Determinants of Recovery Rates on Defaulted Bonds and Loans for North American Corporate Issuers: 1983-2003

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Research on the determinants of recovery in default of corporate bonds and loans has grown enormously in recent years, and with good reason. Estimates and forecasts of recovery in the event of default are key inputs into market pricing and portfolio selection, including value at risk and cheapest to deliver option pricing, and in the ratings of many structured finance securities. Yet findings are mixed on the significance of several intuitively important factors.

We systematically explore the impact of many macroeconomic, industry-specific, and firm-specific factors that influence recovery rates on defaulted corporate bonds and loans. We analyze the univariate effect of each factor on recovery rates, as well as their impact in a multivariate regression model. The results show that many factors with a significant univariate effect are not important once other factors are controlled for.

Our approach is heuristic. Rather than trying to find the best statistical model to predict recovery rates, we attempt to discover the factors that have been historically significant through multiple regression analysis.

In addition to showing that seniority and security are the two most important factors impacting recovery rates, followed by debt cushion, leverage, and asset tangibility, we also document statistically significant correlation between recovery rates and market-to-book value of assets for defaulting issuers as well as for their industries. Firm earnings and stock returns prior to default are positively correlated with recovery rate (but not statistically significantly).

For industry and macroeconomic factors, we find that industry equity returns and market-to-book ratios are positively correlated with recovery rates. The average industry debt rating, estimated as the average ratings of issuers weighted by the amount of debt, is also positively correlated with recovery rates. Capacity utilization is positively but weakly correlated with recovery rates. We do not find any correlation between industry concentration and recovery rates.

Like Altman et al. [2006], we document that aggregate default rates influence recovery rates. When default rates are high, recovery rates on defaulted loans and bonds tend to be low. In addition, we find that recovery rates are negatively correlated with prevailing spreads, even after accounting for increased default rates. Lastly, we find that a strong macroeconomic environment, as proxied by rapid economic growth and high stock market returns, is positively correlated with recovery rates.

I. DATABASE

The sample for the study is drawn from Moody's proprietary default database of rated bond and loan issuers between 1983 and 2003. Our measure of recovery rate is the 30-day post-default observed price for North Amer-

ican firms (U.S. and Canadian). Pricing data come from various sources, including Reuters, Bloomberg, LPC, and Goldman Sachs. Annual accounting information is obtained from the Compustat database.

Stock price data are obtained from a variety of public sources. When closing trade prices for stocks were unavailable, the average of the closing bid and ask prices is used to estimate the closing price.

Although about 2,000 corporate issuers defaulted over the 21-year sample period, our final data set is limited to about 1,100 issuers for which we could obtain complete financial information prior to default, leaving us with roughly 1.4 security types per issuer.[1]

Definition of Default

For an issuer and its securities to be included in our sample of defaulted bonds and loans, the issuer must have been categorized as being in default according to Moody's definition. Moody's default definition includes three types of credit events:

1. A missed or delayed disbursement of interest and/or principal, including delayed payments made within a grace period.
2. Filing for bankruptcy, administration, legal receivership, or other legal blocks to the timely payment of interest or principal (perhaps by regulators).
3. A distressed exchange when: a) the issuer offers bondholders a new security or package of securities that represent a diminished financial obligation (such as preferred or common stock, or debt with a lower coupon or par amount, lower seniority, or longer maturity); or b) the exchange has the apparent purpose of helping the borrower avoid default.

The definition of a default is intended to capture events that change the relationship between the bondholder and bond issuer from the relationship that was originally contracted, and that subject the bondholder to an economic loss. Technical defaults (such as covenant violations) are not included in Moody's definition of default.

Definition of Recovery Rate

The recovery rates we report are based on the 30-day post-default bid prices as a percentage of face value, except in the case of distressed exchanges, where we use the trading prices of exchanged instruments two weeks prior to the exchange. This allows us to capture the recovery price prior to exchange but after announcement of the offer. Recovery rates are expressed as a fraction of face (par) value.[2]

Many firms in our sample have more than one defaulted bond or loan issue with the same seniority ranking. To avoid placing undue emphasis on issuers with many bonds or a high nominal volume of bonds outstanding, we use as the primary unit of analysis the *par debt value-weighted recovery rate* for each seniority class for each firm. That is, for each security or seniority class of each issuer, we estimate the par weighted-average recovery rate, so that each debt class of each issuer appears once in the sample.

II. ANALYTICAL METHODOLOGY

We explore the determinants of recovery rates through both univariate and multivariate analysis. In the univariate analysis, we simply compare the average recovery rates across groups that vary by a single dimension such as seniority or initial default event. When the variable of interest is continuous, such as leverage or aggregate default rates (a macroeconomic variable), we divide the data set into three groups representing issuers that are associated with the high, medium, or low realizations of the variable of interest.

We then consider two multivariate models. In one case, we include all the variables of interest as dummy variables in a single regression with intercept. In the other, we use the *continuous* variables.

This approach serves several purposes. First, it allows us to investigate the impact of each factor on recovery rates. Second, the simplification of variables in the *low, medium*, or *high* categories allows us to present our results visually and in a succinct fashion. It also lets us compare the impact of each variable in the univariate setting and then the impact of the same variable in the multivariate setting. This comparison may be useful for quickly estimating which factors maintain explanatory power across various settings.

Although for most of the discussion we consider recovery rates in the event of all kinds of defaults, we also present results for a subsample of firms that filed for Chapter 11. The effects of the various explanatory variables appear to be more pronounced on this portion of the data set.

We analyze each explanatory variable, one at a time, and compare the univariate results with the estimated

effects for that variable drawn from the multivariable regression with dummy variables.

III. DESCRIPTIVE STATISTICS

Exhibit 1 presents the annual average recovery rates, defaulted amounts, and default counts for all defaulted instruments in the study. The mean recovery rate for the sample was 39.5% of par (median 36.6%) with a standard deviation of 24.3%. One can see there is considerable variation in recovery rates across time. Recovery rates are low in periods of high default rates, such as in the years 1990 and 2001. The appendix provides more information on sample distribution.

The mean total default amount for the sample was US$443 million (median US$130 million). The standard deviation of total default volume is extremely high at US$1.1 billion, over twice the mean. The highest number of defaults occurred in 2001, while the highest default amounts occurred in 2002.

IV. SENIORITY AND INITIAL DEFAULT EVENT

Exhibit 2 describes the impact of priority in the capital structure on recovery rates. Secured bank loans are assumed to be the most senior, followed by equipment trust certificates, senior secured bonds, senior unsecured loans, senior unsecured bonds, and subordinated bonds (which include junior subordinated, senior subordinated, and other subordinated bonds). Exhibit 2 shows that senior secured loans recover 28.9% more value than do senior unsecured bonds in the univariate analysis, and 29.8% more in the multivariate analysis that takes many other factors into consideration.

