Understanding the Recovery Rates on Defaulted Securities[1]

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Abstract

We document empirically the determinants of the observed recovery rates on defaulted securities in the United States over the period 1982-1999. The recovery rates are measured using the prices of defaulted securities at the time of default and at the time of emergence from default or from bankruptcy. In addition to seniority and security of the defaulted securities, industry conditions at the time of default are found to be robust and important determinants of the recovery rates. In particular, recovery in a distressed state of the industry (median annual stock return for the industry firms being less than -30%) is lower than the recovery in a healthy state of the industry by 10 to 20 cents on a dollar depending on the measure of recovery employed. The determinants of recovery rates appear to be only partly correlated to the firm-specific determinants of default risk of the firm. Our results underscore the existence of substantial variability in recoveries, in the cross-section of securities as well as in the time-series, and suggest that in order to capture recovery risk, the next generation of credit risk models should include an industry factor in addition to the factor representing the firm value or the default process.

1 Introduction

Beginning with the seminal work of Altman (1968) and Merton (1974), the literature on credit risk has burgeoned especially in modeling the likelihood of default of a firm on its debt. Recent credit risk models with varying choices of the model for the likelihood of default include among others the industry standard KMV (www.kmv.com), Litterman and Iben (1991), Jarrow and Turnbull (1995), Jarrow, Lando, and Turnbull (1997), Madan and Unal (1998), Schönbucher (1998), Duffie and Singleton (1999), Das and Sundaram (2000), and Acharya, Das, and Sundaram (2002). The credit spreads or the prices of risky bonds determined in these models depend also on the loss given default or inversely on the recovery rates on the bonds under consideration.[1] However, many of the extant models and their calibrations assume that recovery is deterministic.[2] Some preliminary evidence, see e.g., Carty and Hamilton (1999), Carty, Gates, and Gupton (2000), Brady (2001), and Altman (2002), suggests, however, that recovery rates on defaulted instruments exhibit substantial variability.

This paper studies the empirical determinants of recovery risk - the variability in recovery rates over time and across firms - using the data on observed prices of defaulted securities in the United States over the period 1982-1999. We measure recovery rates using the prices of defaulted securities at the time of default and at the time of emergence from default or bankruptcy. We focus our investigation on the contract-specific, firm-specific, industry-specific, and, finally, macro-economic determinants of recovery rates. We document systematically the impact of these factors on recovery rates and study whether these determinants are different from the determinants of the likelihood of default for these securities. Our findings shed light on the differences between default risk and recovery risk, and serve as a foundation for the next generation of credit risk models that are likely to embed both these risks. Furthermore, our tests provide new, indirect evidence supporting the corporate finance literature on the industry equilibrium of firms and its effect on liquidation values (Shleifer and Vishny, 1992).

Our results on contract-specific and firm-specific characteristics are as follows. Seniority and security are important determinants of recovery rates: Bank Loans recover at emergence

[1]For instance, under the specific recovery assumption of Duffie and Singleton (1999), called the Recovery of Market Value (RMV) assumption, the credit spread to be added to the risk-free rate in order to obtain the discount rate applicable for defaultable securities is precisely equal to the risk-neutral hazard rate of default multiplied by the loss given default.

[2]Notable exceptions which model recovery risk are Das and Tufano (1996), Frye (2000a, 2000b), Jokivuolle and Peura (2000), Bakshi, Madan, and Zhang (2001), Jarrow (2001), and Guntay, Madan, and Unal (2003). We discuss some of these models in Section 7. See also the Introduction in Altman et al. (2003) for a survey of the literature on recovery risk.

on average 20 cents more on a dollar than Senior Secured and Unsecured instruments, which in turn recover 20 cents more than Subordinated instruments. The effect is qualitatively similar for recoveries at default, though not statistically significant in univariate specifications. In terms of security, the difference in recovery at emergence between instruments backed by Current Assets and Unsecured instruments is about 25 cents on a dollar.[3] Finally, recoveries at emergence are affected adversely by the length of time the firm spent in bankruptcy.

Among firm-specific factors, the profitability of assets (measured as profit margins, i.e., as EBITDA/Sales, in default year minus one) have a marginal effect on recoveries at default of about 0.25 cents on a dollar for a 1% change in profitability. Recoveries at default are also negatively affected by greater number of defaulted issues and by greater debt dispersion, consistently with the theory that predicts greater coordination problems among creditors in these cases, and in turn, greater bankruptcy and liquidation costs. Surprisingly, we find the tangibility of assets (measured as Property, Plant, and Equipment/Assets in default year minus one) does not affect either recoveries at default or at emergence. The effect of tangibility is captured entirely by the Utility industry dummy: Utility industry firms recover in default 30 to 40 cents on a dollar more than other industries.[4] In fact, none of the firm-specific characteristics appear to be significant determinants of recoveries at emergence. Contract-specific and firm-specific characteristics thus determine some variation in recovery rates for both recoveries at default and at emergence but not in a consistent manner.

Our most striking results, however, concern the effect of industry-specific and macroeconomic conditions in the default year. Shleifer and Vishny (1992) develop a theoretical model where financial distress is more costly to borrowers if they default when their competitors in the same industry are experiencing cash flow problems. To the best of our knowledge, no study has examined the implications of the Shleifer and Vishny (1992) model directly on debt recovery rates in the event of default.[5] A lower asset value in liquidation should

[3]Our data-sets do not provide collateral information matched with instruments for which we have recoveries at default.

[4]Also, consistent with the findings of Altman and Kishore (1996), we do not find any explanatory power for recoveries in coupon, issue size, and outstanding maturity of the instruments, and leverage ratio measured as Long Term Debt/Assets of the defaulting firms in default year minus one.

[5]Using airline industry data, Pulvino (1998) examines data on asset sales in the airline industry. He finds evidence supportive of the Shleifer and Vishny (1992) model: Companies that sell aircrafts when they are financially constrained, or companies that sell aircrafts when the industry is doing poorly, receive a lower price for these aircraft than companies that sell aircrafts at other times. Asquith, Gertner and Scharfstein (1994) find in their study of "junk" bonds during the 1970s and 1980s that the use of asset sales in restructuring of distressed firms is limited by industry conditions such as poor performance and high leverage. Using a sample of 39 highly levered transactions, Andrade and Kaplan (1998) find supporting evidence as well that poor industry and economic conditions adversely affect company performance or value. These studies however do not study prices of bonds. Their findings however suggest that industry and economic factors may be important determinants of recovery rates.

translate into a lower firm value, and this, in turn, should result in a lower debt value. Thus, the Shleifer and Vishny model has the following implications for debt recoveries:

(1) Poor industry or poor macroeconomic conditions when a company defaults should depress recovery rates; (2) Companies that operate in more concentrated industries should have lower recoveries due to the lack of an active market of bidders; (3) Poor liquidity position of industry peers when a firm defaults should lower the recovery on its debt.

We discuss our results on these three implications next. We identify the industry of the defaulted firm using the 3-digit SIC code of the company. First, in the spirit of Gilson, John, and Lang (1990) and Opler and Titman (1994), we define an industry to be "distressed" if the median stock return for this industry in the year of default is less than or equal to −30%. We find that when the defaulting firm's industry is in "distress," its instruments recover about 10–12 cents less on a dollar compared to the case when the industry is healthy, both for recoveries at default as well as emergence. Defaulting companies whose industries also have suffered adverse economic shock thus face significantly lower recoveries. In fact, the magnitude of the effect is about half the relative effect of seniority of the instrument (Bank Loans vs. Senior Debt vs. Subordinated debt). We also consider an alternative definition of industry distress that employs stock returns and sales growth in the two years prior to default. The effect is robust to this definition and twice as large in magnitude for recoveries at default. Furthermore, this effect is found controlling for contract-specific and firm-specific characteristics, and also controlling for Median Q of the industry. Median Q of the industry helps our tests isolate the effect of industry peers' distressed condition from the effect of information contained in the industry's stock market performance about future growth prospects, and thus, in turn about the likely sale value of assets.

Second, we calculate a sales-based Herfindahl index for the industry of the defaulted firm as a measure of its concentration. We do not find any evidence supporting the hypothesis that industry concentration lowers the recovery rates. Third, we construct a measure of industry liquidity based on the median Quick ratio, the ratio of Current Assets minus Inventories to Current Liabilities, and another variant based on the median interest coverage ratio (which is EBITDA/Interest Expense). Controlling for the industry distress condition, we do not find support for the hypothesis that poor liquidity condition of the peers of a defaulting firm depresses the recovery rates on its debt at the time of default. We do, however, find that poor industry liquidity negatively affects the recovery rates at emergence. The effect is both statistically and economically significant.

We also test the first hypothesis using macroeconomic conditions at the time of default. We employ macroeconomic data from Altman, Brady, Resti, and Sironi (2002) who study aggregate recovery rates and find that aggregate recovery rates on defaulted debt are negatively related to aggregate default rates and are strongly affected by the demand and supply of capital in the junk bond market.[6] We find that the aggregate default rate in the default year and the aggregate supply of defaulted bonds measured mid-year in the default year (Altman et al. variables BDR and BDA, respectively) significantly lower recovery rates when employed in the *absence* of industry conditions. However, once industry conditions are employed, their effect is swamped and remains insignificant. The effect of S&P 500 stock return and GDP growth rate in the default year on the recovery rate is generally insignificant. We also do not find any explanatory power from the Fama and French risk factors SMB and HML. Our findings are in contrast to those of Altman et al. in that there is no effect of macroeconomic conditions over and above the industry conditions. Our findings are complementary to theirs in that the effect of industry conditions is robust to inclusion of bond market conditions and macroeconomic conditions. The results thus suggest that the linkage stressed by Altman et al. between bond market aggregate variables and recoveries as arising due to supply-side effects in segmented bond markets may perhaps be a manifestation of Shleifer and Vishny (1992) industry equilibrium effect: Macroeconomic variables and bond market conditions appear to be picking up the effect of omitted industry conditions.

More broadly, our results convincingly demonstrate that recovery risk exists and is economically significant in its magnitude. Does this imply that a modeler in credit risk must incorporate more factors, that is, over and above the ones that are the determinants of default risk? The modeler certainly must be concerned about how the average recovery rates are affected in the time-series and in the cross-sectional variation. Our preliminary evidence suggests, however, that models incorporating recovery risk would likely also need to model industry conditions as a separate state variable: When we include in the regression specification a Z–score based on the credit-scoring models of Altman (1968, 2000), or the credit-score of Zmijewski (1984), or the Distance to Default as computed by the KMV based on the Merton (1974) model, but exclude the firm-specific characteristics, we find these proxies of expected default profitability show up as significant. The magnitudes and significance of the effects of contract-specific and industry-specific characteristics remain unaffected. The determinants of risk of default and the risk of recovery thus seem positively correlated but not perfectly so.

The remainder of the paper is structured as follows. Section 2 discusses additional related literature. Section 3 discusses the data we employ. Section 4 presents summary descriptive statistics of recovery rates in our sample. Section 5 presents the empirical regression analysis of recovery rates using contract-specific, firm-specific, industry-specific, and macroeconomic determinants. Section 6 compares the determinants of recovery risk with Altman's Z-score as the empirical determinant of default risk. Section 7 presents some implications of our

[6] Frye (2000a, 2000b) and Hu and Perraudin (2002) also show that aggregate quarterly default rates and recovery rates are negatively correlated.

results for future credit risk models. Section 8 concludes.

2 Other Related Literature

In addition to the related papers discussed above, a separate literature examines the recovery rates of different classes of creditors in the event of distress. Franks and Torous (1994) examine the recovery rates of different classes of creditors in the event of a distressed exchange of securities or a bankruptcy. The recovery rates in their sample are largely based on book values of securities received in a reorganization or bankruptcy. Hotchkiss (1995) documents that firms that emerge from Chapter 11 tend to default again subsequently. Therefore, recovery rates based on book values are likely to overstate true recoveries. Our proposed study uses the market prices of debt after the default event thereby circumventing this problem. Franks and Torous (1994) do report recovery rates for a sub-sample of 10 cases of distressed exchanges and 12 cases of bankruptcy based on market values for all securities received by the given creditor class. Our sample of market-value based recoveries is more comprehensive, covering 379 firm defaults and 645 instruments for recoveries at default and 465 firm defaults and 1,511 instruments for recoveries at emergence.

Thorburn (2000) looks at the recovery rates for debt in a set of bankruptcy auctions in Sweden. Institutional and legal differences between the bankruptcy codes in the U.S. and Sweden may make some of her results or conclusions inapplicable to the U.S. Also, our data set has bankruptcies with a Chapter 11 filing and also cases of distress and cure (where there is a default and a rapid resolution), and pre-packaged bankruptcies or distressed exchanges which involve no Chapter 11 filing. Furthermore, Chapter 11 gives the incumbent management a substantial advantage in the reorganization process in the U.S. As explained in the paper, our data enables us to test hypotheses concerning fall in defaulted debt prices in anticipation of strategic write-downs by equityholders who attempt to exploit their bargaining power when asset sales are expected to fetch low prices. Finally, Thorburn (2000) does not consider the effect of industry conditions on debt recoveries, a focal point in the analysis of this paper.

Note that in the spirit of our findings, Franks and Torous (1994) do find in their sample a positive relationship between the past performance of the overall stock market and recoveries, and Thorburn (2000) documents a significant effect on recoveries of a binary variable signifying if bankruptcy occurred during an economic downturn (year 1991) or not.

Perhaps our paper is closest to the work of Izvorski (1997) who examines the recovery ratios for a sample of 153 bonds that defaulted in the United States over the period 1983–1993. Consistent with our results, Izvorski finds seniority and type of industry to be the major cross-sectional determinants of recovery.[7] At an industry level, Izvorski finds a positive effect on recoveries from fixed to total assets and from industry growth and somewhat surprisingly, a negative effect of industry concentration. In contrast, we find that once the industry is controlled for, tangibility of assets has no significant effect on recoveries and neither does industry concentration. The industry growth effect is similar to the effect of median industry Q in our results. The key differences between our work and Izvorski's arise from the facts that (i) we examine both recoveries at default and at emergence, (ii) our data enables us to study effect of collateral on recoveries, and (iii) crucially, our tests for industry effects (in particular, industry distress and liquidity) provide a richer analysis of the theoretical priors based on Shleifer and Vishny (1992).

A study of recoveries on bank loans and corporate debt can be found in a series of reports by Moody's Investors Service (Global Credit Research).[8] These studies are focused on a description of average recoveries on loans and bonds across different seniorities, securities, and industries, and on the average length of time to default resolution, but do not study the cross-sectional variation of recoveries across firms and through time. Moody's LossCalc^{TM} model (Gupton and Stein, 2002) does consider explaining the variation in recoveries using contract-specific, firm-specific, industry-specific, and macroeconomic factors. Being a proprietary model, its description does not disclose the exact point estimates or their standard errors. More important, their analysis differs from ours in the choice of industry and macroeconomic variables. In contrast to our variables, the LossCalc model employs the moving average of industry recoveries and an index of prices of bankrupt bonds. Since these are precisely the variables whose variation we attempt to explain, the choice of these variables in their lagged forms may be desirable from a numerical-fitting perspective but is not very useful from an economic perspective. Finally, we examine the economic hypotheses of Shleifer and Vishny (1992) in detail, enabling us to understand the precise causes of industry-specific effects on recoveries.

3 Data

The data source for our study is the Credit Pro database (version 4.0) developed by Standard and Poor's (S&P). The database consists of two component databases, the S&P database

[7]Izvorski also finds the type of restructuring attempted after default to be a significant determinant, a variable that is unavailable in our data set and somewhat cumbersome to obtain given the exhaustive nature of our data set (over 1500 instruments).

[8]See, e.g., Carty and Lieberman (1996), Carty (1998), and Carty and Gupton (2000) for recoveries on defaulted bank loans, Carty and Hamilton (1999) for recoveries on corporate debt in general, and Moody's LossCalc model by Gupton and Stein (2002).

and the Portfolio Management Data (PMD) database. The S&P database provides detailed information on all companies that have defaulted between Jan. 1, 1981 and Dec. 31, 1999. At the issuer level, the database provides company names, industry codes and wherever available the CUSIP and SIC codes. At the issue level, the database provides bond names, coupons, seniority rankings, issue sizes in dollars, price at default, and default dates. The S&P database contains information only about bonds and does not include collateral information.

The PMD database contains recovery data developed by Portfolio Management Data (a part of S&P). The PMD data includes recovery information in the form of price at default and also price at emergence on more than 1,200 bank loans, high-yield bonds and other debt instruments, totaling over $100 billion. The information is derived from more than 300 non-financial, public and private U.S. companies that have defaulted until the end of 1999. The coverage becomes extensive after 1987. In addition, the PMD database also provides information on collateral backing the instruments in default. Collateral for each secured instrument is specifically identified and grouped into several categories including all assets, inventory and/or receivables, real estate, equipment, non-current assets and other. For debtors that have emerged from bankruptcy, emergence dates also are furnished. The source data was obtained by S&P from bankruptcy documents: reorganization and disclosure statements, Securities and Exchange Commission filings, press articles, press releases, and their internal rating studies on the issuer.

