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## Bond Prices at Default and at Emergence from Bankruptcy for US Corporate Issuers

### Summary

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This *Special Comment* investigates the relationship between bond prices at default and prices immediately prior to bankruptcy resolution for a sample of 303 non-financial US firms with an average time in bankruptcy of about twenty months. The key findings are:

- The *median* nominal return on bonds from default to resolution is zero, but the *mean* return is substantial due to the skewness of return distribution. The median ratio of the emergence price to the default price is 1.00, and the mean ratio is 1.17. This means while the typical defaulted bond had the same price at emergences as at default, on average, bond prices at emergence were 17% higher than at default.
- The mean return on defaulted bonds earned by investors is similar to the average return earned by the Lehman single-B bond index, but the median return is substantially less. When the emergence price is discounted back to the default date at the contemporaneous rate of return earned by the index, the mean ratio of the discounted resolution price to the default price is 0.97, and the median ratio is 0.87, implying that, on average, defaulted bonds earn roughly the same return as the Single-B Index.
- The mean ratio of the discounted emergence price to the default price does not appear to vary systematically across various subsets of the sample, including types of initial default events, levels of seniority, price ranges at default, lengths of time spent in bankruptcy, and different years of default.
- Price at default is an informative, but noisy, predictor of the discounted price at emergence. The use of the default price to predict the discounted emergence price reduces the mean absolute forecast error by one-third compared to unconditional variation around the mean of discounted emergence prices.

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# Table of Contents

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	Page
Summary .....	1
Introduction .....	3
Data, Definitions, and Methodology .....	3
Sample Description .....	3
Unit of Observation .....	3
Default and Emergence Prices .....	3
Summary Statistics .....	4
Comparing Prices at Emergence to Prices at Default .....	4
Factors Affecting the Ratio of Price at Emergence to Prices at Default .....	5
Initial Default Event .....	6
Default Price .....	7
Time in Bankruptcy .....	8
Year of Bankruptcy Filing .....	8
Multivariate Framework .....	9
Mean Absolute Errors Using Default Prices as Estimators of Emergence Prices .....	10
Summary .....	10
Related Research .....	10
References .....	11

## Introduction

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Moody's has historically measured recovery rates by using bond prices observed 30 days after default. This recovery rate measure has become the market standard because measuring ultimate recoveries is inherently difficult and also because prices at default:

- should represent investors' discounted expected recoveries,
- are natural reference points in the credit default swap market,
- and represent a transfer price between two investor groups – institutional investors that are liquidating their positions when bonds default and other investors that specialize in investing in defaulted securities.

Investors can buy or sell defaulted bonds whenever they desire – at default or during bankruptcy proceedings – or hold such bonds until they are exchanged for other assets at emergence from bankruptcy. Investors considering holding such bonds may be interested in knowing how defaulted bond prices have historically compared to prices just prior to emergence, as near-emergence prices can be good proxies for the values of claims received at emergence.

Our analysis reveals that, on average, investors that hold bonds from default to emergence earn a rate of return that is similar to the return on the single-B bond index. Moreover, there is little evidence of systematic mispricing; i.e., various subsets of the data – such as those based on seniority classes, price ranges at default, or time spent in bankruptcy – do not appear to provide investors with systematically higher or lower average returns. On average, we find that price at default is an informative, but noisy predictor of price at emergence.

## Data, Definitions, and Methodology

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### SAMPLE DESCRIPTION

The sample is drawn from Moody's default database and consists of all U.S. non-financial corporate bond defaulters since 1982 that emerged from bankruptcy by the end of 2004; and for which we have bond prices near the time of default as well as near the time of emergence from bankruptcy. Zero-coupon bonds and bonds initially sold at deep discounts were excluded from our sample. Although firms must have filed for bankruptcy at some point to be in the sample, initial default events can be either a bankruptcy filing, missed debt service payment, or a distressed exchange offer. Our bid-side pricing data comes from various sources, including Reuters, IDC, Bloomberg, and Goldman Sachs. Lehman Brothers provided the information on the return performance of single-B bonds.

### UNIT OF OBSERVATION

Many firms in our sample defaulted on multiple bond issues with the same seniority. To avoid placing undue emphasis on issuers with a large number of issues or with a large dollar volume of bonds outstanding, our unit of analysis is the equally weighted mean price for each seniority class issued by each firm – both when measuring prices at default and when measuring prices at emergence.