It is not surprising that seniority plays a significant role in determining recovery in default. The average recovery rate for all issues is 39.5% of the par value, but average recovery rates for different seniorities vary widely. For example, recovery rates for senior secured bank loans are 75% higher than those for senior unsecured bonds, while subordinated bonds recover about 20% less than senior unsecured bonds. Other point estimates also indicate intuitive and statistically significant differences.[3]

In a multivariate setting using discrete dummy variables, the estimates of the conditional means change (in this case are lower), but the sign, the relative magnitude, and the significance still point to the fact that seniority and security remain very important factors in determining recovery. The continuous-variable model below also shows the significance of security and seniority in a multivariate regression framework.

Does the severity of the default for each type of

EXHIBIT 1

Summary Statistics for Defaulting Issuers in the United States and Canada

	Recovery Rates			Defaulted Amount			
Year	Mean	Median	STD	Mean	Median	STD	NOBS
1983	47.1	47.3	13.3	75.5	22.1	137.7	14
1984	47.8	44.5	19.6	47.6	28.7	47.0	15
1985	45.2	40.4	19.7	98.9	65.0	119.4	17
1986	49.9	48.9	20.6	103.6	54.0	152.0	34
1987	49.4	48.5	25.3	292.9	58.2	804.9	30
1988	38.2	35.0	18.0	150.3	61.3	227.6	30
1989	31.5	30.3	21.3	165.5	61.0	261.8	55
1990	28.7	26.4	18.7	226.9	100.0	356.7	86
1991	38.2	37.1	24.0	197.0	86.3	288.8	79
1992	46.6	46.0	23.4	167.5	94.7	191.1	38
1993	48.7	44.9	25.2	106.0	43.1	144.3	28
1994	51.4	52.7	17.3	195.7	125.0	177.1	21
1995	52.5	48.8	21.5	272.0	157.4	291.0	40
1996	53.9	63.0	27.9	316.7	163.3	461.2	16
1997	48.2	49.0	26.7	221.3	109.1	341.9	26
1998	42.2	42.0	26.8	249.7	125.0	359.3	55
1999	39.4	33.2	24.6	459.6	167.5	762.9	82
2000	35.6	29.4	26.5	457.9	180.5	798.4	112
2001	33.7	27.3	24.9	801.4	203.2	1722.1	156
2002	39.0	34.5	24.7	1270.4	437.7	2907.0	98
2003	41.5	39.0	24.3	521.7	200.0	779.6	52
Sample Stats	***39.5***	***36.6***	***24.3***	***443.2***	***130.1***	***1,223.5***	***1,084***

default, that is, the type of default event, have an impact on recovery rates? Grace period defaults—which occur when interest payments are not made on time but are eventually made within a specified grace period—do experience higher-than-average recovery rates, particularly compared to defaults associated with bankruptcy filings. Even grace period defaults, though, recover less than 60 cents on the dollar on average because they are common among issuers experiencing financial distress, whose bonds often trade well below par.

Exhibit 3 shows the impact of initial default event on average recovery rates. Both univariate and multivariate results are presented, along with the standard error of the estimates.

Average recovery rates vary with the initial default event. For example, grace period defaults and distress exchanges experienced higher average recovery rates. Grace period defaults and distressed exchanges were associated with loss severity rates that averaged roughly 50% of the face value of the bond, while missed interest payments averaged losses in excess of 65%.

The univariate findings are generally confirmed in the multivariate setting. For distressed exchanges and grace period defaults, however, the recovery rates are significantly higher in the multivariate setting.

V. FIRM-SPECIFIC CHARACTERISTICS

Firm specific-characteristics may also play a significant role in explaining variation in recovery rates. We focus our analysis on a limited set of variables:

- Debt cushion below.
- Leverage.
- Market-to-book ratio of total assets.
- Tangibility.
- Earnings.
- Stock returns.

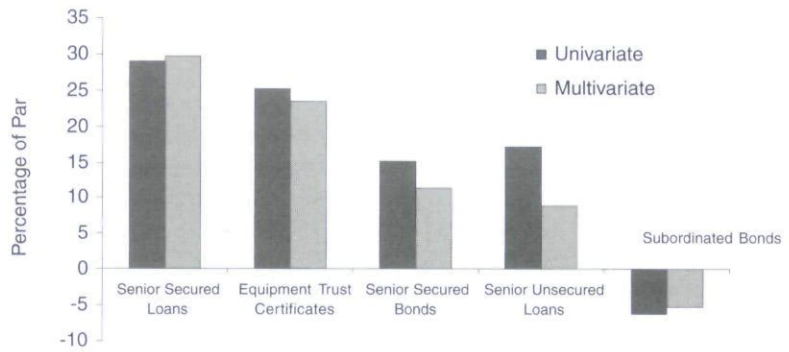
Exhibit 4 presents results on the impact of these firm-specific variables.

Debt Cushion Below

The results on security class in Exhibit 2 demonstrate that securities designated as senior tend to recover more than securities designated junior, but the relative shares of different types of debt in the capital structure should matter as well. The higher the debt cushion below (DCB)—that is, the greater the amount of debt junior to one's own claim—the greater the amount one might expect to

EXHIBIT 2

Recovery Rates Relative to Senior Unsecured Bonds

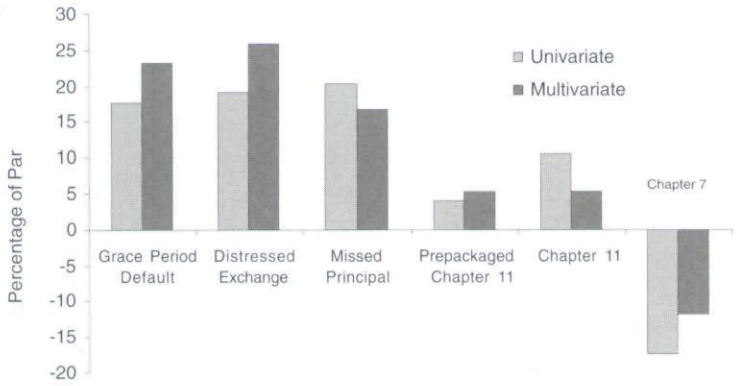


Seniority	Univariate		Multivariate	
	Estimate	*SE*	*Estimate*	*SE*
Senior Secured Loans	28.9	2.3	29.8	8.2 *
Equipment Trust Certificates	25.1	7.2	23.4	4.1 *
Senior Secured Bonds	15.1	2.5	11.3	3.9 *
Senior Unsecured Loans	17.2	5.1	9.0	3.5 *
Subordinated Bonds	-6.1	1.5	-5.3	2.1 *

** Standard error of the difference of the mean relative to the senior unsecured bond mean, which is 37%.*

EXHIBIT 3

Recovery Rates by Initial Default Event Relative to Missed Interest Payment



Initial Default Event	Univariate		Multivariate		
	Estimate	*SE*	*Estimate*	*SE*	ß
Grace Period Default	17.8	3.9	23.3	5.8	*
Distressed Exchange	19.1	2.7	25.8	3.6	*
Missed Principal	20.5	4.6	16.9	6.4	*
Prepackaged Chapter 11	4.0	1.5	5.2	2.1	*
Chapter 11	10.4	5.3	5.2	6.5	*
Chapter 7	-17.3	10.4	-11.8	4.3	*

** Standard error of the difference of the mean relative to the missed interest payment mean, which is 33.7%.*

recover, and hence the higher the expected recovery rate. The deeper the debt cushion, the more assets will likely be available for distribution to more senior claimants. Hence, we expect the coefficient of debt cushion to have a positive sign in the specification.[4]

The estimation of debt cushion below is straightforward. It is the ratio of the face value of a claim to the total debt below it. For example, the debt cushion for the senior unsecured class is the ratio of the sum of all senior unsecured bonds to the sum of all bonds junior to the senior unsecured bonds and preferred stock.