Although there is some overlap between the two databases, by and large the information in one is not replicated in the other. Out of the 1,511 observations in the PMD database 399 are found in the S&P database. The S&P database has a total of 646 observations. While the sample of prices at default from S&P database is smaller, perhaps due to greater illiquidity of corporate bonds at the time of default, the sample of prices at emergence from PMD database is close to being exhaustive and captures well the set of defaults in the United States over the period 1981 to 1999. Combining these two data sets, we obtained our overall sample of bank loans and corporate bonds. Note that our data does not contain any trade credit or project finance instruments, the recovery rates for which likely behave differently from the instruments we examine.

The PMD database measures recoveries at emergence (henceforth, denoted as Pe) using three separate methods: (1) Trading prices of pre-petition instruments at the time of emergence; (2) Earliest available trading prices of the instruments received in a settlement; (3) Value for illiquid settlement instruments at the time of a "liquidity event" – the first date at which a price can be determined, such as the subsequent acquisition of the company, significant ratings upgrade, refinancing, subsequent bankruptcy, or distressed exchange. On the other hand, the S&P database measures recoveries at default. In the case of price at default (henceforth, denoted as Pd), the last trading price at the end of the month in wich default took place is recorded in the database. Thus in the case of 399 instruments we have both the price at default as well as the price at emergence. Both these measures of recovery are given in nominal terms and thus should be interpreted as Recovery of Face Value or Recovery of Par. This way of measuring recovery is often used in practice and is partially justified by the fact that when a firm defaults on any one of its obligations, cross-acceleration clauses typically cause all its other claims to also file for default. Furthermore, the amount payable on defaulted instruments once the firm is in bankruptcy is usually close to par. However it is to be noted that collateralized instruments continue to accrue post-petition interest (after filing for bankruptcy) and thus the amount payable can exceed par.[9]

We obtain the firm and industry variables for our analysis by cross matching the CUSIPs of each of these firms with the CRSP–COMPUSTAT merged database.[10] We also use the macroeconomic variables identified by Altman, Brady, Resti, and Sironi (2002) in our analysis. These were obtained from Edward Altman.

4 Determinants of Recovery Rates: Univariate Analysis

Before discussing the general patterns observed in recovery rates data, we present the adjustments we make to the recovery prices at emergence. Since each defaulted firm's bankruptcy procedure and reorganization takes a different period of time, the time-period between default date and emergence date is not identical for different default instances. In order to compare emergence recovery prices for different default instances, we adjust them for the time between emergence and default dates. In particular, in addition to raw emergence prices (Pe), we construct two other measures, emergence prices discounted at high yield

[9]Guha (2003) discusses the institutional underpinnings of Recovery of Face Value as the appropriate measure of recovery and incorporates it in a structural model of credit risk. In particular, Guha documents with examples (Enron Corp. WorldCom Inc.) that prices of bonds of a corporation with different maturities and coupons but the same seniority differ substantially before bankruptcy; once the bankruptcy is announced however, the prices of these bonds converge to identical or close to identical values, since most bond covenants contain a provision that makes the principal amount (and often accrued interest, if any) immediately payable upon default. Guha and Sbuelz (2002) examine the implications of assuming Recovery of Face Value for pricing and hedging of corporate bonds.

[10]The S&P database does not always have the CUSIP of the issuing firm. Therefore, we hand-matched the list of defaulted companies in this data set with the CRSP–COMPUSTAT database. Our matching procedure is conservative in that we assign a match only when we can absolutely confirm the identity of the defaulted company. Several of the defaulted companies were private at the time of default as they had undergone leveraged buy-outs prior to the default event. Therefore, we are unable to obtain accounting or stock market data for these firms around the time of default or even one year prior to default.

index (*Pehyld*) and emergence prices discounted at coupon rate (*Pecoup*).

For *Pehyld*, we used the formula

$$Pehyld \quad = \quad Pe * \frac{I_d}{I_e} \ , \tag{1}$$

where I_d is the level of a high-yield index at default date, and I_e is the level of the same high-yield index at emergence date. We employed Lehman Brothers, Salomon Brothers, and Merrill Lynch high-yield indices since none of these indices were available for use over the entire sample period using the same high-yield index data at default and emergence.

For *Pecoup*, we used the formula

$$Pecoup \quad = \quad Pe * \frac{1}{(1+c)^{(T-t)}} \ , \tag{2}$$

where c is the coupon rate on the defaulted instrument under consideration, T is the emergence date (in years), and t is the default date (in years).

Our results are qualitatively robust across these measures and in most cases, the economic magnitudes are similar too. Hence, in most of the tables we report the results only with *Pehyld* as the emergence recovery rate. Note that the default recovery prices *Pd* are all measured within one month of default date and thus such time adjustment is not as important for *Pd* series.

4.1 Time-series behavior

In Table 1, we describe the time-series behavior of recovery prices at default and recovery prices at emergence. We also list there the number of instrument defaults and the number of firm defaults available for these two kinds of recovery prices. The number of defaults is quite small over the period 1982 through 1986 (under ten in terms of firm defaults), picks up rapidly reaching its maximum during the recessionary phase of 1987 through 1992, and reduces somewhat in the mid-1990s. The number of defaults for which we have recovery prices at default rises steeply again in 1999 (64 firm defaults). However, most of these firms had not yet emerged from bankruptcy when our data was collected. Hence, they do not appear in the recovery prices at emergence.

The mean (median) recovery rates at default are 41.96 (38.00) cents on a dollar with a sample standard deviation of 25.34. The mean (median) recovery rates at emergence for *Pehyld* and *Pecoup* are 51.11 (49.09) and 52.27 (49.99), respectively, with sample standard deviations of 36.58 and 36.90. There is a clear and a substantial variation in these recovery rates through time. Figure 1 plots the time-series variation in the number of firm defaults (corresponding to Pd series) and median recovery price at default (Pd) in each year. There is a strong negative relationship between Pd and aggregate default intensity (correlation of -0.53), the relationship being particularly strong for the period starting 1987.

For example, the mean and the median Pd are lowest in 1990, with respective values of 26.82 and 19.50, with a small standard deviation of 20.90 for the year. This coincides with a period of deep recession in the U.S. The number of firm defaults in 1990 and 1991 were respectively 41 and 52. In another instance of this correlation, the mean and the median Pd values are 32.07 and 31.00, respectively, in 1999, a year that again coincides with the sharp increase in aggregate default intensity. There were 64 firm defaults in 1999 as compared to a similar number of defaults over the entire period from 1994 to 1998. This lends some preliminary justification for examining the time-series variation in recovery rates and its correlation with aggregate default intensity and macroeconomic conditions as a potential dimension of "recovery risk."[11]

4.2 Effect of Industry

In Table 2, we present the industry-based summary statistics for recovery prices at default and at emergence. We present the summary only for $Pehyld$ since the patterns are similar for both $Pecoup$ and Pe. Our data divides the defaulting firms into 12 industries using the classification employed by S&P: Utility, Insurance and Real Estate, Telecommunications, Transportation, Financial Institutions, Healthcare and Chemicals, High Technology and Office Equipment, Aerospace and Auto and Capital Goods, Forest and Building Production and Homebuilders, Consumer and Service Sector, Leisure Time and Media, and Energy and Natural Resources. The highest number of firm defaults have been for the Consumer and Service sector, Leisure Time and Media sector, and Aerospace, Auto and Capital Goods industries, the numbers being 97, 62, and 50, respectively, based on default date recovery data.

Consistently with the evidence of Altman and Kishore (1996) who examine 696 defaulted bond issues over the period 1978 to 1995, we find the recovery rates are the highest for the Utility sector. The mean (median) recovery at default is 68.37 (77.00) and at emergence

[11] While we do not have complete data on recoveries after 1999, the recent evidence on recoveries is a point in case for the negative correlation between aggregate default intensity and recovery levels. In 2002, global defaults hit a record amount of $157.3 billion and simultaneously bank loans achieved their lowest recovery rate of 72% (in terms of value of instruments received at emergence). This recovery is 8% to 10% below the 15–year mean for bank loan recoveries of 81.6%. Indeed, unsecured bondholders have recovered even less: 28% in 2002 and 22.1% in 2001 compared to the 15–year mean of 46%. See "Unsecured Bondholders Hit Hardest in 2002 Amidst Declining Recovery Rates," Standard and Poor's (www.risksolutions.standardandpoors.com).

is 74.49 (76.94). Although these levels are statistically different from mean recoveries for other industries (at 5% level using the Scheffe, 1953, test), it should be noted that while the number of instrument defaults is large for the Utility sector (55 and 82 based on Pd and Pe data, respectively), the number of firm defaults in this sector has been quite low (8 and 9 for Pd and Pe data, respectively). The mean recoveries are not statistically different across the other 11 industries, though the Energy and Natural Resources sector does stand out with mean (median) recoveries at emergence of 60.41 (58.80). This latter result also is consistent with the findings of Altman and Kishore (1996) who find that chemical, petroleum, and related products had average recoveries of 63% in their sample.

This suggests that although a simple classification of defaults into industries does signal the Utility sector as being different from other industries (perhaps partly due to regulatory issues), the classification does not have a lot of power in explaining the cross-sectional variation of defaults. Hence, in Section 5, we use information about the condition of the defaulted firm's peers in an industry to capture industry-specific effects. This lends a time-series dimension to the industry-specific effects, a dimension that turns out to be a crucial determinant of recovery rates.

4.3 Effect of Seniority

In Table 3a, we classify defaulted instruments by seniority. The categories in decreasing seniority are: Bank Loans, Senior Secured, Senior Unsecured, Senior Subordinated, Subordinated, and Junior Subordinated. Though we do not have any bank loans in the recovery data at default (S&P database), we have 358 defaulted loans from 219 defaulting firms in the recovery data at emergence (PMD database). We report below evidence on the recovery prices of these bank loans at emergence and their relative levels compared to recoveries on other instruments. Our broad findings relating to bank loans are consistent with the rating agency research (on defaulted prices), in particular from Moody's Investors Service (Global Credit Research) cited in Section 2.

The median recoveries at default decline from 48 cents on a dollar for Senior Secured instruments to around 30 cents on a dollar for Senior Subordinated, Subordinated, and Junior Subordinated instruments. In terms of recoveries at emergence, Bank Loans earn on average 30 cents more on a dollar than the next class of seniority, i.e., Senior Secured instruments. This difference is striking, especially given the lack of any prior evidence on recovery rates on bank loans and given the somewhat smaller relative variation in recoveries across other seniority classes. In level terms, median recoveries at emergence decline from 91.55 cents on a dollar for Bank Loans, to 26.78 cents for Senior Subordinated instruments, and further down to 6.25 cents for Junior Subordinated instruments. In addition to their highest seniority, it is possible that a part of the higher recovery at emergence on Bank Loans arises from a superior ability of banks and financial institutions to coordinate a reorganization plan for the firm and from their greater bargaining power in the bankruptcy proceedings compared to the dispersed bondholders. Though banks often provide supra-priority debtor-in-possession (DIP) financing to firms in bankruptcy, such DIP loans are not included in our data.

Comparing the mean recoveries across these different seniority categories and for both types of recoveries, we find that 11 out of 15 pair-wise means are statistically different at 5% confidence level using Scheffe's test. This underscores the importance of seniority of a defaulting instrument as a determinant of its recovery.[12]

4.4 Effect of Collateral

Finally, we document the behavior of recovery rates as a function of the collateral backing the defaulting instruments. Unfortunately, no collateral data is available for Pd series, the recoveries at default (S&P database). For recoveries at emergence (PMD database), instruments are classified into eight collateral categories depending on type of collateral: Current Assets, Plants and Property and Equipment (PPE), Real Estate, All or Most Assets, Other Assets, Unsecured, Secured, and Unavailable Information. Table 3b documents the behavior of $Pehyld$, the recoveries at emergence, across these collateral categories. Note that about two-thirds of our sample (1,005 of 1,511 defaulting instruments) have no collateral information. Though no information is provided on collateral, most of these instruments are in fact un-collateralized bonds. The Unsecured category corresponds to un-collateralized loans.

Among the collateralized instruments, most common are those backed by All or Most Assets (228 of 1,511) and those backed by PPE (83 of 1,511). It is, however, the instruments that are backed by liquid, Current Assets, that have the highest mean (median) recovery of 94.19 (98.81) cents on a dollar. Instruments that are backed by All or Most Assets have the second-highest mean (median) recovery of 80.05 (89.16) cents. The other collateral categories (PPE, Real Estate, Other Assets, Unsecured, and Secured) have mean recoveries ranging from 63.0 to 72.0 cents. The category of instruments where no information is available on collateral has the lowest mean (median) recovery of 38.64 (30.91). Similar numbers are reported for the effect of collateral on recoveries of just bank loans by Carty and Lieberman (1998).

Although there is a certain amount of cross-sectional variation in recoveries across these

[12] Note that recoveries at emergence in our sample for public bonds of different seniorities are roughly similar to the numbers reported in Altman and Kishore (1996) and in Izvorski (1997). Their sample however does not contain data on recoveries at emergence for Bank Loans.

categories, only the mean recovery for instruments collateralized with Current Assets and the mean recovery for instruments where no collateral information is available are statistically different from the mean recoveries on other collateral categories at 5% statistical significance level using a Scheffe's test. We conclude that the relevant collateral categories for determining recovery rates are thus sufficiently captured by just liquid Current Assets and Unsecured (un-collateralized bonds) categories.

This descriptive summary of our data suggests that contract-specific characteristics such as seniority and security (collateral), industry of defaulting firm (utility sector or other sector), and macroeconomic condition (aggregate default intensity), are likely to play an important role in explaining variation in recovery rates. Within all categories, there is substantial variation in recoveries around the means. In order to develop a more formal model of factors that determine recovery rates, we proceed to a multi-variate regression analysis where we exploit firm-specific characteristics as well as industry-specific conditions at time of default. Studies such as Altman and Kishore (1996) and Carty and Lieberman (1998) contain summary data on recoveries with reported magnitudes similar to those in our data. These studies, however, do not undertake a comprehensive, statistical analysis of the explanatory power of different variables and crucially do not examine the industry conditions of the defaulting firm that we show below to be robust and economically important determinants of recovery rates. In Table 4, we report summary statistics of firm-specific, industry-specific, and macroeconomic variables we employ in our regressions. We visit these summaries in sub-sections corresponding to each set of variables.

5 Determinants of Recovery Rates: Multivariate Analysis

Our primary tests relate the price at default and the price at emergence to the contract, firm, industry, and macroeconomic characteristics using OLS regressions on pooled data that combines the entire time-series and the cross-section of recovery data on defaulted instruments. We assume the price at default of each instrument is an unbiased estimate of its actual recovery. An alternative interpretation is that for investors who sell their instruments once default occurs, this is indeed the relevant measure of recovery. Furthermore, many credit risk models do not explicitly capture the bankruptcy proceeding, reorganization, emergence, etc. in their framework. They simply assume a loss given default, which is one minus the recovery rate. For these models, the price of defaulted instruments right after default is a more appropriate measure of recovery.

In all our tests, we use ordinary least squares estimates, and standard errors of these estimates are adjusted for heteroscedasticity using the White (1980) estimator and also adjusted for the existence of clusters as described in Williams (2000) and Wooldridge (2002). The correction for clusters is based on each firm's debt instruments as a single cluster. This helps us address the issue that a single bankrupt firm may have multiple defaulted instruments and all these instruments show up in our data as separate observations. The average number of defaulted instruments per firm in our sample is about 4.5 and only eight firms in the whole sample have multiple firm default observations.[13] Finally, all regressions include industry dummies using the classification employed by S&P. In the tables, we report only the coefficient on the Utility dummy since other industry dummies do not show up as being significant determinants of recovery.

5.1 Contract-specific characteristics

We first consider the effect of contract-specific characteristics on recovery. For this, we estimate the specification

$$\begin{aligned}
\text{Recovery} \;=\; & \alpha + \beta_1 * \text{Coupon} + \beta_2 * \text{Log(Issue Size)} + \beta_3 * \text{Dummy(Bank Loans)} + \\
& \beta_4 * \text{Dummy(Senior Secured)} + \beta_5 * \text{Dummy(Senior Unsecured)} + \\
& \beta_6 * \text{Dummy(Senior Subordinated)} + \beta_7 * \text{Dummy(Subordinated)} + \\
& \beta_8 * \text{Time in Default} + \beta_9 * \text{Maturity Outstanding} + \\
& \beta_{10} * \text{Dummy(Current Assets)} + \beta_{11} * \text{Dummy(Unsecured)} + \text{OR} \\
& \beta_{10} * \text{Collateralized Debt} + \\
& \beta_{12} * \text{Private Debt} + \epsilon. \qquad (3)
\end{aligned}$$

That is, the specification considers seniority of the instrument (dummies for Bank Loans, Senior Secured, Senior Unsecured, Senior Subordinated, Subordinated), and security or collateral of the instrument (dummies for Current Assets and Unsecured) or the extent of Collateralized Debt (in dollars value) in the capital structure of the firm as a fraction of total debt (in dollar value). Some of these were found to be relevant for recoveries in the summary statistics of Section 4. We also include the fraction of the firm's (dollar value) debt

[13] Defaults on instruments of the same firm that are separated by more than one year are counted as being parts of separate or multiple firm default observations. The eight firms experiencing such multiple defaults are: Ballys, Caldor, Cherokee, Greyhound, Heileman, New Valley Corp, TWA, and Zale. The rest of the firms have defaults of different securities within a 3 month period of the first default and these are counted as being part of a single firm default observation. The difference of about 3 month period arises due to the fact that bank loans typically default first followed by bonds.

that is Private Debt (dollar value). In addition, the specification includes the coupon rate on the instrument, log of the issue size to which the instrument belongs, and its outstanding maturity. For recoveries at emergence, we also include the time in default (years).