### DEFAULT AND EMERGENCE PRICES

The default prices are based on the 30-day post-default bid prices as a percent of face value. After default, we track prices at month-end for each obligation through bankruptcy resolution or until vendors stop quoting prices. Prices generally reflect quotes, and we have no assurance that trades have taken place at these quotes. We measure emergence prices with the bid prices observed nearest to the date of emergence from bankruptcy. In order to exclude stale and therefore meaningless price data, a quote is included in the sample only if there has been a price change within 90 days of the bankruptcy resolution date.<sup>1</sup> Although some concern about the quality of the price data inevitably remains, we believe our sample is indicative of trading values because the prices exhibit considerable volatility and imply substantial nominal returns on defaulted bonds.

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1. In a prior Moody's study, instead of focusing on near-emergence prices, Hamilton [1999] values the actual distributions received by bondholders as part of the bankruptcy settlement. Such calculations often require the evaluation of equity warrants and other illiquid financial instruments. See Eberhart and Sweeney [1992] for a discussion on the relationship between near-emergence prices and value of payouts to bondholders in bankruptcy resolutions.

## Summary Statistics

Once all requisite criteria are applied, our sample consists of 303 issuers with 351 seniority classes of default debt, representing on average 1.2 security classes per issuer. (See Exhibit 1.) The dataset includes 528 bonds representing roughly 1.5 bonds per security class. The average price for each security class was estimated at default and at emergence. The average time between the initial default event and the final bankruptcy resolution was 598 days (roughly 20 months), while the median time in default was 499 days (about 17 months).

### Exhibit 1 – Summary Statistics

	1982-2004
Number of Firms	303
Number of Bonds	528
Number of Security Classes	351
Average Number of Days from Initial Default to Bankruptcy Resolution	598
Median Number of Days from Initial Default to Bankruptcy Resolution	499

While all firms in the sample eventually filed for bankruptcy, a large proportion entered into default without initially filing. Exhibit 2 presents information on the *initial default events* for our sample.

### Exhibit 2 – Initial Default Events

Initial Default Event	Number of Observations
Bankrupt	114
Distressed Exchange	12
Missed Debt Service Payments	225
<b>All Defaults</b>	<b>351</b>

Only about 1/3 of the bankrupt issuers filed directly for bankruptcy, while roughly 60% of the issuers initially defaulted on interest and/or principal payment and subsequently filed for bankruptcy. The initial default date of the remaining 12 issuers in the sample is tied to the date they announced a distressed exchange offer. The proposed exchanges, however, did not take place, and the companies subsequently filed for bankruptcy.

## Comparing Prices at Emergence to Prices at Default

Prices at emergence vary widely from prices at default. Nevertheless, in our sample, the median ratio of undiscounted emergence price to default price is precisely equal to 1.00; i.e., the typical defaulted bond had the same price at emergence as at default. The distribution of this ratio is skewed to the right, so that its mean is 1.17. On average, therefore, bond prices were 17% higher at emergence than at default.<sup>2</sup>

It is not obvious which interest rate is most appropriate for discounting the price of a bond at emergence back to the date of default. A number of candidates have been suggested.<sup>3</sup> Some researchers simply use Treasury rates, but clearly this is too low a discount rate for such risky instruments.<sup>4</sup> Another possibility is to use the defaulted bonds' own coupon rates. This practice, however, is difficult to support because a company may issue different bonds with the same seniority but different maturities and coupons, reflecting market conditions at the time of issuance and other institutional aspects.<sup>5</sup> While they may trade differently prior to bankruptcy, once in bankruptcy, all bonds of the same seniority may be clubbed together into a single claim class regardless of coupon and/or maturity; they will often trade at roughly the same discount to par.<sup>6</sup>

2. Hamilton [2000] finds that a portfolio of bankrupt corporate bonds earned an average annualized return of 17.4% between 1981 and 2000.

3. Warner [1977] uses a market model approach in which excess returns are estimated as over and above return on a portfolio of securities with similar characteristics. He uses a portfolio of railroad stock as the benchmark portfolio. More recently, Altman and Eberhart [1994] use "Blume-Keim Low Rated Bond Index" as used in Blume and Keim [1987] and Blume, Keim and Patel [1991] as the comparable portfolio to estimate excess returns. Datta and Iskander-Datta [1995] create excess returns over treasury as a benchmark prior to bankruptcy filing. Other commonly used discount rates are the coupon rate and return on a high-yield index (Acharya, Bharath and Srinivasan [2004]).

4. Once idiosyncratic risk has been completely diversified away, a lower discount rate could be considered. However, at any point in time, only a limited number of defaulted bonds are available for purchase, so it is not generally possible to diversify away idiosyncratic risk in this sector. Moreover, even ignoring idiosyncratic risk, returns on an index of defaulted bonds is highly correlated with other systematic risk factors in the economy (Hamilton [2000]).