We use two data sources to estimate these factors. The first one is the Moody's default database, where all public debt information is recorded in the event of a default. The second is the Compustat database for industrial and financial firms. In the latter case, we take a more granular approach to non-debt claims. Claims such as accounts receivable are classified as the highest unsecured debt in the capital structure. Capitalized leases are considered part of secured claims, and so are all taxes payable. Results presented in Exhibits 4 and 5 use the first estimate for convenience (the economic significance does not change).

Not surprisingly, debt cushion below is statistically and economically a very significant variable that explains recovery rates. For issues with low debt cushion, the recovery rate is roughly 31%; for issues with high debt cushion (more than 60%) recovery rates are 80% higher.

The explanatory power of debt cushion below drops slightly in the multivariate setting. For example, for issues with low debt cushion, the recovery rates inch up to 33% in a multivariate setting, while for issues with medium and high debt cushion recovery rates are lower although not very significantly.

Leverage

Leverage prior to default may also affect recovery rates in a fashion similar to debt cushion below. Higher leverage may imply that the pie has now to be shared among more debtholders in the event of default. Lower leverage, on the other hand, will improve the chances that all debtholders, regardless of seniority, may enjoy higher recoveries.

We present the impact of leverage—measured by the ratio of all publicly traded debt to total assets at the fiscal year-end prior to default—on recovery rates in Exhibit 4, Panel B. Leverage does indeed appear to affect recovery rates; companies with higher leverage have lower average recoveries, although the difference is not as striking as that observed between debt issues with small and large

EXHIBIT 4

Effect of Firm Factors and Recovery Rates on Loans and Bonds

Panel A

Impact of Debt Cushion on Recovery Rates

Debt Cushion	Criterion	Univariate		Multivariate		
		Estimate	*SE*	*Estimate*	SE	
Low	< 0.15	-8.0	1.2	-5.8	4.1	*
High	> 0.60	15.5	2.4	7.0	2.6	*

** Standard error of the difference of the mean relative to the medium debt cushion subsample mean, which is 39.2%.*

Panel B

Impact of Leverage on Recovery Rates

Leverage	Criterion	Univariate		Multivariate		
		Estimate	*SE*	*Estimate*	*SE*	
Low	< 0.35	3.2	1.4	3.5	4.1	*
High	> 0.65	-1.7	2.5	-2.4	2.5	*

** Standard error of the difference of the mean relative to the medium leverage subsample mean, which is 39.5%.*

Panel C

Impact of Market to Book of Assets on Recovery Rates

Market-to-Book	Criterion	Univariate		Multivariate		
		Estimate	*SE*	*Estimate*	*SE*	
Low	< 0.95	-1.8	1.9	-0.6	4.1	*
High	> 1.25	3.2	2.2	4.9	2.5	*

** Standard error of the difference of the mean relative to the medium market-to-book of assets subsample mean, which is 37.3%.*

Panel D

Impact of Tangibility on Recovery Rates

Tangibility Dummy	Criterion	Univariate		Multivariate		
		Estimate	*SE*	*Estimate*	*SE*	
Low	< 0.37	-3.25	1.56	-1.9	4.1	*
High	> 0.65	6.29	2.45	6.7	2.4	*

** Standard error of the difference of the mean relative to the medium tangibility subsample mean, which is 37.8%.*

Panel E

Impact of Earnings on Recovery Rates

Earnings	Criterion	Univariate		Multivariate		
		Estimate	*SE*	*Estimate*	*SE*	
Low	< 0.05	-8.64	1.6	-1.8	4.1	*
High	> 0.15	-3.56	2.4	-1.5	2.3	*

** Standard error of the difference of the mean relative to the medium earnings subsample mean, which is 42.1%.*

Panel F

Impact of Stock Returns on Recovery Rates

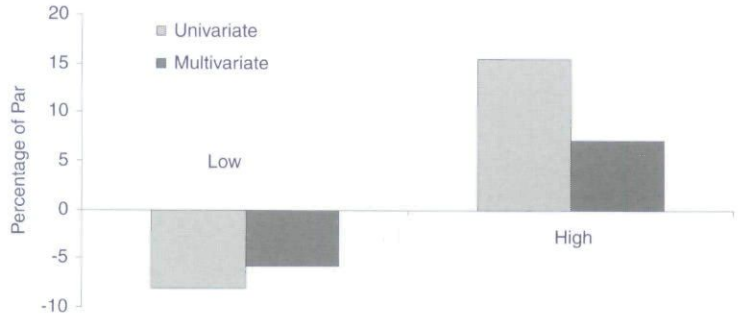
Stock Returns	Criterion	Univariate		Multivariate		
		Estimate	*SE*	*Estimate*	*SE*	
Low	< -0.55	-1.8	1.4	-1.3	4.1	*
High	> -0.40	0.8	2.9	-1.0	2.6	*

** Standard error of the difference of the mean relative to the medium stock returns subsample mean, which is 39.3%.*

EXHIBIT 5

Relative Recovery Rates by Debt Cushion

(medium debt cushion average = 39.2%)



debt cushions below. The difference between recovery rates for firms with low leverage and for firms with high leverage is about 5% of the face value of the debt, which is statistically significant. Issues of firms with low leverage recover roughly 15% more than issues of firms with high leverage.

The difference in average recoveries for low-leverage and high-leverage firms is similar in the multivariate setting, although the point estimates are slightly lower.

Market-to-Book Values of Assets

Market-to-book values of assets (also known as the Q ratio)—calculated as the sum of the market value of equity plus the book value of debt divided by the book value of assets—may also impact recovery rates. All else equal, the higher the market's valuation of a firm's assets prior to default, the greater the expected recovery on its debt in default.

A higher growth rate, however, which may lead to a higher market-to-book ratio, is also correlated with higher risk. Smaller firms, for example, exhibit higher growth but are also associated with higher risk. Therefore, a high market-to-book ratio may be associated with both higher growth and higher risk. Conversely, a low market-to-book ratio would indicate low growth or low risk. Which effect dominates in the case of bond defaults is an empirical issue.

Exhibit 4, Panel C, presents empirical estimates of this effect. The market-to-book ratio is positively correlated with recovery rates. Firms with higher-than-average market-to-book value of assets one year prior to default had higher

recovery rates perhaps because the market continued to believe these firms had growth potential or persistent franchise value, despite the fact that they had defaulted.