A common clause in bond indentures is that once an instrument is in default, the accelerated amount payable to bondholders in bankruptcy equals its remaining promised cash flows discounted at the original issue yield, that is, the yield at which the bonds were issued. If a bond was issued at par, its coupon equals the original issue yield and hence the accelerated amount would also be the par value. However, if a bond was issued at discount or premium, then the coupon on the bond will affect the accelerated amount payable to bondholders in bankruptcy. Though most bonds get issued at par, we include the Coupon on the instrument to allow for such an effect. Note that if the bond was indeed issued at discount or premium, then the discounted value of remaining promised cash flows also would depend on the Maturity Outstanding on the instrument, a variable that we also include. Larger issues may earn higher recoveries as a larger stakeholder in the bankruptcy proceedings may be able to exert greater bargaining power. Hence, we include Log (Issue Size) in our tests. Finally, the Time in Default is included in the specification to allow for the possibility that protracted bankruptcies may result in (or capture) lower values for bankrupt firms from asset sales and/or liquidations.

Table 5 reports the point estimates for some variants of this specification with Recovery being proxied by recovery at default, *Pd*, and recovery at emergence, *Pehyld*. Note that collateral information is not available for data with *Pd* information and there are no Bank Loans in *Pd* data. Furthermore, some data is lost upon requiring that Coupon, Issue Size, and Maturity Outstanding information be available for defaulting instruments.

As the point estimates in the first two columns reveal, for prices at default the seniority of the instrument is not statistically significant in the current specification. Note, however, that the relative ranking of the coefficients is as one would expect: The coefficient is the highest for Senior Secured dummy and decreases progressively as seniority of the instrument is lowered.

In sharp contrast, seniority and security are found to be statistically as well as economically important contract-specific characteristics of recovery rates at emergence (Columns 3-7). For *Pehyld* regressions, the coefficients on dummies for seniority, β_3 through β_7, are monotonically declining as seniority declines. Except for the coefficient on lowest seniority dummy, the coefficients are positive and statistically significant (typically at 1% confidence level). The differences between the coefficients have been verified as being statistically significant as well. The bank loans recover at emergence on average 20 cents on a dollar more than senior bonds which in turn earn 20 cents more than senior subordinated bonds. The recovery at emergence on subordinated bonds is not statistically different from zero. Note that Column 4 considers the same regression as Column 3 but has fewer data points due to inclusion of the Maturity Outstanding for defaulted instruments. We also examine whether the extent of private debt in the capital structure of the firm affects the recovery (Column 6). This does not appear to affect the recovery of either the bank loans or the public bonds (Column 7).[14]

The coefficients on collateral dummies for Current Assets and Unsecured are both statistically significant at 1% confidence level (Column 5). These coefficients are positive (about 14 cents on a dollar) and negative (about 11 cents on a dollar), respectively, mirroring the descriptive evidence that instruments that are collateralized with liquid, current assets recover more than other instruments. The extent of collateralized debt of the firm does not appear to affect the recoveries on defaulted instruments (Column 6), either for secured or unsecured instruments (Column 7).

The sign on Coupon is always negative, but the effect is not as robust in its statistical significance as the seniority and the security effects. This is potentially consistent with higher coupon instruments in our sample being more likely to be issued at discounts and thus being discounted at higher yields to obtain the accelerated amounts due in bankruptcy. Another possibility is that coupon is in fact an endogenous variable and higher coupons reflect issuance by weaker credits, which, in turn, gives rise to lower recoveries. In contrast, Log (Issue Size) and Maturity Outstanding are usually insignificant statistically. In fact, the sign on Log (Issue Size) is not robust across specifications. The fact that Maturity Outstanding is insignificant is consistent with the provision of cross-default clauses across different instruments leading to payment amounts that are pretty close to par for all instruments. Since maturity information is available for a very small subset of our data (about one-fourth for recoveries at emergence), we exclude this variable in tests that follow. Also, note that the Time in Default is always significant at 1% confidence level. An additional year in bankruptcy reduces recovery at emergence by about 5 cents on a dollar. Finally, the Utility dummy represents about 25-35 cents greater recovery at default and emergence for bankrupt utility firms compared to recovery for other industries (whose dummy coefficients are statistically not different from zero).

Two other observations are in order based on Table 5. First, the explanatory power of comparable specifications (without collateral dummies) for recoveries at emergence is substantially greater than for recoveries at default. The adjusted-R^2's are of the order of

[14] Another proxy for seniority commonly employed in industry is the extent of debt below or above (in terms of seniority) a specific issue in the capital structure of the firm. In regressions not reported here for sake of brevity, we find this measure of seniority to be statistically and economically significant when it is included as the only proxy for seniority: a greater debt above the issue at hand in firm's capital structure does reduce recoveries on that issue significantly. For sake of parsimony, we do not include in our specifications this additional variable capturing seniority of the instruments in firm's capital structure.

40% for *Pehyld*, whereas they are close to 30% for *Pd*. Second, for all specifications and for all recovery measures (except the second column), the intercept term is between 20 to 50 cents on a dollar and is usually significant. This suggests that seniority and security, even when important in determining recoveries on defaulted instruments, are not sufficient in explaining the time-series and the cross-sectional variation in recoveries.

5.2 Firm-specific characteristics

As a first step toward explaining the residual variation in recovery rates beyond the variation that is explained by contract-specific characteristics, we examine the role played by characteristics of defaulting firms. Since accounting data is difficult to obtain in the year of default, we employ firm-level accounting data in a year prior to year of default, consistently with the prior literature. This potentially biases our tests against finding any predictive power from firm-specific characteristics. We consider the specification

$$\begin{aligned}\text{Recovery} &= \alpha + \hat{\beta} * \text{Contract Characteristics} + \gamma_1 * \text{Profit Margin} + \\ &\quad \gamma_2 * \text{Tangibility} + \gamma_3 * \text{Debt Ratio} + \gamma_4 * \text{Log(Assets)} + \\ &\quad \gamma_5 * \text{Q Ratio} + \gamma_6 * \text{No. of Issues} + \gamma_7 * \text{Debt Concentration} + \\ &\quad \gamma_8 * \text{Firm Return} + \gamma_9 * \text{Firm Volatility} + \epsilon. \end{aligned} \tag{4}$$

In this specification (and in specifications that follow), Contract Characteristics employed are exactly as in the specification of equation (3), except that Maturity Outstanding, Collateralized Debt, and Private Debt are not employed. The corresponding vector of coefficients is denoted as $\hat{\beta}$.

The first five firm-specific characteristics considered in the specification are: Profit Margin, defined as EBITDA/Sales for the defaulting company in default year minus one; Tangibility, proxied by the ratio of Property, Plant and Equipment (PPE) to Assets in default year minus one; Leverage, measured as Long-Term Debt to Assets ratio in default year minus one - we use book leverage as employing market leverage yielded similar results; Log (Assets), the natural log of total assets in default year minus one; and Q Ratio, the ratio of market value of the firm, estimated as [book value of total assets − book value of equity + market value of equity], to the book value of the firm, estimated as book value of total assets. From Table 4, the median values of these characteristics for firms in our sample one year prior to default are : 7% profitability, 33% tangible assets, 48% leverage ratio, 6.05 for log of asset size which corresponds to $424 million of assets, and a Q ratio of 0.76. There is substantial cross-sectional variation in these characteristics as revealed by the standard deviation and quantiles reported in Table 4.

The next four characteristics employed are: No. of Issues, the total number of issues defaulting for the defaulted company; Debt Concentration, defined as the Herfindahl index measured using the amount of the debt issues of the defaulted company; Firm Return, the stock return of the defaulted company in the year prior to default; and Firm Volatility, a proxy for idiosyncratic volatility of the firm measured as the ratio of the standard deviation of daily stock returns of the firm to the standard deviation of daily stock returns of the CRSP value-weighted index in the year prior to default. The median values of these characteristics are: 3.5 number of defaulted issues, 0.40 Herfindahl index of debt concentration among defaulted firms, a gross (net) stock return of 0.30 (-70%), and firm volatility that is 8.48 times the market volatility. All variables have substantial cross-sectional dispersion.

We expect the recoveries on defaulted bonds to be determined at least partially by the expected value at which the firm gets acquired or merged in a reorganization or the expected value fetched by the assets of the firm in liquidation. The profitability of a firm's assets should thus positively affect recoveries: The greater the profitability, the more a potential buyer would be willing to pay for it (all else being equal). Furthermore, many firms default due to liquidity problems and not economic problems per se, so the profitability of assets of defaulted firms prior to default does exhibit substantial cross-sectional variation. We include the firm's Q to proxy for the growth prospects of the assets which also should affect recovery rates positively, all else being equal. The tangibility of assets also is expected to enhance recovery rates: Intangible assets may be less easily transferrable to acquiring firms and may fetch little or no value in liquidation.

We include the leverage of the firm to capture the possibility that bankruptcy proceedings of high-leverage firms may be more difficult to resolve: Higher leverage may be associated with greater dispersed ownership requiring greater coordination among bargaining parties. In a similar spirit, firms with greater number of issues and more dispersed creditor base, that is, lower debt concentration, may experience greater coordination problems and in turn lower recovery rates.[15] We also consider the size of the firm, its total asset base, in order to allow for potential economies or diseconomies of scale in bankruptcy. On the one hand, a part of bankruptcy costs may be fixed in nature giving rise to some scale economies; on the other hand, larger firms may be difficult in terms of merger and acquisition activity giving rise to greater ongoing concern value and lesser value in a reorganization or a liquidation.

We also include the firm's stock return to proxy for its financial health: Firms with

[15]Shleifer and Vishny (1992) show that the expected recovery rates should affect the ex-ante debt capacity of firms and industries. Bolton and Scharfstein (1996) argue how the number of creditors can be optimally chosen by a firm to trade off strategic defaults by management (equityholders) against the costs of default resulting from liquidity shocks. We do not model this endogeneity aspect of firm leverage. Building a model that simultaneously explains design of leverage and recovery rates of firms is indeed a worthy goal to pursue but beyond the scope of the current paper. We plan to investigate this matter in our future research.

poorer stock returns prior to default, controlling for firms' Q ratios, may capture proximity to binding financial constraints, and thus affect recovery rates negatively. Finally, we include a measure of idiosyncratic volatility of the firm's stock return. As a firm approaches default, we expect the equity option to be more out of the money causing an increase in idiosyncratic volatility of the firm. However, if the firm's distress is purely due to liquidity reasons, then the rise in idiosyncratic volatility would be lower than the rise if the firm's distress is also due to economic reasons. If liquidity problems of defaulted firms can be resolved on average better than economic problems with their assets, then we would expect the firm's volatility to have a negative relationship to recovery rates.

Table 6a reports the point estimates and standard errors for the specification in equation (4) for recoveries at default. Table 6b reports the results for recoveries at emergence. The qualitative nature of effects for contract-specific characteristics is similar to the results in Table 5. Hence, we focus our discussion on the effects of firm-specific characteristics.

A few firm-specific characteristics show up as being significant in affecting recoveries at default (Table 6a). Consistent with our hypothesis, we find that firms with greater profitability of assets have greater *Pd*. All else being the same, the marginal effect of a percentage point increase in EBITDA/Sales margin one year prior to default is between 0.25 to 0.35 cents on a dollar. After controlling for the Utility dummy, tangibility of assets has little effect on recoveries at default. If the Utility dummy is not included, then the effect of tangibility of assets is positive and statistically significant (results are available from the authors upon request). Firm leverage, size, Q, and volatility, however, do not appear to be important determinants of recoveries at default. The magnitudes of coefficients on these characteristics are mostly not different from zero at 5% confidence level.

In contrast, debt design measures show up as significant and with signs that are consistent with starting hypotheses. Instruments of firms with greater number of issues in debt structure and with more dispersed ownership of debt experience lower recoveries suggesting greater bankruptcy and/or liquidation costs arising from coordination problems between creditors. Finally, a greater stock return for the firm in the year prior to default produces better recoveries. Noticeably, the explanatory power of the regression for recoveries at default, *Pd*, is significantly enhanced with the addition of firm-specific variables. The adjusted-R^2 for *Pd* specifications in Table 5 is about 30% whereas in Table 6a it is close to 50%.

Somewhat surprisingly, not a single firm-specific characteristic shows up as a significant determinant of the recoveries at emergence (Table 6b). There is little improvement in the explanatory power for *Pe*, and the intercept term in most specifications of Table 6b is positive and statistically significant. One plausible explanation is that since these characteristics are measured one year prior to default, these are "stale" by the time of emergence. However, we believe this is not likely to be the case since for many firms in our sample the emergence and default year are the same (median Time in Default is about 1.5 years). Another possibility we must entertain is that there are determinants other than firm-specific characteristics that affect recoveries in general. To investigate this, we examine the industry equilibrium aspects of the Shleifer and Vishny (1992) model to motivate our choice of industry-specific determinants of recovery.

5.3 Industry characteristics

Shleifer and Vishny's(1992) industry equilibrium model provides a key theoretical insight that financial distress is more costly to borrowers if they default when their competitors in the same industry are experiencing cash flow problems. To the best of our knowledge, no study has examined directly the implications of this model on debt recovery rates in the event of default. A lower asset value in liquidation should translate into a lower firm value, and this, in turn, should result in a lower debt value. Thus, the Shleifer and Vishny model has the following industry implications for debt recoveries:

(1) Poor industry or poor macroeconomic conditions when a company defaults should depress recovery rates; (2) Companies that operate in more concentrated industries should have lower recoveries due to the lack of an active market of bidders; (3) Poor liquidity position of industry peers when a firm defaults should lower the recovery on its debt.

Using airline industry data, Pulvino (1998) examines data on asset sales in the industry. He finds evidence supportive of the Shleifer and Vishny (1992) model: Companies that sell aircrafts when they are financially constrained, or companies that sell aircrafts when the industry is doing poorly, receive a lower price for these aircraft than companies that sell aircrafts at other times. Asquith, Gertner, and Scharfstein (1994) study a sample of 102 companies that issued high-yield "junk" bonds during the 1970s and 1980s and subsequently got into financial trouble. One of their findings concerns the important use of asset sales in restructuring by troubled companies and that such asset sales are limited by industry factors: Companies in poorly performing or highly leveraged industries are less likely to sell assets. In further evidence, Andrade and Kaplan (1998) use a sample of 39 highly levered transactions of the late 1980s and find supporting evidence that poor industry conditions adversely affect company performance or value.

These studies, however, do not examine the recoveries on loans or bonds of the defaulted companies, either at the time of default or at the time of emergence. Furthermore, the effect on bond prices may capture the *expected* liquidation value even though liquidation may not actually take place. In Chapter 11 in the U.S., the debtors have the first-mover advantage in filing a reorganization plan. The debtors can thus make a take-it-or-leave-it offer to creditors (to capture the first-mover advantage in a simple manner for sake of argument) as theoretically modeled in Anderson and Sundaresan (1996) and Mella-Barral and Perraudin (1997). This literature has suggested that such strategic behavior manifests itself as violations of absolute priority rule (APR) under Chapter 11 in the United States, documented for example in Lopucki and Whitford (1990). The take-it-or-leave-it offer if rejected by creditors may take the firm to liquidation so that the first-mover advantage enables the debtors to strategically offer to creditors only the value that the creditors' debt would receive if the firm's assets were liquidated. The firm may get reorganized, acquired, or merged in the bankruptcy, but the creditors receive simply their expected values if the firm were to be liquidated. This implies that a study that only looks at actual asset sales may be ignoring valuable information about anticipated liquidation values contained in bond prices. Since we examine bond prices at default and emergence, our tests are complementary to the existing papers that test Shleifer and Vishny's (1992) hypothesis for asset sale prices. Furthermore, our tests have the advantage of utilizing more data about the effect of industry conditions on asset sales and on strategic bargaining between debtors and creditors.[16] Finally, our sample of defaults covers more than 600 instrument defaults (for emergence prices and more than 200 instrument defaults for prices at time of default) and spans a period of about two decades from 1982 to 1999. We believe the comprehensive nature of our data has the potential to shed additional light on the effect of industry conditions on defaulted firms.