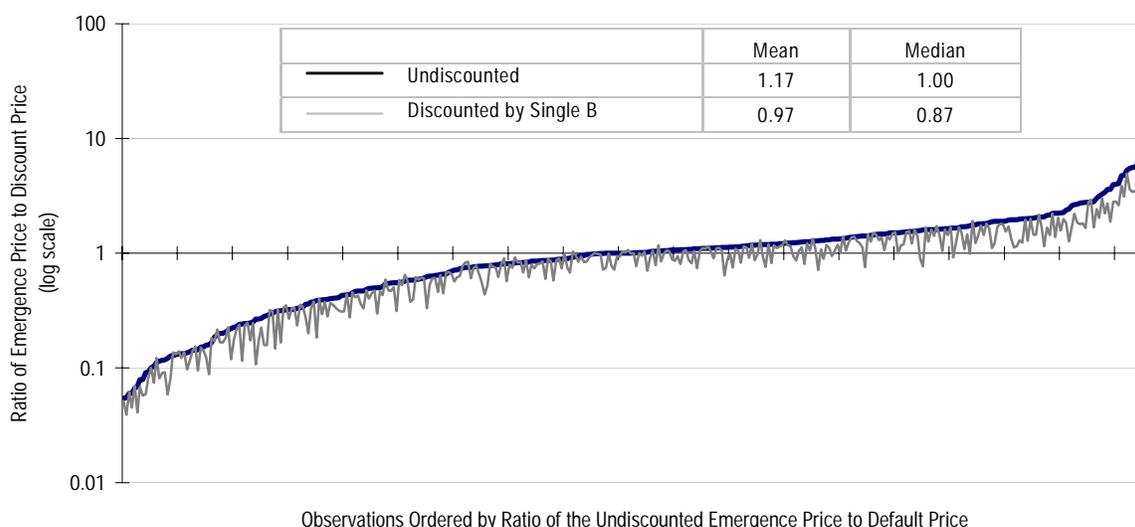
5. However, in order to measure the realized loss rate on a bond relative to its promised payment stream at the time of issue, it would be appropriate to discount at the coupon rate.

We propose to discount price at emergence using the contemporaneous return on the single-B Lehman Index (or the total return on the Index for the time a firm was in bankruptcy).<sup>7</sup> One reason to use a single-B index as the discount rate is that most companies emerge from bankruptcy with capital structures that are consistent with a single-B rating. If holders of defaulted bonds receive bonds in the new company as part of their settlement, they have implicitly been holding single-B-type securities throughout the bankruptcy resolution process.

When discounting by the single-B rate of return, it is important to discount using contemporaneous returns, not simply the long-term average return (which happens to be about 12%), because defaults in our dataset are clustered in time. During periods of high returns on speculative-grade bonds, returns on bonds in default are also likely to be high. As it turns out, our main conclusions are robust whether we discount emergence prices by the contemporaneous single-B returns, their long-term average, or the coupon rates on the defaulted bonds themselves, which on average are close to single-B interest rates.

In Exhibit 3, we present the distribution of the ratio of emergence price to default price for each observation in the sample. The observations are sorted by their undiscounted price-ratio – from low to high as one moves from left to right. The discounted ratios are almost always below the undiscounted ratios, except when the cumulative return on the B index was negative during the length of bankruptcy resolution period.

**Exhibit 3 – Distribution of Ratio of the Emergence Price to the Default Price**



The mean ratio of the undiscounted emergence price to the default price is 1.17 while the median is 1.00. It may seem surprising that the median turns out to be 1.00 given the wide variation in this statistic – from 0.05 to more than 11; however, the majority of the observations are within the range from 0.65 to 1.35. The mean ratio of discounted emergence prices to default prices is 0.97 and median ratio is 0.87. The discounted mean price-ratio of 0.97 is barely indistinguishable from 1.0, which implies that defaulted bonds earn nearly the single-B index return on average. However, the lower median ratio of 0.87 indicates that the typical defaulted bond earns less than the single B index.

## Factors Affecting the Ratio of Price at Emergence to Prices at Default

While the average ratio of discounted emergence prices to default prices is roughly equal to one, Exhibit 3 shows that individual issuers and security classes experience large deviations between discounted emergence prices and default prices. In the following sections we analyze various factors – seniority class, type of initial default event, price at default, time in default or bankruptcy, and the time period when the default occurred bankruptcy – that might be

6. Guha [2003] documents evidence that prices of bonds of a corporation with different maturities and coupons but the same seniority differ substantially before bankruptcy but that prices converge once bankruptcy is announced.