Tangibility

Exhibit 4, Panel D, presents the impact of tangibility of assets on the balance sheet of a defaulting firm. Tangibility is defined as the ratio of hard assets (property, plant, and equipment, or PPE) to total assets.[5] A company holding a higher percentage of total assets in revenue-producing assets like PPE appears more likely to enjoy high recovery rates in default. Firms with a high proportion of tangible assets on their balance sheets recovered roughly 25% more than firms with a low proportion of tangible assets.

The multivariate regressions imply similar results. Interestingly, we also find that firm size (measured by total assets) is not itself a significant determinant of recovery rates (results not tabulated).

Earnings

Exhibit 4, Panel E, shows the impact of earnings—measured by EBITDA-to-sales in the year prior to default—on recovery rates. The evidence on the estimated impact of earnings on recovery rates is mixed. Firms with both medium and high earnings do enjoy higher recovery rates than firms with low EBITDA, but these same firms tend to have statistically similar recovery rates.

The relationship is also not monotonic in the multivariate analysis.

Stock Returns

Panel F of Exhibit 4 presents the relationship between recovery rates and the defaulting firm's stock returns in the year prior to its default. Here again, the results are ambiguous. Stock returns are not significantly correlated with recovery rates. The univariate analysis reveals that the difference between the recovery rates for low and high stock returns is merely 2.5% of the face value with a standard error of 2.9. Multivariate results are similar.

VI. INDUSTRY EFFECTS

Altman and Kishore [1996], Gupton and Stein [2002], and Varma [2003] suggest that certain industries may have traits, whether permanent or transient, that are correlated with higher or lower than average recovery rates. For example, firms in industries experiencing higher-than-average growth rates or market-to-book ratios may experience higher-than-average recovery rates in defaults. High growth rates may lead to high recovery rates, and it is more probable that a firm will achieve high growth rates if it is in a high-growth industry than if it is in a low-growth industry. Similarly, firms in industries experiencing secular decline (such as steel) may have lower recoveries than firms in industries with steady cash flows (such as utilities).[6]

Industry concentration may also affect recovery rates. Firms in industries that are highly concentrated might be expected to have lower recovery rates than firms in industries that are highly competitive. Defaults in a concentrated industry, with fewer potential buyers for the defaulted firm's assets, may experience lower average recovery rates.

More broadly, we consider the effects on recovery rates of industry factors as follows:

- Industry market-to-book ratio.
- Average industry debt rating.
- Industry concentration.
- Industry stock returns.
- Capacity utilization.
- Utility industry effect.

Industry Market-to-Book Ratio

The market-to-book ratio of an industry can be a proxy for its growth prospects. Using three-digit SIC codes, we estimate market-to-book ratio for each industry as an equally weighted market-to-book value of assets of each firm in that industry. The market-to-book ratio for each firm is estimated as the ratio of market value of equity plus book value of liabilities and total assets according to Compustat for the year prior to default. The results are in Exhibit 6, Panel A.

The industry market-to-book ratio is positively and statistically significantly correlated with recovery rates in both the univariate and the multivariate setting. Assets of a defaulting company that is operating in a high-growth industry would naturally be valued more highly because of its higher potential than a defaulting firm in a low-growth industry. This positive relationship between the industry market-to-book ratio and recovery rates indicates not only that the firm's growth prospects are important, as we see in Exhibit 4, but also that the growth prospects of its industry are important.

EXHIBIT 6

Effect of Industry Factors and Recovery Rates on Loans and Bonds

Panel A

Impact of Market-to-Book of Assets on Recovery Rates						
Industry Market-to-Book Ratio of Assets	Criterion	Univariate		Multivariate		
	Equally Weighted M/B of Assets	*Estimate*	*SE*	*Estimate*	*SE*	
Low	< 0.33	-3.3	1.7	-4.6	4.1	*
High	> 0.6	1.2	2.2	0.8	2.9	*

** Standard error of the difference of the mean relative to the medium industry market-to-book subsample mean, which is 38.4%.*

Panel B

Impact of Industry Debt Rating on Recovery Rates						
Average Industry Debt Rating	Criterion	Univariate		Multivariate		
	Issuer Rating Weighted by Sales	*Estimate*	*SE*	*Estimate*	*SE*	
Low	< B1	-6.92	1.7	-5.3	4.1	*
High	> Ba1	-5.11	2.2	-3.4	2.0	*

** Standard error of the difference of the mean relative to the medium industry rating subsample mean, which is 42.1%.*

Panel C

Impact of Industry Concentration on Recovery Rates						
	Criterion	Univariate		Multivariate		
Industry Concentration	*Herfindahl Index*	*Estimate*	*SE*	*Estimate*	*SE*	
Low	<1200	-2.4	1.6	-1.5	4.1	*
High	> 2000	-0.9	2.4	-2.2	2.1	*

** Standard error of the difference of the mean relative to the medium industry concentration subsample mean, which is 38.9%.*

Panel D

Impact of Industry Stock Returns on Recovery Rates						
		Univariate		Multivariate		
Industry Returns	Criterion	*Estimate*	*SE*	*Estimate*	*SE*	
Low	< -1.5%	-6.4	1.6	-2.6	4.1	*
High	> 26%	2.4	2.5	4.7	2.6	*

** Standard error of the difference of the mean relative to the medium industry returns subsample mean, which is 39.6%.*

Panel E

Impact of Industry Capacity Utilization on Recovery Rates						
		Univariate		Multivariate		
Capacity Utilization	Criterion	*Estimate*	*SE*	*Estimate*	*SE*	
Low	< 70%	-3.5	4.5	-3.1	4.1	*
High	> 77%	2.5	2.5	1.4	2.1	*

** Standard error of the difference of the mean relative to the medium industry capacity utilization subsample mean, which is 40.1.4%.*

Panel F

Utility Industry Effect on Recovery Rates					
	Univariate		Multivariate		
Industry	*Estimate*	*SE*	*Estimate*	*SE*	
Non-Utility	37.7	0.7	33.9	4.1	
Utility	51.4	3.7	43.9	4.4	*

** Standard error of the difference of the mean relative to the non-utility industry subsample.*

Average Industry Debt Rating

Average industry rating can also be used to indicate the riskiness of an industry. Investors in a high-risk industry would demand higher yield to be compensated for risk. The converse is also true—investors in a low-risk industry (such as the utility industry) may demand lower compensation as the risk is lower.

The impact of average industry ratings on recovery rates has not been clear, and research on the question has produced contradictory evidence. We investigate this issue by developing a proxy of industry riskiness. We estimate a debt-weighted average rating for an industry using three-digit SIC codes. The average industry rating is computed using Moody's Investors Service ratings for each issuer in that industry prior to the year of default.

Exhibit 6, Panel B, presents the results. The evidence of a relationship between industry ratings and recovery rates is mixed. We find that issuers in medium-risk industries recover over 42% compared to 35% for firms in high-risk industries (industries that are rated lower). Yet firms in low-risk (highly rated) industries and firms in high-risk industries have statistically similar recovery rates.

This non-monotonic relationship persists in the multivariate test results.

Industry Concentration

We have noted that firms operating in highly concentrated industries may be expected to have lower average recovery rates. There are two ways to estimate proxies for industry concentration. The first is based on a Herfindahl index where we use companies' sales to estimate industry concentration. A higher index for an industry indicates more concentration, while a lower index would indicate a more competitive or fragmented industry with many

players. The second approach uses total long-term debt instead of sales.