In order to test the three industry hypotheses of Shleifer and Vishny, we estimate the following specification:

$$\begin{aligned}\text{Recovery} \;=\;& \alpha + \hat{\beta} * \text{Contract Characteristics} + \hat{\gamma} * \text{Firm Characteristics} + \\ & \delta_1 * \text{Dummy(Industry Distress)} + \delta_2 * \text{Median Industry Q} + \\ & \delta_3 * \text{Industry Concentration} + \delta_4 * \text{Industry Liquidity} + \\ & \delta_5 * \text{Median Industry Leverage} + \epsilon. \qquad (5)\end{aligned}$$

Note that $\hat{\gamma}$ is the vector of coefficients on firm-specific characteristics. Based on the results in Table 6, we include only Profit Margin and Debt Concentration as the firm-specific characteristics. Tangibility is included to verify that the result of Table 6 that tangibility of assets does not affect recoveries is not due to omitted variable bias. According to the Shleifer and Vishny hypotheses, we expect that $\delta_1 < 0$, $\delta_3 < 0$, $\delta_4 > 0$, and $\delta_5 < 0$. Note that median

[16] The recent example of the bankruptcy of United Airlines illustrates this point well: "Some of the US's leading companies, including Ford and Philip Morris, are facing billions of dollars of losses on United Airlines leases... The US airline believes it can slash its costs by renegotiating its $8bn of aircraft leases that are spread among 300 companies, ranging from Walt Disney to Pitney Bowes and DaimlerChrysler. It plans to send revised terms to leaseholders over the next three days... United's advisers argue it is in a strong negotiating position because of the weak market for used aircrafts." (*US groups face UAL lease losses*, by Robert Clow in New York, *Financial Times, December 13, 2002)*

industry leverage also could be employed as a proxy for difficulty in raising new financing. Firms in industries with high leverage may be closer to being financially constrained or may find taking on more leverage costly.

The industry of a defaulted firm is identified as the set of firms with the same 3-digit SIC code as the defaulted firm following the literature. All industry variables are computed using data from CRSP and COMPUSTAT and measured contemporaneous to default, that is, in the year of default. If the 3-digit SIC code of a defaulted firm does not include at least five other firms, then we do not include the observation in the tests. We construct two versions of dummy variables for Industry Distress. First, in the spirit of Gilson, John, and Lang (1990) and Opler and Titman (1994), we define an industry to be "distressed" if the median stock return for the industry of the defaulting firm in the year of default is less than or equal to −30%. This dummy is Distress1. We also consider an alternative definition of industry distress that in addition to Distress1 being one requires one year or two year median sales growth for the industry in the year of default or the preceding year (based on data availability) to be negative. This dummy, Distress2, is thus based on stock market performance of the industry as well as on the book measure of industry performance, unlike Distress1 which is based only on stock market based performance. In our data, these industry distress dummies take on the value of 1 for about 10% of the sample size in terms of defaulting instruments. As Table 4 reveals, 13% of industry-year pairs have distressed industries classified on the basis of Distress1, the number being 3% when classified on the basis of Distress2. We employ only one of Distress1 or Distress2 at a time in a specification. Note that we measure industry conditions at time of default since we were not able to classify any industry as distressed if we measured industry conditions at the time of emergence of the defaulted firm.

Median Industry Q is the median of the ratio of market value of the firm (estimated as book value of total assets − book value of total equity + market value of equity) to the book value of the firm (estimated as book value of total assets) where the median is taken over all firms in the 3-digit SIC code of the defaulted firm. Industry Concentration is proxied by the sales-based Herfindahl index of all firms in the 3-digit SIC code of the defaulted firm. Industry Liquidity is proxied using two measures. First, Industry Liq1 is the median Quick ratio, defined as the ratio of [Current Assets - Inventories] to Current Liabilities, the median being taken over all firms in the industry of the defaulted firm. Second, Industry Liq2 is the median Interest Coverage ratio, measured as EBITDA/Interest. Both measures are frequently employed in empirical corporate finance to proxy for industry liquidity conditions.[17] Finally, Median Industry Leverage is the median Long-Term Debt to

[17]See, for example, Stromberg (2001) for the use of Quick ratio, and Asquith, Gertner and Scharfstein (1994) and Andrade and Kaplan (1998) for the use of Interest Coverage ratio.

Assets for all firms in the industry of the defaulted firm. Again, to avoid multi-collinearity issues, we employ either Industry Liq1 or Industry Liq2 in a given specification. The median values of these variables for industry–year pairs in our sample are (from Table 4): 0.91 for Q ratio, 0.17 for Herfindahl index capturing industry concentration, 0.99 for Quick ratio (Industry Liq1), 3.08 for interest coverage ratio (Industry Liq2), and 18% industry leverage. Note that the median firm Q (leverage) is substantially smaller (greater) compared to the respective medians at industry–level, as one would expect for defaulting firms.

In Table 7a, we report the results from estimation of equation (5) for recoveries at default. Table 7b contains the results for recoveries at emergence. We find that when the defaulting firm's industry is in "distress," as defined by Distress1 (based on median stock return for industry), its instruments recover about 10-12 cents less on a dollar compared to when the industry is healthy. This statement holds for both recoveries at emergence as well as recoveries at default. Thus, defaulting companies whose industries also have suffered adverse economic shock face significantly lower recoveries. This is further confirmed when we use Distress2, based also on median sales growth for the industry, as the dummy variable for industry distress. In this case, if the defaulting firm's industry is in "distress," it recovers between 16-20 cents on a dollar less at default compared to the case when the industry is healthy. The magnitude of the effect is as high as the relative effect of seniority of the instrument (Bank Loans vs. Senior Debt vs. Subordinated debt). The effects discussed above are all statistically significant at 5%, and mostly at 1%. The effect of Distress2 on recoveries at emergence is somewhat weaker statistically, though still of the order of 7-10 cents on a dollar.

We believe this provides support for the primary hypothesis of Shleifer and Vishny (1992) that poor industry conditions when a company defaults depress recovery rates on the defaulting company's instruments. A possible counterargument is that a very high negative median stock return for the industry may arise also if assets of this industry are not expected to be profitable in the future. That is, the median stock return for industry may proxy in fact for expected profitability of assets of the defaulting firm, a very high negative return generating lower recoveries simply because defaulting firm's assets are not worth much in expectation. This counterargument would generate a negative coefficient on Industry Distress dummies without any role for conditions of peer firms of the defaulting firm.

We address this issue along three dimensions: First, we have employed Profit Margin of the defaulting firm one year prior to default. Thus, the effect of Industry Distress dummies is after controlling for profitability of the firm under consideration. Second, Distress2 dummy is based not only on stock returns but also on the sales growth for the industry which is a book measure of the industry's condition. This book measure is thus less likely to embed expectations of future profitability. The effect of Distress2 on Pd is even stronger than that of

Distress1. Third, we have included in the specification Median Industry Q. Median Industry Q is insignificant for *Pd* and it has a positive and marginally significant effect on *Pehyld*. If we assume that median industry Q proxies for future growth prospects of the industry and in turn of the defaulted firm's assets, examining the coefficient of distress dummies in its presence helps isolate the effect on recoveries due to financial and economic distress of the peers of the defaulted firm. This assumption is borne out in the data, especially in Table 7b for *Pehyld* where the coefficient of Median Industry Q is positive and at least marginally significant in most specifications. The coefficients on distress dummies are negative in both Tables 7a and 7b, and generally statistically significant in the presence of industry Q. This lends robust support for the first Shleifer and Vishny hypothesis.

To examine this result with a microscope, we identify in Table 8a the industries that experience distress based on Distress1 and the year in which they do so. The table shows the 23 industry-year distress pairs: Insurance and Real Estate sector experienced distress in 1990 and 1994; Transportation in 1984 and 1990; Financial Institutions in 1987, 1990 and 1991; Healthcare and Chemicals in 1987, 1990, 1994, 1995, and 1998; High Technology and Office Equipment in 1990; Aerospace, Auto and Capital Goods in 1990; Forest, Building Products and Homebuilders in 1990; Consumer and Service Sector in 1990, 1993, 1995 and 1996; Leisure Time and Media in 1990, 1994 and 1995; and Energy and Natural Resources in 1986. In Panel A of Table 8b, we examine non-parametrically the difference in recoveries measured in different forms between no industry distress years and industry distress years. The difference is 19.5 cents on a dollar for *Pd*, 14.6 for *Pe* and *Pehyld*, and 12.6 for *Pecoup*, all differences being statistically significant with p-values close to zero. The alternative z-statistics for Wilcoxon rank sum test between no industry distress and distress samples also have a p-value close to zero.[18]

Interestingly, the magnitudes of these differences based on non-parametric tests are quite close to the ones implied by the coefficient on Distress1 in the parametric regressions of Table 7 where we employ contract-specific, firm-specific, and other industry-specific characteristics. Furthermore, the coefficients on contract-specific and firm-specific characteristics are of similar magnitudes as in the earlier tables (Tables 5, 6a, and 6b). This evidence implies that the effect of industry distress on recovery rates is orthogonal to that of contract-specific and firm-specific characteristics. Industry's financial health is an economically important determinant of recoveries on instruments of a defaulted firm, over and above other determinants of such recoveries.

Continuing our examination of Tables 7a and 7b, we find little evidence supporting the second hypothesis that industry concentration lowers the recovery rates. The coefficient

[18]While we do not report these numbers, we find that the standard deviation of *Pd* and *Pehyld* are of the same order between no industry distress and industry distress years.

on revenue-based Herfindahl index for the defaulting firm's industry is always negative for recoveries at emergence as well as at default. The effect is, however, never statistically significant at conventional levels of confidence. This result is in contrast to the findings of Izvorski (1997) who documents a positive relationship between industry concentration and recoveries for a set of 153 bonds that defaulted in the United States between 1983-1993. Izvorski considers his finding a "puzzle" since it is opposite to the theoretical literature, in particular, Shleifer and Vishny (1992).

The third hypothesis, that poor liquidity position of industry peers when a firm defaults should lower the recovery on its debt, finds little support in Table 7a for recoveries at default, but finds strong support in Table 7b for recoveries at emergence. We find that controlling for the industry distress condition and industry concentration, the coefficient on Industry Liquidity is mostly insignificant for Pd in terms of statistical confidence. Furthermore, the sign of the coefficient is not robust. The coefficient is negative for Industry Liq1 and positive for Industry Liq2. In contrast, both industry liquidity proxies have positive and significant effect on $Pehyld$. Using Table 4 and the coefficient estimates, we find the effect of lowering industry illiquidity by one standard deviation is to depress the recovery at emergence by about five cents on a dollar. Finally, the coefficient on Median Industry Leverage is insignificant for both Pd and $Pehyld$. The support for liquidity hypothesis of Shleifer and Vishny is thus supported to some extent, but the effect is not as strong or robust as the effect of the overall health of the industry.

In terms of explanatory power, note that the incremental explanatory power of industry-specific characteristics (over and above the explanatory power of contract-specific and firm-specific characteristics) is relatively small. Nevertheless, F-tests performed to check that industry-specific effects are jointly significant have p-values less than 0.05 for all the specifications. The smaller incremental power for industry-specific effects is an artifact of the pooling of data in the cross-section as well as in the time-series. The total variability in recoveries that is to be explained consists of cross-sectional variability (i.e., across firms, seniority, and collateral classes) as well as time-series variability. The strong industry effect arises from whether the industry is in distress or not, an effect that is primarily a time-series effect. This effect explains well the time-series variability in recovery rates, which is small in magnitude compared to the total cross-sectional variability of recoveries in our data.

We conclude our pursuit of identifying determinants of recoveries by examining macroeconomic conditions which if poor also may depress recoveries, consistent with the first hypothesis of Shleifer and Vishny in the discussion above.

5.4 Macroeconomic conditions

We examine the macroeconomic and bond market variables shown by Altman, Brady, Resti, and Sironi (2000) to be significant in explaining the time-series of *average annual recoveries*. These variables are: BDR, the aggregate weighted average default rate of bonds in the high yield market where weights are based on the face value of all high-yield bonds outstanding in the year; SR, the S&P 500 stock return for the year; GDP, the annual Gross Domestic Product growth rate; and BDA, the total face value amount of defaulted bonds in a year measured at mid-year and in trillions of dollars.[19] We use the aggregate BDR as a summary statistic of the macroeconomic conditions and thus employ either BDR or the SR, GDP and BDA variables together in any specification. From Table 4, we see that both BDA and BDR are highly skewed variables; median aggregate default rate is about 2% reaching a maximum value of 10%. Similary, median face value of defaulted bonds in a year is about 4 billion dollars with a maximum of 23.5 billion dollars (in 1999).

If we interpret high values of BDR and BDA as capturing adverse macroeconomic conditions, then the negative effects of these variables on recovery rates would be consistent with the first hypothesis of Shleifer and Vishny discussed before: Poor macroeconomic conditions reduce the ability of potential buyers to pay high prices for these assets. Altman et al. (2000) present another hypothesis which is that a negative effect may capture supply conditions in the defaulted bond market: The set of investors participating in the defaulted bond market is segmented and limited to vulture funds, hedge funds, high-yield desks of banks and financial institutions, and high net-worth individuals. A greater supply of defaulted bonds for a limited demand could imply that the prices on defaulted bonds must fall in order to clear the markets.[20]

In addition to testing these hypotheses, we also examine the effect of the three Fama and French factors, Market, Size (Small Minus Big), and Book-to-Market (High Minus Low), obtained from the Web-site of Ken French and computed using the procedures described in Fama and French (1993). We employ these variables to capture the extent of macroeconomic risk in the year of default. An increase in these risks would raise the cost of raising funds in the economy, and in the spirit of Shleifer and Vishny's hypothesis could depress recoveries.

[19] The time–series variation in BDR and BDA is quite large. For example, in the Altman et al. (2002) data, the aggregate default rate is 1.6% in 1998 and 9.6% in 2002. Similarly, the aggregate defaulted amount was $7.5bln in 1998 and $63.6bln in 2002.

[20] This is also the perceived wisdom in some industry literature concerning the depressed prices of defaulted securities in 2001–2002 period: "As the huge volume of defaulted debt floods the market, trading prices for distressed debt have become depressed, a response to increased supply meeting a generally shallow, illiquid market." (*Ultimate Recovery Remains High for Well-Structured Debt, Dropping for Poorly Structured Debt*, Standard & Poors, Risk Solutions, January 2002)

Using these variables, we estimate the specification

$$\begin{aligned}\text{Recovery} &= \alpha + \hat{\beta} * \text{Contract Characteristics} + \hat{\gamma} * \text{Firm Characteristics} + \\ &\quad \hat{\delta} * \text{Industry Conditions} + \\ &\quad \theta_1 * \text{SR} + \theta_2 * \text{GDP} + \theta_3 * \text{BDA or BDR} + \epsilon \text{ OR} \\ &\quad \theta_1 * \text{Market} + \theta_2 * \text{SMB} + \theta_3 * \text{HML} + \epsilon. \end{aligned} \tag{6}$$

In Table 9a, we report the point estimates and the standard errors from estimation of equation (6) for recoveries at default, *Pd* (Columns 1–2), and recoveries at emergence, *Pehyld* (Columns 3–5). For ease of reporting, the coefficients on seniority dummies are not reported in this table. Note that, unlike Altman et al. (2000), we do our regressions using recovery information on individual defaulted instruments and not using average annual recoveries. As the table reveals, the macroeconomic and bond market conditions are not significant determinants of recoveries, once industry dummies and industry conditions (Distress1, Median Industry Q, and Industry Liq1) are controlled for. The Fama and French factors do not appear to have any incremental explanatory power either.

These results are at one level in contrast to those of Altman et al. (2000). The strongest effects, in Altman et al. (2000), arise from the aggregate default rate BDR and the aggregate defaulted bond supply BDA. However, it must be recognized that in our regressions, we control for the effect of industry conditions and also control for industry dummies. Altman et al. (2000) examine annual average recovery rates and hence such conditioning is not possible. To examine this issue, in Table 9b we run the same specifications as in Table 9a but without any industry variables (industry dummies are still included). Even in the absence of industry variables, stock market return, GDP growth rate, and economy-wide risk factors, have no explanatory power for either *Pd* or *Pehyld*. In contrast, the effect of aggregate defaulted bond supply BDA is negative and statistically significant for both *Pd* and *Pehyld*, and the effect of aggregate default intensity BDR is negative and significant for *Pehyld*. The intercept terms for *Pehyld* regressions are now again positive and statistically significant, reflecting the inadequacy of the specification without industry conditions.

Indeed, what is most striking is that in Table 9a, the bond market conditions do not drive out the effect of industry distress, Distress1, on *Pd* and *Pehyld*, and instead are rendered insignificant themselves. The effect of Distress1 in the presence of macroeconomic and bond market conditions is negative, significant usually at 5% level, and of the order of 10–13 cents on a dollar as before. The effect of industry liquidity, Industry Liq1, on *Pehyld* is also unaffected in magnitude and statistical significance. Finally, in Table 9a, the intercept terms for *Pehyld* are not statistically different from zero, reflecting that industry conditions are an essential ingredient of a specification that explains well the recoveries at emergence.

In Panel B of Table 8b, we examine non-parametrically the difference in recoveries measured in different forms between no industry distress years and industry distress years where we exclude 1990, the NBER recession year in which nine out of the twenty-three industry distress events occur. Except for *Pd*, we find that the difference in recoveries between no industry distress years and industry distress years (excluding 1990) is of similar magnitude as in Panel A which includes 1990 in industry distress years: 17.1 for *Pe*, 13.1 for *Pehyld*, and 12.4 for *Pecoup*, all differences being statistically significant with p-values close to zero. This illustrates that it is not per se the existence of a recession year for the economy at large which depresses recoveries at emergence. What is crucial for the recovery on defaulted instruments is whether the industry of the defaulting firm is itself in distress or not. If an industry is in distress, the recoveries for firms defaulting in this industry are significantly depressed even when the overall economy is not in distress or recession. In contrast, the difference in *Pd*, the prices at default, between no industry distress and distress years is close to zero in Panel B. It must be observed though that excluding 1990 leaves only 10 instrument observations in the sample of industry distress years.

