to change. So-called vulture investors, which are active investors in defaulted debt, become more numerous in markets with high default rates.[7] They expect internal rates of return (IRR) on investments of 20 percent and 25 percent, often much higher than the IRR of the holder of the asset prior to default. When vulture investors are numerous, the average risk premium in the market will increase.

Further, one can argue that the risk premium for an individual investor in defaulted debt will vary with the level of risk in the market. That is, as default rates go up, the investor's level of uncertainty about returns will go up and therefore the risk premium (discount rate) will increase. The investor's bid prices on defaulted debt should then fall as market risk increases. If deals are done at these prices (how motivated is the seller?), then recovery rates should fall.

Exhibit 2 Recovery Rates on Defaulted Commercial Loans



Source: Cash flow data from Araten et al., 2004, and present value produced by the Recovery Rate Simulator of Stevenson Associates, LLC.

Seller Motivation and the Pricing of Defaulted Debt

While it is obvious that present values of defaulted debt will vary as discount rates vary, the impact that discount rates (risk premiums) have on the value of defaulted debt is less obvious. Exhibit 2 shows the range in value of both secured and unsecured bank loans under expectations of risk by sellers and buyers of such debt and shows how recovery rates to banks might fall with the presence of vulture investors in a distressed market.

Let's assume that the vulture investor discounts the future cash flows on a defaulted loan at 25 percent and the bank holding the loan discounts the same cash flows at 7.5 percent (the original contractual interest rate). For a typical secured loan, the vulture investor will estimate a value of 52 cents on the dollar while the bank will see a value of 65 cents. For an unsecured loan, the estimated values will be 44 cents and 54 cents, respectively. The vulture investor's estimate of value will be only 80 percent of the bank's estimate of value.

If the seller of defaulted debt is motivated, he or she will be receptive to the bid price, even if it's aggressive. The recent history of banking is replete with examples of banks that sell nonperforming loans for half (or less) of their face value in order to clean up their balance sheets. Bulk loan sales and collateralized debt obligations consisting of distressed loans are two vehicles that banks have used for this purpose. Such discounts are typical for all illiquid markets.[8]

Vulture investors ... become more numerous in markets with high default rates.

If the seller is not motivated, the value gap will not close and no trade will occur.

It becomes obvious, then, that if recovery rates are defined based on trading prices (that is, when buyer and seller agree), then a default rate/recovery rate correlation is very likely since distressed debt investors will be numerous in periods of high defaults and less numerous in periods of low defaults.

Behavior of Nontraded Debt

If defaulted assets are not traded, there is no *a priori* reason to expect a strong PD-LGD correlation. In

fact, studies of recoveries on defaulted private debt report mixed results: Some show correlation between default rate and recovery rate and some do not.

There are several reasons for this phenomenon. First, actual recovery on a defaulted asset should be specific to the asset itself (loan to value [LTV], seniority, *etc.*). Numerous studies have demonstrated that collateral and seniority are important discriminators of recovery on defaulted corporate bonds and loans.[9] The investor holding such assets (for example, bank workout department) will realize value as collateral is sold or as payments are made by the borrower.

Second, variability of LGD is very high, reflecting characteristics that are idiosyncratic to individual defaults.[10] As noted above, one can easily segment defaulted loans and bonds according to collateral, seniority and industry. Typically, however, the range of variability does not shrink within the resulting categories.

In short, if the investor chooses to hold the defaulted asset, he or she will incur recoveries commensurate with the specific characteristics of that asset.

Linkage of Corporate Debt Recoveries to Macroeconomic Forces

Some authors have argued that the correlation of default rates and recovery rates on traded corporate debt, such as public bonds, is due to underlying economic forces.[11] When the economy contracts, companies' operations contract, cash flows to service debt become limited, and their risk of default increases. At the same time, the value of the collateral backing secured loans falls, leading to lower recovery rates for lenders. When the economy expands, the reverse occurs: Companies' operations improve, cash flow to service debt increases, defaults fall, and collateral values improve.

Mine is an alternative view: Supply and demand for defaulted debt are the deterministic forces leading the PD-LGD correlation. Recovery rates fall as the supply of defaulted debt exceeds the demand and *vice versa*. This relationship is accentuated by the ebb and flow of vulture investors in the market, investors who have a tendency to offer low bids on tradable defaulted debt.

If defaulted assets are not traded, there is no *a priori* reason to expect a strong PD-LGD correlation, because the recoveries on the defaulted asset should be specific to the asset itself (LTV, seniority, *etc.*) rather than market forces.

Endnotes

1 For example, E.I. Altman, B. Brady, A. Resti and A. Sironi, *The Link Between Default Rates and Recovery Rates: Theory, Empirical Evidence and Implications*, 78 J. Bus. 6 (2005), at 2203–28; G.M. Gupton, D. Gates and L.V. Carty, *Bank Loan Loss Given Default*, Moody's Investor Service (2000); D.T. Hamilton, P. Varma, S. Ou and R. Cantor, *Default and Recovery of Corporate Bond Issuers. A Statistical Review of Moody's Ratings Performance, 1920–2003*, Moody's Investor Service (2004).

2 B.G. Stevenson, *Corporate Debt Defaults and Recoveries: Are They Really Correlated?* (working paper, 2005).

3 A. Chabaane, J.P. Laurent and J. Salomon, *Double Impact: Credit Risk Assessment and Collateral Value*, (working paper, 2004); D. Tasche, *The Single Risk Factor Approach to Capital Charges in the Case of Correlated Loss Given Default Rates* (working paper, 2004); G. Giese, *The Impact of PD/LGD Correlations on Credit Risk Capital*, Risk 18 (2005), at 79–84.

4 I. Maclachlan, *Choosing the Discount Factor for Economic LGD* (working paper, 2004).

5 K. Kelhoffer, D.C. Schwartz and J. Zennario, *Standard and Poor's Recovery Highlights of 2004*, Standard and Poor's Risk Solutions (2005).

6 A. Berndt, R. Douglas, D. Duffie, M. Ferguson and D. Schranz, *Measuring Default Risk Premia from Default Swap Rates and EDFs* (working paper, 2005); S.M. Denzler, M.M. Dacorogna, U.A. Muller and A.J. McNeil, *From Default Probabilities to Credit Spreads: Credit Risk Models Do Explain Market Prices* (working paper, 2005).

7 E.I. Altman, *Market Dynamics and Investment Performance of Distressed and Defaulted Debt Securities* (working paper, 1998).

8 J. Ericsson and O. Renault, *Liquidity and Credit Risk* (working paper, 2001).

9 For example, M. Araten, M.J. Jacobs, Jr. and P. Varshney, *Measuring LGD on Commercial Loans: An 18-Year Internal Study*, 86 RMA Journal 8 (2004), at 96–103; G.M. Gupton and R.M. Stein, *Losscalc V2: Dynamic Predication of LGD*, Moody's Investor Service (2005).

10 Stevenson, *supra* note 2

11 For example, J. Frye, *Collateral Damage*, Risk 13 (2000), at 91–94; J. Frye, *A False Sense of Security*, 16 Risk (2003), at 63–67.