We create an index for each industry every year on a sales basis using a three-digit SIC code. The relationship between recovery rates and the Herfindahl index based on sales is presented in Exhibit 6, Panel C. A debt-based index yields similar results (not tabulated).

We fail to find any statistically significant relationship between recoveries and industry concentration. While some differences are evident between low and medium industry concentrations in the univariate setting, there are none in the multivariate setting. Even in the univariate setting, the differences are not significant.[7]

Industry Stock Returns

Industry stock returns in the year prior to default may also indicate whether an industry is in distress, and may help predict recovery rates. An industry can be considered in distress if average stock returns fall below a certain threshold. For example, Acharya, Bharath, and Srinivasan [2004] consider an industry to be in distress if average stock return for that industry is below –30% for the year preceding default. We implement an approach similar in spirit.

Using lagged 12-month returns for an industry as an explanatory variable, we explore the relationship between industry returns and recovery rates in Exhibit 6, Panel D. Industry returns and recovery rates appear positively correlated. Defaulting firms in industries with high average returns recover 25% more than firms in industries with low returns. The relationship between industry stock returns and recovery rates appears monotonic, in both the univariate and multivariate analyses.

Capacity Utilization

Capacity utilization rates are another potential indicator of industry distress. Emery [2004a] uses a 5% decline in capacity utilization from the previous year as a signal that an industry is in distress. He finds some evidence that defaulting firms in distressed industries experience lower average recovery rates on defaulted loans.

Using data published by the Federal Reserve Bank of St. Louis, we estimate the capacity utilization rates for each non-financial industry. Like Emery [2004], we use high, medium, and low to indicate levels of capacity utilization. Exhibit 6, Panel E, presents the results.

There is a positive relationship between capacity utilization and recovery rates in both univariate and multivariate analyses, but the significance level is weaker in the multivariate setting. The relationship is monotonic, consistent with the hypothesis that industries with low capacity utilization produce lower recovery rates, as the low utilization indicates weak demand for goods produced by a particular industry. Such industry slack reduces the revenue-generating capability of assets, thus reducing the value of any claims on these assets.

Utility Industry Effect

Exhibit A-4 in the appendix shows that recovery rates differ across different industries. Utilities have the highest recovery rates, while telecom and steel have the lowest. Most industry effects appear to vanish after one incorporates in the multivariate analysis various industry traits. The utility industry, however, persistently experiences higher average recovery rates in both univariate and multivariate analyses. We describe the utility industry effect in Exhibit 6, Panel F, and graph it in Exhibit 7.

Issues of companies in the utility industry recover over 51% of the face value compared to just 38% for issues in other industries, a difference of over 35%. This is statistically and economically significant.

In the multivariate analysis, the number drops to about 44% of the face value for the utility industry, still 30% higher than firms in non-utility industries. This is not surprising, as utilities have large fixed asset bases that produce significant cash flows protected by regulatory authorities.

VII. MACROECONOMIC FACTORS

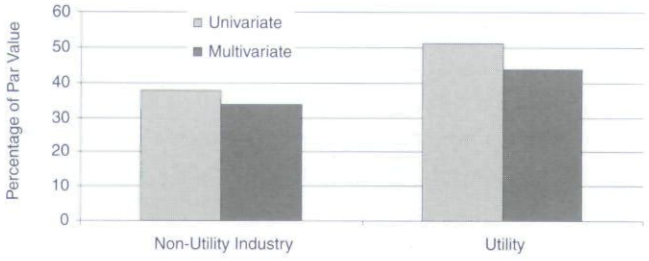
The economic environment has an impact on recovery rates. Like any other asset class, defaulted debt can be expected to be affected by factors influencing the economy. Default rates and recovery rates have been shown to be negatively correlated, but there may be other macroeconomic factors that impact recovery rates and, in the presence of those other factors, the effect of default rates on recovery rates may be diminished.[8]

We investigate the relationship between recovery rates and the following macroeconomic factors:

- GDP growth.
- Stock market returns.
- Speculative-grade spreads.
- Speculative-grade default rates.

EXHIBIT 7

Recovery Rates by Utility and Non-Utility Industries



GDP Growth Rate

Frye [2000a, 2000b, 2000c] suggests that high gross domestic product growth may raise expected recovery rates; we intuitively expect higher recovery rates in an expansionary economy.

To investigate the impact of economic growth on recovery rates, we construct a real GDP growth rate index, again using data published by the Federal Reserve Bank of St. Louis. Growth rates are then divided into low, medium, and high. The results are presented in Exhibit 8, Panel A, and graphed in Exhibit 9.

There is positive correlation between aggregate recovery rates and GDP growth rate and between issue-level recovery rates and the GDP growth rate. Recoveries are materially higher (about 15% higher) in times of higher than lower GDP growth rates.

The univariate results are confirmed by the multivariate tests, although the estimated effects are somewhat smaller.

Stock Market Returns

Unlike the GDP growth rate, aggregate stock market returns are a forward-looking estimate of macroeconomic performance. A stronger stock market indicates market expectations of an expanding economy; a slumping stock market would indicate the reverse. Market expectations may also impact recovery rates through the price of claims on revenue-producing assets. Thus, a positive relationship is expected between measures of stock returns and recovery rates.

We present this evidence in Exhibit 8, Panel B. To measure stock market performance, we use the returns on the S&P 500 index during the 12 months immediately prior to default.

We find that firms defaulting in a declining stock market environment fare worse than firms defaulting in an improving stock market environment. Firms defaulting when stock market returns have been in the bottom third of our ranking have recovered roughly 6% less than the firms defaulting when the stock market is doing well.

These differences are amplified after controlling for other factors (in the multivariate model).

Speculative-Grade Spreads

The price of risk is another factor that may impact recovery rates. A higher price of risk should lead to low recovery rates, as the price reflects the higher compensation required for holding a risky security that will have a lower recovery rate. Acharya, Bharath, and Srinivasan [2004] use an indirect measure of price of risk using the Fama and French [1993] factors: market, size (small minus big), and book-to-market (high minus low). They find such proxies are negatively correlated with ultimate recovery rates.

We use a more direct measure as the price of risk—the speculative-grade spread over Treasuries. A wider spread would indicate a higher required risk premium, which should lead directly to lower recovery rates (see Fridson, Garman, and Wu [1997]). A wider spread may also be associated with higher expected default rates.

Exhibit 8, Panel C, presents the relationship between recovery rates and spreads. The empirical relationship between recovery rates and spreads is as hypothesized. In the univariate results, recovery rates in a low spread speculative-grade environment are 30% higher than those in a high spread environment. The standard errors are also very low, enhancing the statistical significance of the estimates.

The difference between low and high becomes even greater in the multivariate setting, lending further evidence of the economic relationship between recovery rates and spreads.