These results clarify that the industry condition effects, as motivated by the theoretical work of Shleifer and Vishny (1992), are not subsumed by the effect of macroeconomic conditions. Industry conditions appear to be the most robust and economically important determinants of recoveries among factors other than contract-specific and firm-specific characteristics.

5.5 Summary

We conclude from the results of Tables 5-9 that the following factors play an important role in explaining recovery rates on defaulted instruments measured as prices at default and at emergence. Seniority and security (collateral) of defaulted instruments help explain the cross-section of recovery rates at emergence. Profitability of assets of defaulting firms and concentration of its debt structure explain well the cross-section of recovery rates at default. Both recoveries, at default and at emergence, are affected significantly by the industry condition when a firm defaults (distressed or healthy) and by the type of industry (utility or not). Finally, recoveries at emergence also seem to be affected adversely by the illiquidity of peer firms in industry of the defaulted firm and by the length of time the firm spends in bankruptcy. These sets of factors do not subsume each other, and each set has incremental power in explaining observed recovery rates in the United States over the period 1982-1999.

6 Are Determinants of Recovery Risk and Default Risk Identical?

In this section, we examine whether ex-ante measures of likelihood of default of a firm, found to be important by extant empirical literature, affect recovery rates or not. In particular, we examine three predictors of default risk of a firm employed in the literature and in practice. First, we employ the Z–score employed in credit-scoring models by rating agencies. The Z–score we employ is as defined in Altman (1968, 2000) and as modified by Mackie-Mason (1990):

$$\text{Z} = (3.3 * \text{EBIT} + \text{Sales} + 1.4 * \text{Retained Earnings} + 1.2 * \text{Working Capital})/\text{Assets}. \quad (7)$$

Second, we consider another credit-scoring model from the accounting literature, the Zmijewski Score, as defined in Zmijewski (1984):

$$\begin{aligned} \text{Zmijewski Score} &= -4.3 - 4.5 * \text{Net Income/Total Assets} \\ &+ 5.7 * \text{Total Debt/Total Assets} \\ &- 0.004 * \text{Current Assets/Current Liabilities.} \end{aligned} \quad (8)$$

Finally, we also employ the Distance to Default as computed by KMV (www.kmv.com) using stock returns and stock return volatility of a firm, based on the Merton (1974) model. We have have employed (but do not report the results for) the Expected Default Frequency (EDF), a variant of the Distance to Default measure. The exact computation of these measures is described in Appendix A.

We estimate the specification

$$\begin{aligned} \text{Recovery} &= \alpha + \hat{\beta} * \text{Contract Characteristics} + \hat{\gamma} * \text{Firm Characteristics} + \\ &\hat{\delta} * \text{Industry Conditions} + \\ &\omega * \text{Z–Score or Zmijewski Score or Distance to Default} + \epsilon. \end{aligned} \quad (9)$$

Note that since the determinants of default risk are also based on firm-specific characteristics, we only include Debt Concentration among these variables. This lets us capture cleanly whether determinants of likelihood of default are also determinants of recoveries or not. The estimates are reported in Table 10 for recovery at default (Columns 1–3) and at emergence (Columns 4–6). The determinants of default risk are in general also significant as determinants of recoveries: Z–Score for both *Pd* and *Pehyld*, Zmijewski Score for *Pehyld*, and Distance to Default for *Pd*. The effect of seniority of instruments, time in default, debt concentration, and industry conditions remains overall unaffected from the presence of the determinants of ex-ante default risk.

7 Implications for Credit Risk Models

The results of the previous section imply that default risk and recovery risk are positively correlated. Factors affecting a firm's likelihood of default also affect the recoveries on its debt instruments once the firm is in default. This in turn implies that current credit risk models which take recovery as a constant input (e.g., average or expected recovery) understate the true credit risk of underlying instruments. The Value at Risk (VaR) calculations would be understated, as shown through calibrations by Altman, Brady, Resti, and Sironi (2002), Frye (2000a, 2000b), and Hu and Perraudin (2002), papers that like us have also shown that the probability of default and loss given default are correlated. Izvorski (1997) also documents a dependence between the recovery rates and the survival times of bonds. This correlation also would adversely affect the diversification possibilities in a credit portfolio.

Our results from Sections 5 and 6 put together show that while determinants of default risk and recovery risk are correlated, they are not perfectly correlated. Seniority and collateral, time in default, concentration of debt structure, industry distress and industry liquidity are factors that seem to affect recoveries over and above factors that affect default risk. How do these factors affect inputs of recovery rates in existing credit risk models? Senority and collateral, and also concentration of debt structure, could be captured by allowing a constant recovery rate but one that varies depending on the firm and the instrument (assuming debt structure does not change dramatically during the life of the instrument). It is not fully clear that uncertainty about time in default is a systematic risk and thus may also be reasonably captured in an average recovery rate. However, the state of the industry of the defaulted firm, distressed or healthy, is certainly a systematic risk factor. It constitutes a dimension of recovery risk that may in fact carry a risk-premium to it given its systematic nature. Our results thus underscore the need for modeling recovery risk as stemming from firm-specific factors as well as systematic, industry-specific factors.

To the best of our knowledge, such an integrated credit risk model does not yet exist either in the structural class of credit risk models or in the reduced form variety. In a recent contribution to the limited literature that considers modeling recovery risk and associated risk premium, Guntay, Madan and Unal (2003) propose an approach to infer the risk neutral density of recovery rates implied by debt prices of a firm and demonstrate that interest rates, firm tangible assets, and the level of senior debt appear to be significant determinants of the price of recovery. Their model however assumes that default risk and recovery risk are independent, in contrast to our finding that these risks are positively correlated but not perfectly so. In this regard, Das and Tufano (1996)'s assumption where interest rate risk affects credit risk as well recovery risk is more consistent with our findings. Their model however limits recovery risk to being determined completely by interest rates. The models of Frye (2000a, 2000b) capture in a reduced form the correlation of default risk and recovery risk as potentially arising from the risk of recessions. As our tests reveal, it is the risk of an industry recession rather than an economy-wide recession which is the primary driver of recovery risk.

Building a next generation of credit risk models that embed industry-specific factors thus appears to be a fruitful goal to pursue, and our empirical work should provide guidance concerning the additional factors to introduce in these models. Another possibility is to analyze in general equilibrium or asset-pricing frameworks the risk-premia arising from the industry effect, that is, from the risk of recovery or the risk of asset fire-sales when firms receive common shocks. Such an exercise would be valuable in understanding the implications of industry-driven recovery risk for prices of credit risky instruments.

8 Conclusions

In this paper, we have provided a comprehensive empirical analysis of recovery rates on defaulted loans and bonds in the United States over the period 1982–1999. Our main finding is that the condition of the industry of the defaulted firm, that is, whether the industry is in distress or not, is a robust and economically important determinant of recovery rates. This finding suggests that the next generation of credit risk models would benefit from considering an industry factor that drives recovery risk in addition to a firm-specific factor that drives default risk.

We hope our research will serve as the empirical benchmark for recoveries on different kinds of debt and in different conditions. We hope to employ our benchmark results in future research that links ex-post recovery outcomes to ex-ante capital structure of firms. This would empirically formulate the link between recovery levels and debt capacity that Shleifer and Vishny (1992) theoretically model and posit as being relevant in explaining the variation in leverage across industries and over the business cycle. Finally, studies that examine the determinants of credit spread changes, e.g., Collin-Dufresne, Goldstein, and Martin (2001), have not accounted for the rich cross-sectional and time-series variation in recoveries found in our study. A more complete analysis of credit spread changes is called for, especially one that employs some of the industry factors identified by us as important determinants of recovery rate changes.

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A The KMV-Merton Model Implied Distance to Default

Symbolically, the Merton (1974) model stipulates that the equity value of a firm satisfies

$$E = V\mathcal{N}(d_1) - e^{-rT}F\mathcal{N}(d_2), \tag{A.1}$$

where V is the value of firm's assets, E is the market value of firm's equity, F is the face value of the firm's debt (assumed to be zero-coupon) maturing at date T, r is the instantaneous risk-free rate continuously compounded, $\mathcal{N}(\cdot)$ is the cumulative standard normal distribution function, d_1 is given by

$$d_1 = \frac{ln(V/F) + (r + 0.5\sigma_V^2)T}{\sigma_V\sqrt{T}}, \tag{A.2}$$

and d_2 is just $d_2 = d_1 - \sigma_V\sqrt{T}$.

The KMV-Merton model makes use of two important equations. The first is the Black-Scholes-Merton equation (A.1), expressing the value of a firm's equity as a function of the value of the firm. The second relates the volatility of the firm to the volatility of its equity. Under Merton's assumptions the value of equity is a function of the value of the firm and time, so it follows directly from Ito's lemma that

$$\sigma_E = (V/E)\frac{\partial E}{\partial V}\sigma_V. \tag{A.3}$$

In the Black-Scholes-Merton model, it can be shown that $\frac{\partial E}{\partial V} = \mathcal{N}(d_1)$, so that under the Merton model's assumptions, the volatilities of the firm and its equity are related by

$$\sigma_E = (V/E)\mathcal{N}(d_1)\sigma_V, \tag{A.4}$$

where d_1 is defined in equation (A.2).

The KMV-Merton model basically uses the two nonlinear equations, (A.1) and (A.4), to translate the value and volatility of a firm's equity into an implied probability of default. While most of the values that these two equations depend on are readily observable, the assumptions of the Merton model require making a few decisions about the data. The value of a firm's equity, E, is easy to observe in the marketplace by multiplying shares outstanding by the firm's current stock price. The estimate of σ_E is obtained from either the stock returns data or the implied volatility of the options written on the stock. We can then solve (A.1) and (A.4) for V and σ_V.

Using these, the distance to default is computed as

$$DD = \frac{ln(V/F) + (r - 0.5\sigma_V^2)T}{\sigma_V \sqrt{T}} \ , \tag{A.5}$$

and EDF, the expected default frequency,

$$EDF = N\left[-\left(\frac{ln(V/F) + (r - 0.5\sigma_V^2)T}{\sigma_V \sqrt{T}}\right)\right]. . \tag{A.6}$$

Table 1 : Time-series Behavior of Recovery Prices at Default (Pd) and at Emergence (Pehyld, Pecoup, Pe). This table documents the time series behavior of recovery prices in terms of cents per dollar. Pd is the price observed at default. Pe is the price observed at emergence. Pehyld is the price observed at emergence discounted by the high yield index for the period between default and emergence. Pecoup is the price observed at emergence discounted by the coupon rate of the instrument in default for the period between default and emergence. Note that one firm could have defaulted in multiple years. There was only one default in 1981.

	Pd					Pehyld				
Year	**Defaults**	**Firm defaults**	**Average**	**Median**	**St.Dev.**	**Defaults**	**Firm defaults**	**Average**	**Median**	**St.Dev.**
Overall	645	379	41.96	38.00	25.34	1511	465	51.11	49.09	36.58
1982	16	9	35.80	34.00	15.01	12	5	44.86	51.66	16.57
1983	6	5	49.25	54.75	20.50	5	4	46.17	35.94	34.95
1984	11	6	53.31	50.50	15.67	6	3	50.70	48.57	26.91
1985	19	12	44.70	35.00	20.43	12	8	21.71	10.82	30.13
1986	43	20	36.65	37.25	16.96	37	16	21.53	15.48	23.49
1987	23	14	53.99	41.00	27.70	56	11	55.59	58.80	36.11
1988	55	25	44.55	40.00	19.91	101	24	56.59	64.64	33.73
1989	52	28	43.67	35.54	31.31	110	29	43.76	36.02	37.49
1990	77	41	26.82	19.50	20.90	245	69	41.24	34.14	35.78
1991	111	53	47.02	38.50	29.96	326	81	48.97	47.62	35.06
1992	42	25	53.88	52.75	23.27	137	53	58.80	62.58	33.89
1993	11	9	50.20	38.00	28.89	103	36	55.84	49.09	38.18
1994	10	9	56.09	55.00	19.82	60	25	66.02	82.54	38.23
1995	23	18	49.88	43.50	23.30	97	35	63.22	68.30	36.96
1996	17	13	45.34	45.00	25.32	75	27	60.64	62.40	36.55
1997	14	9	56.40	52.50	27.31	38	11	61.18	73.71	40.27
1998	21	19	41.50	30.00	25.77	49	16	36.69	38.76	29.47
1999	94	64	32.07	31.00	19.63	42	12	67.18	80.00	37.19

Table 1 (continued) : Time-series Behavior of Recovery Prices at Default (Pd) and at Emergence (Pehyld, Pecoup, Pe). This table documents the time series behavior of recovery prices in terms of cents per dollar. Pd is the price observed at default. Pe is the price observed at emergence. Pehyld is the price observed at emergence discounted by the high yield index for the period between default and emergence. Pecoup is the price observed at emergence discounted by the coupon rate of the instrument in default for the period between default and emergence. Note that one firm could have defaulted in multiple years. There was only one default in 1981.

	Pecoup					**Pe**				
Year	**Defaults**	**Firm defaults**	**Average**	**Median**	**St.Dev.**	**Defaults**	**Firm defaults**	**Average**	**Median**	**St.Dev.**
Overall	1510	464	52.27	49.99	36.90	1541	475	62.02	63.07	42.98
1982	12	5	61.15	68.81	23.27	12	5	78.63	88.06	33.53
1983	5	4	45.93	42.46	31.57	5	4	53.81	57.66	32.28
1984	6	3	60.13	58.58	32.44	6	3	78.31	75.46	40.48
1985	12	8	19.06	8.43	28.35	12	8	29.18	15.13	41.83
1986	37	16	24.05	14.90	27.26	37	16	38.03	20.56	44.57
1987	56	11	53.31	58.70	34.83	56	11	63.03	72.04	42.05
1988	101	24	52.30	59.93	30.48	101	24	72.07	89.25	42.31
1989	110	29	42.12	30.77	36.51	110	29	51.73	36.71	44.96
1990	245	69	44.67	36.09	37.54	244	70	54.27	51.88	43.05
1991	326	81	54.21	52.32	37.32	344	85	66.99	68.50	45.57
1992	137	53	59.75	67.04	34.35	138	54	68.03	80.39	37.81
1993	103	36	54.92	42.12	38.44	111	38	58.61	50.35	41.01
1994	60	25	66.43	81.45	38.70	61	26	71.96	93.57	42.02
1995	97	35	62.21	68.00	36.85	100	36	70.45	80.17	40.63
1996	74	26	60.44	65.15	35.83	75	27	65.16	65.13	38.73
1997	38	11	59.50	73.30	39.25	38	11	65.88	77.50	44.28
1998	49	16	33.75	35.69	27.71	49	16	36.78	38.76	29.46
1999	42	12	64.61	72.23	36.15	42	12	67.28	80.00	37.20

Table 2 : Industry Behavior of Recovery Prices at Default and at Emergence. This table documents the industry behavior of recovery prices in terms of cents per dollar. Pd is the price observed at default. Pe is the price observed at emergence. Pehyld is the price observed at emergence discounted by the high yield index for the period between default and emergence. Pecoup is the price observed at emergence discounted by the coupon rate of the instrument in default for the period between default and emergence. Note that one firm could be classified in multiple industries based on the division that defaulted. ** means significantly different from other group means at 5% level using a Scheffe's test.

		Pd					Pehyld				
S&P Code	**Industry Description**	**Def**	**Firm defaults**	**Avg**	**Mdn**	**St.Dev.**	**Def**	**Firm defaults**	**Avg**	**Mdn**	**St.Dev.**
Overall	Overall	646	365	41.96	38.00	25.34	1511	424	51.11	49.09	36.58
1	Utility	55	8	68.37**	77.00	20.82	82	9	74.49**	76.94	18.79
2	Insurance and Real Estate	33	15	39.79	33.50	26.70	77	23	37.13	27.92	30.96
3	Telecommunications	16	5	27.33	22.31	9.99	26	6	53.01	49.49	44.29
4	Transportation	43	24	36.98	36.00	26.10	99	20	38.92	18.69	40.76
5	Financial Institutions	24	15	29.70	28.75	24.63	76	24	58.79	51.94	42.13
6	Healthcare / Chemicals	22	18	36.51	36.25	26.33	111	35	55.67	49.41	38.13
7	High Technology/ Office Equipment	16	11	46.78	49.38	22.97	63	22	47.05	40.11	38.07
8	Aerospace / Auto / Capital Goods	82	50	41.99	40.00	21.59	138	46	52.08	48.43	37.18
9	Forest,Building Prod / Homebuilders	43	24	39.69	29.25	29.46	114	30	53.50	53.33	32.35
10	Consumer / Service Sector	165	97	37.33	38.00	21.25	472	126	47.22	41.09	35.57
11	Leisure Time / Media	87	62	42.88	35.00	26.90	167	54	51.82	48.50	36.05
12	Energy and Natural Resources	60	36	45.07	37.38	25.68	86	29	60.41	58.80	35.41

Table 3a : Seniority Behavior of Recovery Prices at Default and at Emergence. Pd is the price observed at default. Pe is the price observed at emergence. Pehyld is the price observed at emergence discounted by the high yield index for the period between default and emergence. Pecoup is the price observed at emergence discounted by the coupon rate of the instrument in default for the period between default and emergence. All recovery prices are measured in cents per dollar. Note that one firm could be classified in multiple seniorities based on instruments that defaulted. 11 of the 15 pairwise means test for difference is significant at 5% level or lower using a Scheffe's test.