Speculative-Grade Default Rates

A negative relationship between aggregate recovery rates and speculative-grade default rates is documented in Frye [2000a, 2000b], Hamilton and Varma [2004], and Altman, et al. [2006]. An increase in default rates can be expected to increase the amount of defaulted debt in the marketplace, which, *ceteris paribus*, depresses recovery rates. In a contractionary phase of a credit cycle or economic cycle, asset values may be adjusted downward to reflect reduced forecasted cash flows.

Exhibit 8, Panel D, presents the results based on the issuer-weighted 12-month lagged speculative-grade default rate prevailing at the time of default.

EXHIBIT 8

Effect of Macroeconomic Factors and Recovery Rates on Loans and Bonds

Panel A

Impact of Economic Growth on Recovery Rates

Economic Growth	Criterion	Univariate		Multivariate		
		Estimate	*SE*	*Estimate*	*SE*	
Low	< 1.54%	-2.9	1.0	-3.1	4.1	*
High	> 4.52%	2.9	1.8	1.1	1.1	*

** Standard error of the difference of the means relative to the medium economic growth subsample mean, which is 38.5%.*

Panel B

Impact of Stock Market Performance on Recovery Rates

Stock Market Returns	Criterion	Univariate		Multivariate		
		Estimate	*SE*	*Estimate*	*SE*	
Low	< 6.0%	-4.41	1.1	-7.8	4.1	*
High	> 12.1%	1.79	1.6	-1.9	2.5	*

** Standard error of the difference of the means relative to the medium stock returns subsample mean, which is 38.9%.*

Panel C

Impact of Speculative-Grade Spreads on Recovery Rates

Spec-Grade Spreads	Criterion	Univariate		Multivariate		
		Estimate	*SE*	*Estimate*	*SE*	
Low	< 3.8%	4.0	1.6	7.3	4.1	*
High	> 4.81%	-4.4	1.9	-2.1	3.6	*

** Standard error of the difference of the means relative to the medium spreads subsample mean, which is 39.2%.*

Panel D

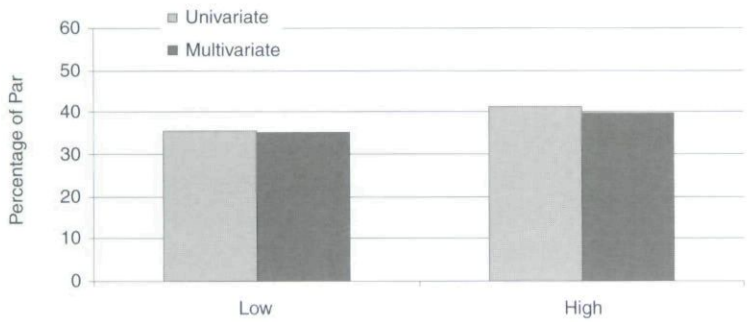
Impact of Speculative-Grade Default Rates on Recovery Rates

US Spec-Grade Default Rate	Criterion	Univariate		Multivariate		
		Estimate	*SE*	*Estimate*	*SE*	
Low	< 3.5%	4.74	1.8	9.8	4.1	*
High	> 4.9%	-1.74	2.0	-3.1	4.0	*

** Standard error of the difference of the means relative to the medium default rate subsample mean, which is 38.2%.*

EXHIBIT 9

Recoveries by Economic Growth



The default rate environment is clearly a significant factor in explaining recovery. Issues defaulting in a low-default rate environment recover 43% of par value on average compared to only 36.5% for issues in a high-default rate environment.

The multivariate results show an even wider gap between recoveries in low- versus high-default environments.

VIII. MULTIVARIATE ANALYSIS

So far we have presented the results of our analysis using a discrete variable approach. While such an approach is intuitive and convenient, it is less precise and less informative than a continuous variables approach. Our expanded multivariate regression models use discrete as well as continuous variables. Implementation of the ordinary least squares models is similar to that used by Acharya, Bharath, and Srinivasan [2004].[9]

Exhibit 10 compares the results for both models.

Certain differences between the results are apparent. As expected, the continuous-variable model has more explanatory power at about a 45% adjusted R^2, compared to 36% for the discrete model. A second difference is the scale difference. Given the change in the definition of the explanatory variables, it is not meaningful to compare the absolute magnitudes of the coefficients across specifications, but we can compare the reported significance of the coefficients. Many of the variables that appear significant in one specification are also significant in the other.

IX. ANALYSIS OF FIRMS FILING CHAPTER 11

We use Chapter 11 filings (either ordinary or prepackaged) to abstract from the higher-variance out-

EXHIBIT 10
Determinants of Recovery Rates

Variables	Discrete Variable Model		Continuous Variable Model	
	Adjusted R^2	36%	Adjusted R^2	45%
	Estimate	Standard Error	Estimate	Standard Error
Intercept	20.3	4.1	24.9	5.4
Seniority				
Equipment Trust Certificates	23.4	8.2	18.5	11.8
Senior Secured Loans	29.8	3.9	32.4	2.2
Senior Secured Bonds	11.3	3.5	12.5	2.8
Senior Unsecured Loans	9.0	2.6	18.6	7.9
Subordinated Bonds	-5.3	2.1	-5.3	1.7
Initial Default Event				
Grace Period Default	23.3	5.8	19.9	4.0
Distressed Exchange	25.8	3.6	33.2	2.4
Missed Principal Payment	16.9	6.4	27.6	4.7
Prepackaged Chapter 11	5.2	2.1	5.6	1.4
Chapter 11	5.2	6.5	6.1	4.4
Chapter 7	-11.8	4.3	-15.1	7.9
Firm-Specific Factors				
Debt Cushion			8.3	2.2
Debt Cushion - Medium	5.8	2.9		
Debt Cushion - High	12.8	2.6		
Leverage			-4.9	2.0
Leverage - Medium	-3.2	1.2		
Leverage - High	-5.0	2.5		
Market-to-Book Ratio			3.6	2.4
Market-to-Book Ratio - Medium	0.6	2.3		
Market-to-Book Ratio - High	5.5	2.5		
Tangibility			4.6	2.3
Tangible Assets (PPE/TA) - Medium	1.9	2.2		
Tangible Assets (PPE/TA) - High	8.5	2.4		
Earnings			-1.2	1.2
Earnings - Medium	1.8	2.4		
Earnings - High	0.3	2.2		
Stock Returns			-1.0	2.1
Stock Returns - Med	-1.3	2.7		
Stock Returns - High	-0.3	2.6		
Industry Factors				
Capacity Utilization			2.2	1.4
Capacity Utilization - Medium	3.1	1.9		
Capacity Utilization - High	4.5	2.1		
Industry Q-Ratio			2.8	2.2
Industry Q-Ratio - Medium	4.6	2.2		
Industry Q-Ratio - High	5.3	2.9		
Industry Concentration			2.6	2.2
Herfindahl Index - Medium	1.5	2.3		
Herfindahl Index - High	2.1	2.1		
Industry Stock Returns			0.3	0.5
Average Industry Stock Returns - Medium	2.6	2.2		
Average Industry Stock Returns - High	4.7	2.6		
Average Industry Debt Rating			0.9	0.7
Average Industry Debt Rating - Medium	5.3	2.6		
Average Industry Debt Rating - High	1.8	2.0		
Utility Industry	8.5	4.4	11.3	5.0
Macroeconomic Factors				
*Spreads**			-5.4	1.2
Spreads - Medium	-6.3	3.3		
Spreads - High	-8.4	3.6		
Speculative-Grade Default Rate			-2.2	0.6
Speculative-Grade Default Rate - Medium	-9.8	4.3		
Speculative-Grade Default Rate - High	-12.9	4.0		
*GDP Growth Rate***			31.4	15.7
GDP Growth Rate - Medium	3.1	2.7		
GDP Growth Rate - High	4.2	1.3		
*Stock Market Returns****			32.7	11.8
Return on Market Index - Medium	7.5	2.8		
Return on Market Index - High	5.6	2.5		

Intercept for discrete model includes: Senior unsecured bonds, missed interest payment, and all LOW dummies.
Intercept for continuous variable model includes: Senior unsecured bonds, missed interest payment.
**Source: Merrill Lynch.*
***Source: GDP growth rate is computed by billions of chained Y2K dollars (Source: St. Louis Federal Reserve Bank).*
****Source: Return on market index is computed by using lagging 12-month returns on S&P 500 portfolio.*

comes that occur when the data set includes missed interest payments, distressed exchanges, grace period defaults, and other types of defaults. Given the importance of the absolute priority rule in the Chapter 11 framework of the U.S. bankruptcy code, one might expect that the effects of seniority, security, size of debt cushion, and tangibility would prove even more important in this portion of the data set.

The multivariate discrete and continuous model estimates for the Chapter 11 data set—103 firms with 127 defaulting security types—are presented in Exhibit 11. In the Chapter 11 sample, the explanatory power of these regressions is generally higher. The adjusted R^2 is 53% for the discrete model and 59% for the continuous model. As in the other analysis, we find that seniority and other contract-specific factors matter. In the discrete model, estimates and standard errors are similar to those in the larger sample. While some of the estimates change signs from the larger sample to the smaller sample, the standard errors continue to be high for these estimates.

In the continuous-variable model, some important differences between the complete sample results and the Chapter 11 results are apparent, especially in the case of macroeconomic factors. The estimated coefficients are higher in the Chapter 11 sample. Debt cushion and other factors like the utility industry dummy turn out to be insignificant in the smaller sample, while they are significant in the larger sample. Surprisingly, in the smaller sample we do not find any evidence that tangibility matters (which is consistent with the lack of significance of the utility dummy), and leverage is only marginally significant.

X. SUMMARY AND CONCLUSIONS

Using 30-day post-default prices as recovery rates, we find that seniority and security are the most key in explaining recovery rates of defaulted loans and bonds.

EXHIBIT 11
Determinants of Recovery Rates

Chapter 11 Sample	Discrete Variable Model		Continuous Variable Model	
	Adjusted R2	53%	Adjusted R2	59%
	Estimate	Standard Error	Estimate	Standard Error
Intercept	27.9	10.2	28.7	12.2
Seniority				
Equipment Trust Certificates	NA	NA	NA	NA
Senior Secured Loans	34.9	4.8	37.9	4.5
Senior Secured Bonds	10.3	5.1	9.3	5.4
Senior Unsecured Loans	8.2	6.2	12.1	8.7
Subordinated Bonds	-12.3	3.7	-13.8	4.2
Firm Specific Factors				
Debt Cushion			-0.5	0.4
Debt Cushion Medium	-0.1	4.6		
Debt Cushion High	7.8	2.9		
Leverage			-6.7	3.9
Leverage Medium	-13.5	3.8		
Leverage High	-3.0	4.2		
Tangibility			4.3	3.9
Tangible Assets (PPE/TA) Medium	3.6	2.2		
Tangible Assets (PPE/TA) High	1.0	3.5		
Earnings			-0.1	0.6
Earnings Medium	5.5	3.9		
Earnings High	2.2	3.9		
Stock Returns			4.9	3.7
Stock Returns Med	-0.8	3.6		
Stock Returns High	2.5	5.2		
Q-Ratio			6.5	4.7
Q-Ratio Medium	6.7	3.7		
Q-Ratio High	6.3	4.3		
Industry Factors				
Capacity Utilization			1.2	3.9
Capacity Utilization Medium	3.3	2.9		
Capacity Utilization High	3.9	2.1		
Industry Market-to-Book Ratio			0.1	4.9
Industry Market-to-Book Ratio Medium	13.0	4.9		
Industry Market-to-Book Ratio High	5.5	3.7		
Industry Concentration			1.7	2.2
Herfindahl Index Medium	-3.9	4.0		
Herfindahl Index High	-0.8	4.3		
Industry Stock Returns			7.9	3.1
Average Industry Stock Returns Medium	2.6	2.2		
Average Industry Stock Returns High	4.7	2.6		
Average Industry Debt Rating			-1.3	0.6
Average Industry Debt Rating Medium	6.4	2.4		
Average Industry Debt Rating High	0.5	3.2		
Utility Industry	8.5	4.4	0.3	6.9
Macroeconomic Factors				
Spreads*			-37.6	11.3
Spreads Medium	-17.8	7.8		
Spreads High	-10.3	7.9		
Speculative-Grade Default Rate			-22.6	8.3
Speculative-Grade Default Rate - Medium	-5.7	3.4		
Speculative-Grade Default Rate High	-4.4	4.9		
GDP Growth Rate**			198.2	88.9
GDP Growth Rate Medium	6.1	5.1		
GDP Growth Rate High	11.7	8.0		
Return on Market Index***			69.7	13.6
Return on Market Index Medium	12.1	4.6		
Return on Market Index High	10.7	5.2		

Intercept for discrete model includes: Senior unsecured bonds, missed interest payment, and all LOW dummies. Intercept for continuous variable model includes: Senior unsecured bonds, missed interest payment.

**Source: Merrill Lynch.*

***Source: GDP growth rate is computed by billions of chained Y2K dollars (Source: St. Louis Federal Reserve Bank).*

****Source: Return on market index is computed by using lagging 12-month returns on S&P 500 portfolio.*

We also extend the literature, which has focused primarily on Chapter 11 defaults, to discover average recovery rates are sensitive to the type of event that precipitates default. Exhibit 12 summarizes the basic results.

Firm-specific, industry-specific, and macroeconomic factors play a significant role in explaining recovery rates. Debt cushion below, which provides an estimate of support to any claim class, adds significantly to recovery rate. Leverage impacts recovery rates negatively—higher leverage is associated with lower recovery rates. A firm's market-to-book ratio and stock returns prior to default have less consistent relationships with recovery rates.

Only a few industry factors seem to play a significant role. Industry market-to-book ratio, which is positively but weakly correlated with recovery rates, is a mixed picture. The positive relationship between industry market-to-book and recovery rates indicates not only that the firm's growth prospects are important, but also that the growth prospects of the firm's industry are important (although not as important). As with the industry market-to-book ratio, the relationship between average industry rating and recovery rates is weakly positive. Average industry stock returns, capacity utilization rates, and Herfindahl concentration indexes are not statistically significant, although the estimated signs of their effects are as expected.