		Pd					**Pehyld**				
Seniority Code	**Seniority Description**	**Def**	**Firm defaults**	**Avg**	**Mdn**	**St.Dev.**	**Def**	**Firm defaults**	**Avg**	**Mdn**	**St.Dev.**
Overall	Overall	598	418	42.07	37.75	25.17	1511	829	51.11	49.09	36.58
1	Bank Loans	No Data					358	219	81.12	91.55	26.26
2	Senior Secured	183	110	48.33	48.00	23.10	267	119	59.14	61.99	30.18
3	Senior Unsecured	107	57	51.06	42.50	26.89	236	98	55.92	54.63	34.58
4	Senior Subordinated	153	133	34.01	29.00	23.13	266	172	34.37	26.78	30.39
5	Subordinated	148	113	36.07	32.00	24.11	346	186	27.07	16.66	30.37
6	Junior Subordinated	7	5	43.70	28.90	33.00	38	35	18.28	6.25	27.11

Table 3b : Collateral Behavior of Recovery Prices at Default and at Emergence. Pd is the price observed at default. Pe is the price observed at emergence. Pehyld is the price observed at emergence discounted by the high yield index for the period between default and emergence. Pecoup is the price observed at emergence discounted by the coupon rate of the instrument in default for the period between default and emergence. All recovery prices are measured in cents per dollar. Note that one firm could be classified in multiple collateral classes based on instruments that defaulted. ** means different from other group means is significant at 5% level using a Scheffe's test.

		Pd					**Pehyld**				
Collateral Code	**Collateral Description**	**Def**	**Firm defaults**	**Avg**	**Mdn**	**St.Dev.**	**Def**	**Firm defaults**	**Avg**	**Mdn**	**St.Dev.**
Overall	Overall						1511	644	51.11	49.09	36.58
1	Current Assets						52	46	94.19**	98.81	15.96
2	PP and E						83	44	71.36	77.74	27.51
3	Real Estate						38	23	71.83	77.77	31.07
4	All or Most assets			No data			228	126	80.05	89.16	26.35
5	Other						33	20	60.94	53.67	31.21
6	Unsecured						32	25	63.71	63.79	33.48
7	Secured						40	17	63.59	67.42	36.43
8	Information Not available						1005	343	38.64**	30.91	33.48

Table 4 : Summary Statistics of firm, industry and macro characteristics. Note that the number of data observations are different for each variable due to data availability.All firm specific variables are measured as of the last fiscal year before the default and data is obtained from COMPUSTAT. Profit Margin is the ratio of EBITDA to Sales. Tangibility is the ratio of Property Plant and Equipment to Total Assets. Debt Ratio is the ratio of Long Term Debt to Total Assets. Log(Assets) is the natural logarithm of the total assets. Total assets are in millions of dollars. Q ratio is the ratio of Market value of the firm (estimated as Book Value of total assets - book value of equity + market value of equity) to the book value of the firm (estimated as book value of total assets). No. of issues is the total number of debt issues of the firm that is currently under default. Debt concentration is the Herfindahl index measure by amount of the debt issues of the firm that are under default. Firm return is the stock return of the firm that has defaulted in the year before default. Firm volatility is the ratio of the standard deviation of daily stock returns of the firm to the standard deviation of daily stock returns of the CRSP value weighted index in the year before default. Distress1 is a dummy variable that takes a value 1 if the median stock return of all the firms in the 3 digit SIC code of the defaulted firm is less than -30% and 0 otherwise. Distress2 is a dummy variable that takes on a value 1 if distress1 is 1 and if the median sales growth of all the firms in the 3 digit SIC code of the defaulted firm is negative in any of the 2 years before the default date. Med.Ind.Q is the median, of the ratio of Market value of the firm (estimated as Book Value of total assets $-$ book value of equity + market value of equity) to the book value of the firm (estimated as book value of total assets), of all the firms in the 3 digit SIC code of the defaulted firm. Ind. Liq1 is the median Quick ratio (ratio of (Current Assets$-$Inventories) to Current Liabilities), Ind. Liq2 is the median Interest coverage ratio (EBITDA/Interest), Med. Ind. leverage is the median Long term debt to total assets, of all the firms in the 3 digit SIC code of the defaulted firm. Herfindahl Index is the industry concentration measure based on sales. All Industry variables are measured in the year of default. SR, GDP, BDA, BDR are the macro variables used by Altman et.al (2002). SR is the annual return on the SandP 500 stock index. GDP is the annual GDP growth rate in percentage. BDA is the total amount of high yield bonds defaulted amount for a particular year (measured at mid-year in billions of dollars) and represents the potential supply of defaulted securities. BDR is the weighted average default rate in percentage on bonds in the high yield bond market. Weights are based on the face value of all high yield bonds outstanding each year.

Variable	n	Mean	S.D.	Min	25th Percentile	Median	75th Percentile	Max
Profit Margin	163	0.08	0.20	-0.77	0.01	0.07	0.14	0.94
Tangibility	163	0.38	0.25	0.00	0.17	0.33	0.57	0.93
Debt Ratio	165	0.49	0.35	0.00	0.23	0.48	0.69	1.93
Log(assets)	168	6.23	1.33	3.43	5.35	6.05	7.04	10.46
Q ratio	113	0.86	0.43	0.08	0.63	0.76	0.98	2.45
No of issues	196	4.27	3.97	1.00	2.00	3.50	5.00	33.00
Debt Concentration	196	0.49	0.28	0.09	0.27	0.40	0.61	1.00
Firm Return	86	0.43	0.36	0.02	0.17	0.30	0.56	1.70
Firm Volatility	101	9.09	4.83	1.89	5.56	8.48	10.87	23.71
Distress1	94	0.13	0.34	0.00	0.00	0.00	0.00	1.00
Distress2	94	0.03	0.18	0.00	0.00	0.00	0.00	1.00
Med Ind Q	94	1.02	0.43	0.20	0.79	0.91	1.16	3.52
Herfindahl Index	91	0.20	0.13	0.01	0.09	0.17	0.27	0.69
Ind Liq1	86	1.01	0.34	0.25	0.81	0.99	1.23	2.05
Ind Liq2	87	3.43	2.08	-0.83	1.86	3.08	4.65	10.32
Med Ind Leverage	90	0.18	0.10	0.01	0.10	0.18	0.24	0.50
SR	18	0.18	0.12	-0.03	0.08	0.17	0.29	0.38
GDP	18	3.22	1.99	-2.03	2.67	3.54	4.17	7.27
BDA	18	6.47	6.84	0.30	2.29	4.07	7.49	23.53
BDR	18	3.06	2.82	0.84	1.25	1.81	3.50	10.27

Table 5: OLS Estimates of Regression of Recovery Prices at Default and at Emergence on Contract Characteristics. Pd is the price observed at default. Pehyld is the price observed at emergence discounted by the high yield index for the period between default and emergence. Both recoveries are measured in cents per dollar for each debt instrument. Coupon is the coupon rate of the instrument. Log (Issue size) is the natural logarithm of issue size (in millions of dollars). Bank Loans, Senior Secured, Senior Unsecured, Senior Subordinated, Subordinated are dummy variables that take on a value of 0 or 1 depending on the seniority of the instrument. Time in default is the time in years between the emergence and default dates. Maturity O/s is the remaining time to maturity of the instrument that has defaulted. Current Assets and Unsecured are dummy variables that take the value of 0 or 1 depending on the collateral for the instrument. Collateralized Debt is the ratio of dollar value of debt backed by collateral for the defaulting firm to the dollar value of all debt of the defaulting firm. Private Debt is the ratio of dollar value of bank debt for the defaulting firm to the dollar value of non-bank debt of the defaulting firm. Utility is a dummy variable if the firm belongs to the utility industry. All regressions have industry dummies (the coefficients are not reported except for utility dummy). Cluster (based on each firm's debt instruments as a single cluster) and heteroscedasticity corrected standard errors are reported in parentheses. $***, **, *$ represent significance levels at 1%, 5%, and 10% respectively.

	Pd	Pd	Pehyld	Pehyld	Pehyld	Pehyld	Pehyld
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Const.	45.29***	46.41***	27.56***	18.28	37.50***	25.95***	27.82***
	(15.43)	(15.68)	(8.56)	(11.75)	(9.60)	(8.80)	(8.91)
Coupon	-0.84*	-0.82*	-0.25	-1.04*	-0.30	-0.22	-0.23
	(0.50)	(0.50)	(0.37)	(0.62)	(0.38)	(0.37)	(0.37)
Log (Issue Size)	1.45	1.60	-0.05	4.53***	0.25	0.08	-0.05
	(1.54)	(1.55)	(0.86)	(1.50)	(0.87)	(0.86)	(0.86)
Bank Loans			58.59***		46.69***	64.17***	59.52***
			(4.96)		(6.17)	(5.60)	(5.41)
Senior Secured	6.81	5.95	36.21***	31.50***	30.19***	37.24***	37.16***
	(13.85)	(13.97)	(5.35)	(7.63)	(5.48)	(5.30)	(5.47)
Senior Unsecured	2.89	3.33	34.08***	32.84***	33.94***	33.9***	33.95***
	(13.94)	(14.11)	(5.80)	(7.81)	(5.78)	(5.68)	(5.67)
Senior Subordinated	-7.18	-7.63	13.88***	11.47	13.66***	13.72***	13.81***
	(13.80)	(13.91)	(4.64)	(7.62)	(4.66)	(4.66)	(4.66)
Subordinated	-9.39	-9.37	6.72	6.69	6.60	6.86	6.76
	(13.83)	(13.95)	(4.78)	(7.26)	(4.81)	(4.76)	(4.77)
Time in Default			-5.37***	-3.22***	-5.13***	-5.28***	-5.41***
			(0.95)	(1.18)	(0.94)	(0.97)	(0.97)
Maturity O/s		-0.26		-0.26			
		(0.27)		(0.26)			
Current Assets					13.53***		
					(3.28)		
Unsecured					-10.94***		
					(4.23)		
Collateralized Debt						-3.15	
						(5.73)	
Collateralized Debt * Unsecured							-1.61
							(7.27)
Collateralized Debt * (1-Unsecured)							-3.51
							(5.89)
Private Debt							1.04
							(6.80)
Private Debt * Bank Loans						-7.67	
						(8.16)	
Private Debt * (1-Bank Loans)						6.83	
						(7.51)	
Utility	26.02***	26.57***	33.13***	36.68***	33.54***	33.14***	32.92***
	(8.08)	(7.71)	(6.58)	(6.55)	(6.50)	(6.52)	(6.47)
Obs.	399	396	1510	396	1510	1510	1510
R^2	0.28	0.29	0.41	0.47	0.43	0.42	0.41

Table 6a: OLS Estimates of Regression of Recovery Prices at Default on Contract and Firm Characteristics. Pd is the price observed at default measured in cents per dollar for each debt instrument. Coupon is the coupon rate of the instrument. Log (Issue size) is the natural logarithm of issue size (in millions of dollars). Senior Secured, Senior Unsecured, Senior Subordinated, Subordinated are dummy variables that take on a value of 0 or 1 depending on the seniority of the instrument. All firm specific variables are measured as of the last fiscal year before the default and data is obtained from COMPUSTAT. Profit Margin is the ratio of EBITDA to Sales. Tangibility is the ratio of Property Plant and Equipment to Total Assets. Debt Ratio is the ratio of Long-Term Debt to Total Assets. Log (Assets) is the natural logarithm of the total assets. Q ratio is the ratio of Market value of the firm (estimated as Book Value of total assets - book value of equity + market value of equity) to the book value of the firm (estimated as book value of total assets). No. of issues is the total number of debt issues of the firm that is currently under default. Debt concentration is the Herfindahl index measure by amount of the debt issues of the firm that are under default. Firm return is the stock return of the firm that has defaulted in the year before default. Firm volatility is the ratio of the standard deviation of daily stock returns of the firm to the standard deviation of daily stock returns of the CRSP value weighted index in the year before default. Utility is a dummy variable if the firm belongs to the utility industry. All regressions have industry dummies (the coefficients are not reported except for utility dummy). Cluster (based on each firm's debt instruments as a single cluster) and heteroscedasticity corrected standard errors are reported in parentheses. $***, **, *$ represent significance levels at 1%, 5%, and 10% respectively.

	Pd	Pd	Pd	Pd	Pd	Pd	Pd
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Const.	13.49	7.24	32.28*	18.58	8.81	15.95	33.23**
	(18.19)	(23.15)	(17.48)	(17.04)	(16.05)	(19.77)	(16.71)
Coupon	-0.64	-0.53	-1.21**	-0.54	-1.03*	-0.94	-1.47**
	(0.63)	(0.60)	(0.60)	(0.57)	(0.60)	(0.68)	(0.59)
Log (Issue Size)	3.76*	3.27	4.25*	4.03*	4.66**	3.79	3.82*
	(2.17)	(2.22)	(2.49)	(2.06)	(2.18)	(2.39)	(2.30)
Senior Secured	26.74***	28.06***	20.69**	26.86***	21.70***	23.52**	27.34***
	(8.52)	(9.33)	(8.38)	(7.51)	(6.93)	(10.38)	(8.84)
Senior Unsecured	27.38***	28.29***	17.23**	27.15***	23.14***	18.55**	23.35***
	(8.72)	(9.18)	(8.35)	(7.62)	(6.62)	(9.09)	(7.97)
Senior Subordinated	1.74	3.28	-5.84	-0.40	-3.32	-4.07	-0.15
	(8.43)	(9.26)	(9.32)	(7.26)	(6.58)	(9.40)	(9.19)
Subordinated	10.38	11.91	4.02	7.33	3.69	1.32	4.14
	(8.38)	(9.44)	(8.97)	(7.32)	(6.70)	(8.94)	(8.69)
Profit margin	25.81***	24.97**	26.42*	27.2***	30.1***	32.55*	34.37***
	(9.14)	(9.84)	(14.78)	(9.37)	(8.92)	(19.47)	(12.13)
Tangibility	-13.75	-13.00	-37.32**	-7.38	-11.80	-29.22*	-31.30*
	(12.66)	(12.53)	(17.69)	(11.13)	(12.03)	(16.24)	(16.09)
Leverage	11.81*	12.31*	7.89	8.20	12.86*	19.33**	13.76
	(7.11)	(7.27)	(11.10)	(7.82)	(7.15)	(9.27)	(9.01)
Log (Assets)		0.81					
		(1.83)					
Q Ratio			-1.09				
			(8.56)				
No.of Issues				-0.91**			
				(0.44)			
Debt Concentration					23.32***		
					(7.68)		
Firm return						17.81**	
						(7.22)	
Firm Volatility							-0.28
							(0.54)
Utility	27.11***	25.78**	42.58***	38.81***	30.36***	35.79***	30.93***
	(10.32)	(10.65)	(9.14)	(12.50)	(10.08)	(11.98)	(10.74)
Obs.	241	241	190	241	241	166	180
R^2	0.47	0.47	0.51	0.50	0.51	0.60	0.55

Table 6b: OLS Estimates of Regression of Recovery Prices at Emergence on Contract and Firm Characteristics. Pehyld is the price observed at emergence measured in cents per dollar for each debt instrument and discounted by the high yield index for the period between default and emergence. Coupon is the coupon rate of the instrument. Log (Issue size) is the natural logarithm of issue size (in millions of dollars). Bank Loans,Senior Secured, Senior Unsecured, Senior Subordinated, Subordinated are dummy variables that take on a value of 0 or 1 depending on the seniority of the instrument. Time in default is the time in years between the emergence and default dates. Current Assets and unsecured are dummy variables that take the value of 0 or 1 depending on the collateral for the instrument. All firm-specific variables are measured as of the last fiscal year before the default and data is obtained from COMPUSTAT. Profit Margin is the ratio of EBITDA to Sales. Tangibility is the ratio of Property Plant and Equipment to Total Assets. Debt Ratio is the ratio of Long-Term Debt to Total Assets. Log (Assets) is the natural logarithm of the total assets. Q ratio is the ratio of Market value of the firm (estimated as Book Value of total assets - book value of equity + market value of equity) to the book value of the firm (estimated as book value of total assets). No. of issues is the total number of debt issues of the firm that is currently under default. Debt concentration is the Herfindahl index measure by amount of the debt issues of the firm that are under default. Firm return is the stock return of the firm that has defaulted in the year before default. Firm volatility is the ratio of the standard deviation of daily stock returns of the firm to the standard deviation of daily stock returns of the CRSP value weighted index in the year before default. Utility is a dummy variable if the firm belongs to the utility industry. All regressions have industry dummies (the coefficients are not reported except for utility dummy). Cluster (based on each firm's debt instruments as a single cluster) and heteroscedasticity corrected standard errors are reported in parentheses. $***, **, *$ represent significance levels at 1%, 5%, and 10% respectively.

	Pehyld	Pehyld	Pehyld	Pehyld	Pehyld	Pehyld	Pehyld
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Const.	39.70***	30.49*	49.85***	41.19***	38.43***	49.11**	43.92**
	(14.22)	(17.52)	(18.91)	(14.32)	(14.32)	(20.22)	(21.54)
Coupon	0.05	0.15	-0.03	0.04	0.01	0.21	0.31
	(0.47)	(0.45)	(0.55)	(0.47)	(0.47)	(0.58)	(0.52)
Log (Issue Size)	1.54	0.86	1.85	1.55	1.69	2.17	2.50**
	(1.08)	(0.98)	(1.15)	(1.07)	(1.08)	(1.35)	(1.23)
Bank Loans	37.53***	38.02***	33.73***	37.18***	36.79***	25.38	27.07
	(9.60)	(9.55)	(13.09)	(9.50)	(9.63)	(16.09)	(16.81)
Senior Secured	20.11**	20.19**	19.79	20.45**	19.86**	4.43	6.51
	(9.16)	(9.08)	(12.92)	(9.10)	(9.16)	(17.31)	(17.76)
Senior Unsecured	24.90***	24.86***	24.31**	25.40***	24.97***	14.09	13.52
	(8.81)	(8.75)	(12.28)	(8.68)	(8.81)	(16.60)	(17.22)
Senior Subordinated	-1.34	-0.60	-9.13	-1.29	-1.61	-22.40	-20.81
	(8.31)	(8.33)	(12.83)	(8.24)	(8.35)	(16.49)	(17.18)
Subordinated	-4.35	-3.49	-6.88	-4.32	-4.74	-20.15	-18.99
	(8.37)	(8.40)	(12.32)	(8.30)	(8.40)	(16.54)	(17.07)
Time in Default	-7.51***	-7.89***	-6.84***	-7.43***	-7.40***	-8.71***	-8.57***
	(1.16)	(1.25)	(1.49)	(1.15)	(1.17)	(1.53)	(1.41)
Current Assets	18.67***	18.67***	25.53***	18.56***	18.41***	16.74***	19.96***
	(5.23)	(5.25)	(6.44)	(5.22)	(5.19)	(6.14)	(5.71)
Unsecured	-4.29	-4.53	-6.07	-4.66	-4.83	-0.47	-1.78
	(4.84)	(4.78)	(5.37)	(4.78)	(4.83)	(5.76)	(5.38)
Profit margin	7.14	5.09	10.4	7.75	7.82	5.94	4.03
	(9.30)	(9.52)	(11.13)	(9.21)	(9.37)	(11.00)	(8.10)
Tangibility	-3.07	-1.78	-15.5	-2.64	-3.58	0.76	-5.45
	(9.85)	(9.85)	(11.37)	(9.95)	(9.81)	(12.08)	(11.1)
Leverage	-6.72	-5.78	-14.13*	-7.01	-6.64	-12.20	-10.72
	(5.31)	(5.52)	(8.51)	(5.37)	(5.32)	(8.69)	(8.16)
Log (Assets)		1.59					
		(1.55)					
Q ratio			-0.14				
			(7.39)				
No.of Issues				-0.21			
				(0.32)			
Debt Concentration					5.81		
					(6.70)		
Firm return						5.78	
						(5.58)	
Firm Volatility							0.21
							(0.35)
Utility	43.00***	41.45***	45.17***	46.25***	43.86***	41.78***	51.15***
	(8.06)	(7.98)	(8.40)	(10.42)	(8.01)	(10.06)	(8.88)
Obs.	670	670	468	670	670	348	396
R^2	0.57	0.57	0.60	0.57	0.57	0.67	0.66

Table 7a: OLS Estimates of Regression of Recovery Prices at Default on Contract, Firm and Industry Characteristics. Pd is the price observed at default measured in cents per dollar for each debt instrument. Coupon is the coupon rate of the instrument. Log(Issue size) is the natural logarithm of issue size (in millions of dollars). Senior Secured, Senior Unsecured, Senior Subordinated, Subordinated are dummy variables that take on a value of 0 or 1 depending on the seniority of the instrument. Time in default is the time in years between the emergence and default dates. Current Assets and unsecured are dummy variables that take the value of 0 or 1 depending on the collateral for the instrument. All firm-specific variables are measured as of the last fiscal year before the default and data is obtained from COMPUSTAT. Profit Margin is the ratio of EBITDA to Sales. Tangibility is the ratio of Property Plant and Equipment to Total Assets. Distress1 is a dummy variable that takes a value 1 if the median stock return of all the firms in the 3-digit SIC code of the defaulted firm is less than -30% and 0 otherwise. Distress2 is a dummy variable that takes on a value 1 if distress1 is 1 and if the median sales growth of all the firms in the 3-digit SIC code of the defaulted firm is negative in any of the 2 years before the default date. Med.Ind.Q is the median, of the ratio of Market value of the firm (estimated as Book Value of total assets $-$ book value of equity $+$ market value of equity) to the book value of the firm (estimated as book value of total assets), of all the firms in the 3 digit SIC code of the defaulted firm. Ind. Liq1 is the median Quick ratio (ratio of (Current Assets$-$Inventories) to Current Liabilities), Ind. Liq2 is the median Interest coverage ratio (EBITDA/Interest), Med. Ind. leverage is the median Long term debt to total assets, of all the firms in the 3 digit SIC code of the defaulted firm. Herfindahl Index is the industry concentration measure based on sales. All Industry variables are measured in the year of default. Utility is a dummy variable if the firm belongs to the utility industry. All regressions have industry dummies (the coefficients are not reported except for utility dummy). Cluster (based on each firm's debt instruments as a single cluster) and heteroscedasticity corrected standard errors are reported in parentheses. $***, **, *$ represent significance levels at 1%, 5%, and 10% respectively.

	Pd	Pd	Pd	Pd	Pd	Pd	Pd
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Const.	13.54	11.98	11.44	6.23	10.27	4.98	13.22
	(11.52)	(11.17)	(14.40)	(13.98)	(14.23)	(13.51)	(13.73)
Coupon	-0.84	-0.98*	-0.92	-0.57	-1.00*	-0.74*	-0.83
	(0.55)	(0.53)	(0.59)	(0.47)	(0.59)	(0.45)	(0.57)
Log (Issue Size)	4.99**	5.31**	5.46**	4.33**	5.57**	4.75**	4.71**
	(2.20)	(2.18)	(2.39)	(1.97)	(2.41)	(1.98)	(2.13)
Senior Secured	23.65***	23.27***	25.97***	23.54***	25.48***	23.37***	25.76***
	(8.33)	(8.13)	(9.10)	(9.10)	(8.89)	(8.91)	(8.94)
Senior Unsecured	23.54***	23.95***	24.77***	24.24***	25.03***	24.68***	25.07***
	(7.82)	(7.64)	(8.53)	(8.82)	(8.33)	(8.58)	(8.54)
Senior Subordinated	0.54	-0.58	2.15	1.22	1.07	0.34	2.84
	(6.99)	(6.86)	(7.65)	(7.84)	(7.46)	(7.64)	(7.82)
Subordinated	8.40	8.22	8.83	7.79	8.42	7.65	8.79
	(7.83)	(7.80)	(8.25)	(8.34)	(8.14)	(8.31)	(8.17)
Profit margin	28.05***	26.40***	27.28***	29.47***	26.09***	28.13***	28.90***
	(7.04)	(6.76)	(7.88)	(7.83)	(7.80)	(7.62)	(6.77)
Tangibility	0.17	3.82	0.11	-1.01	3.24	2.10	-2.82
	(12.55)	(12.39)	(14.24)	(12.31)	(14.38)	(12.23)	(12.60)
Debt Concentration	20.00***	21.56***	24.27***	20.64**	25.34***	22.31***	20.87***
	(7.19)	(7.05)	(8.22)	(8.17)	(8.09)	(8.16)	(7.29)
Distress1	-10.55**		-12.80***	-10.09**			-10.74**
	(4.35)		(4.24)	(4.19)			(4.30)
Distress2		-20.05***			-20.81***	-16.05**	
		(6.85)			(6.70)	(7.55)	
Med Ind Q	-2.16	-3.74	-5.22	-3.90	-5.97	-4.66	-4.20
	(8.01)	(7.99)	(8.90)	(8.50)	(8.79)	(8.67)	(8.40)
Herfindahl Index	-14.12	-4.61	-12.87	-17.78	-4.91	-10.86	-18.97
	(15.61)	(15.08)	(15.20)	(14.69)	(14.80)	(14.25)	(14.91)
Ind Liq1			-0.98		-1.61		
			(5.50)		(5.45)		
Ind Liq2				2.43**		2.15	
				(1.22)		(1.33)	
Med Ind Leverage							6.89
							(20.78)
Utility	18.61*	18.81*	19.26*	18.65*	19.12*	18.63*	18.11
	(10.57)	(10.47)	(10.94)	(10.44)	(10.87)	(10.38)	(11.17)
Obs.	262	262	242	253	242	253	261
R^2	0.51	0.51	0.52	0.53	0.52	0.53	0.52

Table 7b: OLS Estimates of Regression of Recovery Prices at emergence on Contract, Firm and Industry Characteristics. Pehyld is the price observed at emergence measured in cents per dollar for each debt instrument and discounted by the high yield index for the period between default and emergence. Coupon is the coupon rate of the instrument. Log(Issue size) is the natural logarithm of issue size (in millions of dollars). Bank Loans, Senior Secured, Senior Unsecured, Senior Subordinated, Subordinated are dummy variables that take on a value of 0 or 1 depending on the seniority of the instrument. All firm specific variables are measured as of the last fiscal year before the default and data is obtained from COMPUSTAT. Profit Margin is the ratio of EBITDA to Sales. Tangibility is the ratio of Property Plant and Equipment to Total Assets. Distress1 is a dummy variable that takes a value 1 if the median stock return of all the firms in the 3-digit SIC code of the defaulted firm is less than -30% and 0 otherwise. Distress2 is a dummy variable that takes on a value 1 if distress1 is 1 and if the median sales growth of all the firms in the 3-digit SIC code of the defaulted firm is negative in any of the 2 years before the default date. Med.Ind.Q is the median, of the ratio of Market value of the firm (estimated as Book Value of total assets $-$ book value of equity $+$ market value of equity) to the book value of the firm (estimated as book value of total assets), of all the firms in the 3 digit SIC code of the defaulted firm. Ind. Liq1 is the median Quick ratio (ratio of (Current Assets$-$Inventories) to Current Liabilities), Ind. Liq2 is the median Interest coverage ratio (EBITDA/Interest), Med. Ind. Leverage is the median Long term debt to total assets, of all the firms in the 3 digit SIC code of the defaulted firm. Herfindahl Index is the industry concentration measure based on sales. All Industry variables are measured in the year of default. Utility is a dummy variable if the firm belongs to the utility industry. All regressions have industry dummies (the coefficients are not reported except for utility dummy). Cluster (based on each firm's debt instruments as a single cluster) and heteroscedasticity corrected standard errors are reported in parentheses. $***, **, *$ represent significance levels at 1%, 5%, and 10% respectively.

	Pehyld	Pehyld	Pehyld	Pehyld	Pehyld	Pehyld	Pehyld
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Const.	18.67	18.21	9.48	14.77	9.82	14.50	21.56
	(14.87)	(14.90)	(14.53)	(14.38)	(14.51)	(14.41)	(15.33)
Coupon	0.04	-0.03	0.13	0.15	0.09	0.09	0.11
	(0.46)	(0.47)	(0.46)	(0.46)	(0.47)	(0.47)	(0.46)
Log (Issue Size)	1.75	1.84*	1.55	1.68	1.56	1.75*	1.65
	(1.09)	(1.10)	(1.12)	(1.06)	(1.12)	(1.06)	(1.10)
Bank Loans	42.52***	40.16***	43.29***	40.86***	41.02***	38.70***	43.15***
	(9.71)	(9.64)	(9.48)	(9.66)	(9.25)	(9.51)	(9.57)
Senior Secured	21.82**	20.50**	21.26**	19.91**	19.86**	18.60**	21.69**
	(8.91)	(8.86)	(8.79)	(9.07)	(8.67)	(8.99)	(8.77)
Senior Unsecured	27.50***	26.24***	26.38***	26.60***	25.02***	25.37***	27.60***
	(8.56)	(8.60)	(8.29)	(8.62)	(8.26)	(8.63)	(8.40)
Senior Subordinated	5.41	3.39	4.27	2.74	2.55	0.85	4.34
	(8.37)	(8.27)	(8.04)	(8.33)	(7.94)	(8.19)	(8.29)
Subordinated	-0.12	-1.81	-0.14	-2.31	-1.64	-3.96	-0.98
	(8.19)	(8.08)	(7.82)	(8.21)	(7.69)	(8.08)	(8.03)
Time in Default	-6.30***	-6.28***	-5.43***	-6.11***	-5.41***	-6.10***	-6.04***
	(1.18)	(1.21)	(1.14)	(1.17)	(1.16)	(1.19)	(1.15)
Current Assets	18.39***	18.27***	19.13**	17.18**	19.62***	17.01**	18.46***
	(7.03)	(6.95)	(7.44)	(7.20)	(7.43)	(7.13)	(7.17)
Unsecured	-6.05	-6.46	-4.02	-6.62	-4.50	-6.97	-5.32
	(4.86)	(4.93)	(4.76)	(4.86)	(4.79)	(4.91)	(4.84)
Profit margin	13.61	12.81	14.03	10.58	13.58	9.79	11.81
	(8.7)	(8.74)	(9.64)	(7.57)	(9.65)	(7.52)	(8.29)
Tangibility	-0.48	1.14	-0.46	0.73	0.24	2.01	-1.79
	(8.79)	(8.88)	(9.49)	(8.90)	(9.68)	(8.95)	(8.96)
Distress1	-12.01***		-10.79**	-9.81**			-10.82**
	(4.57)		(4.83)	(4.47)			(4.36)
Distress2		-12.00**			-10.30*	-7.75	
		(6.09)			(5.83)	(6.42)	
Med Ind Q	10.47*	12.01**	8.60*	8.17	10.04*	9.58*	8.75*
	(5.39)	(5.62)	(5.06)	(5.32)	(5.20)	(5.45)	(5.22)
Herfindahl Index	2.10	6.80	-5.53	-2.40	-3.47	0.29	-3.61
	(15.30)	(16.52)	(14.03)	(14.83)	(15.10)	(16.05)	(14.79)
Ind Liq1			13.67***		13.32***		
			(4.61)		(4.59)		
Ind Liq2				2.07**		2.11**	
				(0.87)		(0.90)	
Med.Ind Leverage							-5.07
							(16.73)
Utility	44.07***	44.12***	42.36***	42.73***	42.58***	42.71***	44.29***
	(7.19)	(7.24)	(6.82)	(7.27)	(6.87)	(7.30)	(7.16)
Obs.	749	749	709	734	709	734	744
R^2	0.57	0.56	0.58	0.58	0.58	0.57	0.57

Table 8a: Industries in Distress. Industry Distress, Distress1, is a dummy variable that takes a value 1 if the median stock return of all the firms in the 3 digit SIC code of the defaulted firm in the default year is less than −30% and 0 otherwise. The following table lists the S and P Industry Code, the description of the industry, and the year in which it was classified as distressed using the above criterion.

S and P Code	Description	Year
4	Transportation	1984
12	Energy and Natural Resources	1986
5	Financial Institutions	1987
6	Healthcare/Chemicals	1987
2	Insurance and Real Estate	1990
4	Transportation	1990
5	Financial Institutions	1990
6	Healthcare/Chemicals	1990
7	High Technology/Office Equipment	1990
8	Aerospace/Auto /Capital goods	1990
9	Forest, Building Products/Home Builders	1990
10	Consumer/Service Sector	1990
11	Leisure Time/Media	1990
5	Financial Institutions	1991
10	Consumer/Service Sector	1993
2	Insurance and Real Estate	1994
6	Healthcare/Chemicals	1994
11	Leisure Time/Media	1994
6	Healthcare/Chemicals	1995
10	Consumer/Service Sector	1995
11	Leisure Time/Media	1995
10	Consumer/Service Sector	1996
6	Healthcare/Chemicals	1998

Table 8b: Industry Distress Behavior of Recovery Prices at Default (Pd) and at Emergence (Pehyld, Pecoup, Pe). Pd is the price observed at default. Pe is the price observed at emergence. Pehyld is the price observed at emergence discounted by the high yield index for the period between default and emergence. Pecoup is the price observed at emergence discounted by the coupon rate of the instrument in default for the period between default and emergence. All recoveries are measured in cents per dollar for each debt instrument. The table lists the recoveries as average over the entire sample, average over the sample whose industry is in distress in a given year, and average over the remaining sample. The medians are shown within brackets. Industry Distress is a dummy variable that takes a value 1 if the median stock return of all the firms in the 3-digit SIC code of the defaulted firm in the default year is less than −30% and 0 otherwise. The t–statistic tests for difference of means (B)-(C). The z–statistic tests for differences in medians (B)-(C) using the Wilcoxon rank sum test. $***, **, *$ represent significance levels at 1%,5%,and 10% respectively. Panel A is for the entire sample while Panel B excludes 1990 defaults.