Macroeconomic factors like the health of the economy and the stock market are significantly correlated with recovery rates. Interestingly, factors like speculative-grade default rates and speculative-grade spreads, while strongly correlated with recovery rates in a univariate analysis, lose their explanatory power significantly when other factors are controlled for.

In a subsample of firms that filed for Chapter 11 bankruptcy protection, the model's explanatory power increases to about 60%. The most significant factors are seniority, security, leverage, industry, and macroeconomic factors. The market seems to place a higher value on the assets of bankrupt firms when both a firm's industry and the economy are doing well.

EXHIBIT 12
Summary of Findings

Factors	Variable Value	Expected Impact Relative to the Omitted Variable	Statistically Significant?*
Seniority	Equipment Trust Certificates	+	Yes
(relative to Senior Unsecured Bonds)	Senior Secured Loans	+	Yes
	Senior Secured Bonds	+	Yes
	Senior Unsecured Loans	?	Yes(+)
	Subordinated Bonds	-	Yes
Initial Default Event	Grace Period Default	+	Yes
(relative to Missed Interest Payments)	Distressed Exchange	+	Yes
	Missed Principal Payment	?	Yes(+)
	Prepackaged Chapter 11	-	Yes
	Chapter 11	-	No
	Chapter 7	-	Yes
Firm-Specific Factors	(Omitted = Low**)	ß	
Debt Cushion	Medium	+	Yes
(relative to Low)	High	+	Yes
Leverage	Medium	-	No
(relative to Low)	High	-	No
Market-to-Book Ratio	Medium	+	No
(relative to Low)	High	+	Yes
Tangibility	Medium	+	No
(relative to Low)	High	+	Yes
Earnings	Medium	+	No
(relative to Low)	High	+	No
Stock Returns	Medium	+	No
(relative to Low)	High	+	No
Industry-Specific Factors	(Omitted = Low**)		
Industry Market-to-Book Ratio	Medium	+	No
(relative to Low)	High	+	Yes
Average Industry Debt Rating	Medium	+	Yes
(relative to Low)	High	+	No
Herfindahl Index/industry Concentration	Medium	-	No
(relative to Low)	High	-	No
Average Industry Stock Returns	Medium	+	Yes
(relative to Low)	High	+	Yes
Capacity Utilization	Medium	+	No
(relative to Low)	High	+	No
Utility Industry Dummy Variable		+	Yes
(relative to all other industries)			
Macroeconomic Factors	(Omitted = Low**)		
Economic Growth	High	+	No
(relative to Low)	Medium	+	Yes
Return on Market Index	Medium	+	Yes
(relative to Low)	High	+	Yes
High Yield Spreads	Medium	-	No
(relative to Low)	High	-	Yes
Speculative-Grade Default Rate	Medium	-	No
(relative to Low)	High	-	Yes

**Significant at 10% or better confidence interval.*
Yes(+) indicates the observed sign for the coefficient and whether the estimate is significant.
***For each continuous explanatory variable, the sample is divided into three equally sized groups—low, medium, and high. Dummy variables for the medium and high groups are included in the regression, so that the estimated effects measure the impact of being in either of those two groups compared to being in the low group.*

APPENDIX

EXHIBIT A-1

Sample Distribution Based on Issue Seniority (number of issuers)

Seniority Type	Observations
Senior Secured Bank Loans	138
Senior Unsecured Bank Loans	23
Equipment Trust Certificates	11
Senior Secured Bonds	116
Senior Unsecured Bonds	379
Subordinated Bonds	728
All Issues	1,395

EXHIBIT A-2

Sample Distribution Based on Initial Default Event (number of issuers)

Initial Default Event	Observations
Missed Interest Payment	584
Grace Period Default	30
Distressed Exchange	86
Missed Principal	20
Prepackaged Chapter 11	12
Chapter 11	338
Chapter 7	14
All Defaults	1,084

EXHIBIT A-3

Sample Distribution Based on Industry (utility versus non-utility) (number of issuers)

Industry Type	Observations
Utility	30
Non-Utility	1,054
All Industries	1,084

EXHIBIT A-4

Global Recovery Rates Based on Industry Classification

Industry	Value Weighted Mean	Issuer Weighted Mean
Automotive	27.4	33.4
Construction	29.5	31.9
Consumer Goods	26.7	32.5
Finance and Banking	51.6	36.3
Healthcare	28.2	32.7
Hospitality	45.7	42.5
Industrial	35.1	35.4
Media, Broadcasting, and Cable	43.5	38.2
Miscellaneous	43.3	39.5
Oil and Oil Services	53.4	44.5
Real Estate	24.3	28.8
Retail	34.8	34.4
Steel	26.0	27.4
Technology	25.5	29.5
Telecom	17.1	23.2
Transport Air	33.3	34.3
Transport Ocean	42.3	38.8
Transport Surface	35.1	36.6
Utility Electric	47.3	41.4
Utility Gas	56.4	51.5
All Industries	33.8	35.4

Source: Varma [2003].

ENDNOTES

[1]We excluded from the sample bonds originally issued at deep discounts to face value.

[2]After the exchange process is complete, the defaulted instrument may stop trading or may trade very thinly.

[3]Our results are consistent with Altman and Kishore [1996] but inconsistent with Acharya, Bharath, and Srinivasan, [2004], who find that at default, seniority plays an insignificant role in determining recovery rates after controlling for other factors.

[4]One would also expect debt cushion above to be negatively correlated with recoveries since a greater amount of senior debt would leave less in assets available to pay more junior claims. We were unable to identify the impact of debt cushion above empirically, perhaps because some of the most senior classes of debt—taxes, secured traded credit, and secured bank debt—are difficult to identify in published accounting statements.

[5]We also calculate tangibility as the ratio of the sum of current assets and PPE to total assets, with no significant change in results.

[6]The issue of growth and riskiness as measured by size and other proxies has been investigated extensively. Beginning with Fama and French [1992], book-to-market, size, and risk have been shown to be correlated. See Pilotte [1992] and Denis [1994] for a review of the literature.

[7]Industry effects often manifest themselves as one-time shocks to the default rate that are not repeated. Examples abound: telecom, shipping, or movie theatres. While certain industries may always be more volatile than others, this does not show up consistently in default rates or recovery rates.

[8]The relationship between default rates and recovery is well documented. For example, Carey and Gordy [2003] and Altman et al. [2006] have shown that default rates and recovery rates, in aggregate, are related. See also, Altman and Kishore [1996], Altman, Resti, and Sironi [2003], and Hamilton and Varma [2004] for discussion of a negative correlation between default and recovery rates with a relatively high R^2. This relationship is consistent with the hypothesis that a larger supply of defaulted debt (more defaults, higher default rate) depresses prices of such defaulted debt.

[9]It is not uncommon to recalibrate recovery rates using a beta distribution (see Gupton and Stein [2002]). Others, like Renault and Scailett [2003], have argued that a non-parametric

distribution may be better than the beta distribution. Hu and Perraudin [2001] use an inverse Gaussian function to extract recovery rates.

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