Recovery rates (Panel A)	Full sample	Obs	No Industry Distress (B)	Obs	Distress (C)	Obs	t-statistic (z- statistic)
Pd	44.2	387	46.0	350	26.5	37	4.52***
	(39.5)		(41.0)		(19.0)		(4.85)***
Pe	61.8	1473	63.4	1312	48.8	161	4.07***
	(61.7)		(65.0)		(35.0)		(4.21)***
Pehyld	50.8	1443	52.4	1285	37.8	158	4.77***
	(48.4)		(50.3)		(24.9)		(4.92)***
Pecoup	52.0	1442	53.4	1285	40.8	157	4.03***
	(49.0)		(51.3)		(27.9)		(4.24)***

Recovery rates (Panel B)	Full sample	Obs	No Industry Distress (B)	Obs	Distress (C)	Obs	t-statistic (z- statistic)
Pd	47.4	330	47.5	320	42.5	10	0.62
	(41.7)		(42.0)		(38.0)		(0.62)
Pe	63.5	1237	64.1	1194	47.0	43	2.57***
	(65.0)		(66.8)		(32.5)		(2.62)***
Pehyld	52.8	1209	53.2	1167	40.2	42	2.30**
	(50.5)		(51.2)		(27.5)		(2.33)**
Pecoup	53.4	1209	53.9	1167	41.5	42	2.15**
	(51.3)		(52.4)		(34.3)		(2.15)**

Table 9a, 9b: OLS estimates of regression of Recovery Prices at default and emergence on Contract, Firm, Industry and Macro Characteristics. Pd is the price at default. Pehyld is the price observed at emergence discounted by the high yield index for the period between default and emergence. Both recoveries are measured in cents per dollar on each debt instrument. Coupon is the coupon rate of the instrument. Log(Issue size) is the natural logarithm of issue size (in millions of dollars). Bank Loans, Senior Secured, Senior Unsecured, Senior Subordinated, Subordinated are dummy variables that take on a value of 0 or 1 depending on the seniority of the instrument. To conserve space these variables are not reported in the table. Time in default is the time in years between the emergence and default dates. Current Assets and unsecured are dummy variables that take the value of 0 or 1 depending on the collateral for the instrument. Debt concentration is the Herfindahl index measure by amount of the debt issues of the firm that are under default. All firm specific variables are measured as of the last fiscal year before the default and data is obtained from COMPUSTAT. Profit Margin is the ratio of EBITDA to Sales. Tangibility is the ratio of Property Plant and Equipment to Total Assets. Distress1 is a dummy variable that takes a value 1 if the median stock return of all the firms in the 3 digit SIC code of the defaulted firm is less than −30% and 0 otherwise. Med.Ind.Q is the median, of the ratio of Market value of the firm (estimated as Book Value of total assets − book value of equity + market value of equity) to the book value of the firm (estimated as book value of total assets), of all the firms in the 3 digit SIC code of the defaulted firm. Ind. Liq1 is the median Quick ratio (ratio of (Current Assets−Inventories) to Current Liabilities) of all the firms in the 3 digit SIC code of the defaulted firm. All Industry variables are measured in the year of default. SR, GDP, BDA, BDR are the macro variables used by Altman et.al (2002). SR is the annual return on the SandP 500 stock index. GDP is the annual GDP growth rate. BDA is the total amount of high yield bonds defaulted amount for a particular year (measured at mid-year in trillions of and represents the potential supply of defaulted securities. BDR is the weighted average default rate on bonds in the high yield bond market. Weights are based on the face value of all high yield bonds outstanding each year. Market, SMB, HML are the Fama-French factors in the 3 factor model. Utility is a dummy variable if the firm belongs to the utility industry. All regressions have industry dummies (the coefficients are not reported except for utility dummy). Cluster (based on each firm's debt instruments as a single cluster) and heteroscedasticity corrected standard errors are reported in parentheses. $***, **, *$ represent significance levels at 1%,5%,and 10% respectively.

Table 9a - Contract, Firm, Industry and Macro Characteristics

	Pd	Pd	Pehyld	Pehyld	Pehyld
	(1)	(2)	(3)	(4)	(5)
Const.	5.47	14.83	22.74	16.06	10.29
	(26.14)	(11.79)	(15.26)	(14.20)	(14.34)
Coupon	-0.91	-0.98	0.10	0.14	0.07
	(0.62)	(0.60)	(0.46)	(0.46)	(0.47)
Log(Issue Size)	5.98**	5.54**	1.58	1.31	1.28
	(2.44)	(2.31)	(1.12)	(1.11)	(1.13)
Time in Default			-5.98***	-5.43***	-4.08**
			(1.13)	(1.12)	(1.96)
Current Assets			18.13**	17.42**	19.27***
			(8.22)	(7.77)	(7.28)
Unsecured			-4.39	-4.56	-3.27
			(4.79)	(4.72)	(4.68)
Profit margin	25.61***	26.02***	12.52	14.03	14.17
	(7.72)	(7.57)	(9.14)	(9.51)	(9.11)
Tangibility	2.00	0.31	-0.69	-0.78	2.48
	(12.73)	(12.64)	(9.04)	(9.08)	(9.17)
Debt Concentration	22.08**	23.77***			
	(8.63)	(7.97)			
Distress1	-9.80*	-13.19***	-11.60**	-10.04**	-11.10**
	(5.05)	(4.77)	(4.80)	(4.51)	(4.57)
Med Ind Q	-8.18	-6.18	5.69	5.70	8.31
	(9.07)	(8.79)	(5.14)	(5.18)	(5.25)
Ind Liq1	3.89	-2.03	12.41**	14.30***	12.00**
	(7.73)	(5.19)	(5.17)	(5.09)	(5.26)
SR	14.11		-17.05		
	(18.48)		(12.87)		
GDP	-167.04		-44.41		
	(150.50)		(139.81)		
BDA	-558.03*		-381.92		
	(294.00)		(300.44)		
BDR		-17.85		-62.56	
		(80.13)		(43.31)	
Market					-3.61
					(12.69)
SMB					8.25
					(18.14)
HML					-16.97
					(11.22)
Utility	20.57*	21.25**	41.78***	41.48***	39.48***
	(10.57)	(10.77)	(7.35)	(7.15)	(7.18)
Obs.	242	242	709	709	702
R^2	0.54	0.52	0.59	0.58	0.58

Table 9b - Contract, Firm and Macro Characteristics

	Pd	Pd	Pehyld	Pehyld	Pehyld
	(1)	(2)	(3)	(4)	(5)
Const.	18.91	18.39	49.73***	42.89***	36.91***
	(12.97)	(12.04)	(14.42)	(13.61)	(13.49)
Coupon	-.71	-.87*	-.19	-.11	-.26
	(.57)	(.53)	(.49)	(.49)	(.5)
Log(Issue Size)	4.32*	3.92*	1.84*	1.34	1.32
	(2.43)	(2.32)	(1.05)	(1.04)	(1.07)
Time in Default			-7.6***	-6.95***	-6.15***
			(1.13)	(1.16)	(2.04)
Current Assets			17.82**	16.66**	18.88***
			(7.65)	(7.13)	(6.66)
Unsecured			-7	-7.54	-5.85
			(4.94)	(4.94)	(4.75)
Profit margin	8.3*	9.23*	12.31***	13.15***	13.34***
	(4.92)	(4.92)	(3.49)	(3.44)	(3.45)
Tangibility	7.67	6.69	-.47	-1.91	1.79
	(10.88)	(11.12)	(8.49)	(8.55)	(8.8)
Debt Concentration	11.57	15.79**			
	(7.63)	(7.42)			
SR	21.7		-15.98		
	(16.67)		(12.9)		
GDP	-181.56		-83.42		
	(145.18)		(140.07)		
BDA	-678.52***		-717.77**		
	(260.37)		(317.06)		
BDR		-39.61		-101.75**	
		(70.88)		(44.82)	
Market					-4.73
					(13.13)
SMB					-3.47
					(18.59)
HML					-14.38
					(11.27)
Utility	18.95**	20.37**	42.04***	42.61***	41.1***
	(9.23)	(10.36)	(7.51)	(7.44)	(7.3)
Obs.	266	266	760	760	753
R^2	.46	.44	.57	.56	.56

Table 10: OLS estimates of regression of Recovery Prices at default and emergence on risk factors that explain default. Pd is the price at default. Pehyld is the price observed at emergence discounted by the high yield index for the period between default and emergence. Both recoveries are measured in cents per dollar on each debt instrument. Coupon is the coupon rate of the instrument. Log(Issue size) is the natural logarithm of issue size (in millions of dollars). Bank Loans, Senior Secured, Senior Unsecured, Senior Subordinated, Subordinated are dummy variables that take on a value of 0 or 1 depending on the seniority of the instrument. Time in default is the time in years between the emergence and default dates. Current Assets and unsecured are dummy variables that take the value of 0 or 1 depending on the collateral for the instrument. Debt concentration is the Herfindahl index measure by amount of the debt issues of the firm that are under default. All firm specific variables are measured as of the last fiscal year before the default and data is obtained from COMPUSTAT. Distress1 is a dummy variable that takes a value 1 if the median stock return of all the firms in the 3 digit SIC code of the defaulted firm is less than -30% and 0 otherwise. Med.Ind.Q is the median, of the ratio of Market value of the firm (estimated as Book Value of total assets $-$ book value of equity $+$ market value of equity) to the book value of the firm (estimated as book value of total assets), of all the firms in the 3 digit SIC code of the defaulted firm. Ind. Liq1 is the median Quick ratio (ratio of (Current Assets$-$Inventories) to Current Liabilities) of all the firms in the 3 digit SIC code of the defaulted firm. All Industry variables are measured in the year of default. Z–Score is the Altman Z–score as modified by Mackie-Mason(1990). Zmij.Score is the Zmijeswki (1984) Score. Distance to default is the measure obtained by solving the Merton(1974) model for each firm. Utility is a dummy variable if the firm belongs to the utility industry. All regressions have industry dummies (the coefficients are not reported except for utility dummy). Cluster (based on each firm's debt instruments as a single cluster) and heteroscedasticity corrected standard errors are reported in parentheses. $***, **, *$ represent significance levels at 1%,5%,and 10% respectively.

	Pd	Pd	Pd	Pehyld	Pehyld	Pehyld
	(1)	(2)	(3)	(4)	(5)	(6)
Const.	1.43	12.12	8.84	13.24	15.65	10.87
	(17.89)	(15.36)	(19.16)	(15.17)	(14.37)	(18.33)
Coupon	-0.99	-1.15*	-0.65	-0.20	0.03	0.65
	(0.63)	(0.67)	(1.03)	(0.50)	(0.48)	(0.47)
Log(Issue Size)	6.14***	6.58***	3.54	1.85	2.26*	0.96
	(2.38)	(2.48)	(3.60)	(1.15)	(1.28)	(1.10)
Bank Loans				44.62***	44.98***	36.90***
				(10.50)	(10.18)	(14.09)
Senior Secured	24.80***	21.68**	18.33**	25.31***	22.79**	9.63
	(9.19)	(8.59)	(7.79)	(9.12)	(8.88)	(14.47)
Senior Unsecured	22.28***	20.15***	5.79	27.40***	24.84***	16.59
	(8.01)	(7.62)	(7.90)	(8.42)	(8.44)	(14.44)
Senior Subordinated	2.63	-1.72	-8.10	6.67	3.52	-17.07
	(8.18)	(7.72)	(7.84)	(8.78)	(8.57)	(14.16)
Subordinated	11.76	6.48	-1.62	4.96	4.13	-7.95
	(9.26)	(8.16)	(8.94)	(8.18)	(8.01)	(13.92)
Time in Default				-6.14***	-6.32***	-6.22***
				(1.23)	(1.14)	(1.39)
Current Assets				15.60*	15.22	18.86***
				(8.89)	(9.49)	(6.78)
Unsecured				-5.81	-4.79	-0.51
				(5.71)	(5.54)	(5.09)
Debt Concentration	22.74**	28.46***	31.71**			
	(9.94)	(9.87)	(13.15)			
Distress1	-14.45***	-13.30***	-20.70**	-14.25***	-14.50***	-14.14*
	(4.36)	(4.77)	(8.69)	(5.16)	(4.88)	(8.19)
Med Ind Q	5.56	0.67	-1.77	6.96	5.26	5.55
	(13.11)	(11.73)	(11.76)	(4.94)	(5.09)	(5.57)
Ind Liq1	-4.85	-5.27	-1.71	13.30**	13.61***	16.22*
	(5.19)	(5.11)	(8.94)	(5.43)	(5.18)	(9.76)
Z-Score	2.94**			3.32***		
	(1.39)			(1.20)		
Zmij. Score		-0.19			-0.92***	
		(0.36)			(0.36)	
Distance to Default			0.48**			0.16*
			(0.20)			(0.10)
Utility	32.01***	26.91***	28.03***	47.57***	43.14***	48.55***
	(8.50)	(7.87)	(8.64)	(6.24)	(5.18)	(6.09)
Obs.	211	212	165	598	609	395
R^2	0.51	0.50	0.65	0.59	0.57	0.68

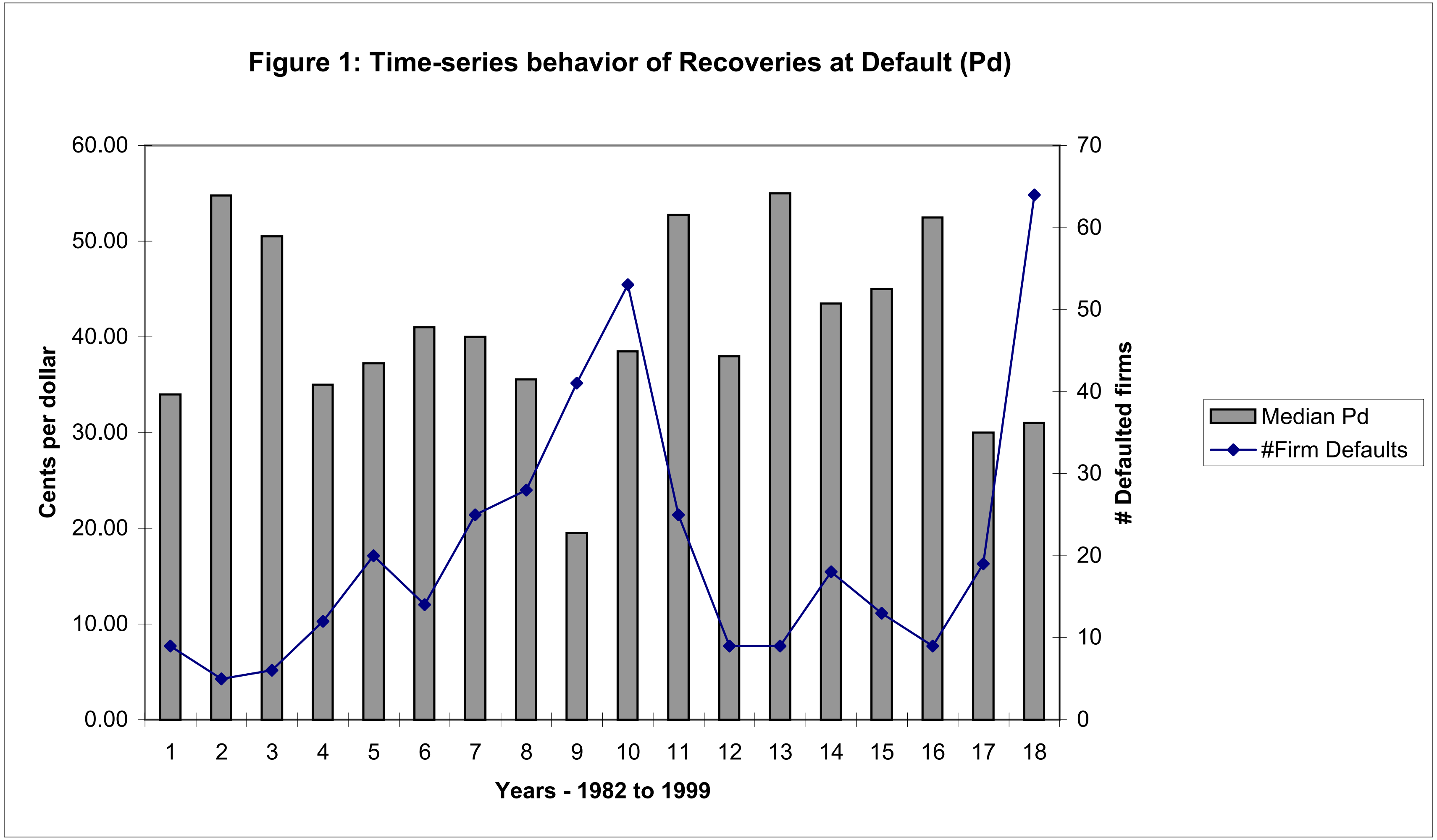

Figure 1: This figure plots the time-series variation in the number of firm defaults in a year and the corresponding median recovery prices at default (Pd) corresponding to that year, for the United States over the period 1982 to 1999.