7. Some might argue that a higher discount rate than that implied by the single B index would be appropriate because bonds that are already in default must “by definition” be riskier than bonds that have not defaulted. In fact, defaulted bonds may be less risky than non-defaulted Caa (as rated by Moody’s) securities because in default, the range of price variation may be much narrower than the range for a security that still stands a good chance of being paid in full but also has a significant probability of loss with very high severity.

expected to affect the ratio of prices at emergence to prices at default. In a later section, we explore these factors in a multivariate setting.

### Seniority Class

In Exhibit 4 we present a summary table of prices at default and emergence and the ratio of the two, measured both on undiscounted and discounted basis. The largest category in the sample is senior subordinated (36%), followed by senior unsecured and then general subordinated, which contributed roughly equally to our sample (about 26% each). A vast majority (over 95%) were straight (non-convertible) issues.

**Exhibit 4 – Ratio of the Emergence Price to Default Price by Seniority Class**

Seniority	Default Prices		Ratio of Emergence Price to Default Price				Number of Observations
	Mean	Median	Undiscounted		Discounted		
			Mean	Median	Mean	Median	
Senior Secured	58.21	56.00	1.31	1.20	1.02	0.99	33
Senior Unsecured	41.02	42.00	1.13	1.06	1.01	0.94	95
Senior Subordinated	30.88	26.75	1.08	1.02	0.90	0.90	126
Subordinated	28.35	25.00	1.29	0.86	1.02	0.74	97
<b>All</b>	<b>35.49</b>	<b>31.00</b>	<b>1.17</b>	<b>1.00</b>	<b>0.97</b>	<b>0.87</b>	<b>351</b>

The rank ordering of default prices and emergence prices by seniority is consistent with that observed in other studies.<sup>8</sup> The relationship between seniority and the ratio of emergence prices to default prices, however, has not been widely studied by others.<sup>9</sup>

The effect of seniority on the ratio of emergence to default prices differs greatly depending on whether we discount emergence prices or not. The mean undiscounted price-ratio would seem to suggest that senior secured and general subordinated bonds were on average grossly underpriced at default, by 31% and 29%, respectively. However, when one takes discounting into account, the average under-pricing falls to just 2% for each security class.

The only seniority class whose mean performance is noticeably different from the rest on a discounted basis is the senior subordinated class, which appears to have been overpriced by 10% on average at default. Such an underperformance of subordinated debt in default has previously been documented in Fridson [2001]. He argues that prices of all subordinated debt classes are excessively bid up at default because they are the preferred point of entry for vulture investors into the capital structure.<sup>10</sup> This argument is not entirely supported by our sample, however, because in it senior subordinated bonds not only underperformed relative to secured bonds and senior unsecured bonds, but also relative to generally subordinated bonds, part of this group attractive to these investors.

The results presented in Exhibit 4 may seem counterintuitive at first glance as they suggest that senior secured bonds have required rate of returns similar to those for more junior (subordinate) bonds. However, the comparison of undiscounted mean and median for these bonds shows that while on *average* the undiscounted ratios (1.31 versus 1.29) are roughly the same, the medians are very different: 1.20 for senior secured bonds and 0.80 for subordinated bonds. The wide gap between the mean and the median indicates that there is a very large variation in the emergence prices for subordinated bonds.

### Initial Default Event

Initial default events with different severity have been shown to have different prices at default.<sup>11</sup> However, the emergence prices for these default events have not been investigated. In Exhibit 5 we present the effect of the initial default event on the ratio of emergence prices and default prices.

8. See for example, Moody's Investors Service Special Comment "Recovery Rates on Corporate Bonds and Preferred Stock for North American Issuers" [2003]. For a more detailed discussion, see Varma and Cantor [2005].

9. With two notable exceptions, Weiss [1990] and Fridson [2001].

10. Fridson [2001] also argues due to overbidding for the junior claims at the time of default, senior claims would have to be priced lower on average, for defaulted bonds to perform as an asset class on risk adjusted basis.

11. See, for example, Varma [2004].

## Exhibit 5 - Ratio of the Emergence Price to the Default Price by Initial Default Event

Initial Default Event	Default Prices		Ratio of Emergence Price to Default Price				Number of Observations
	Mean	Median	Undiscounted		Discounted		
			Mean	Median	Mean	Median	
Bankrupt	32.52	26.13	1.23	1.00	1.04	0.85	114
Distressed exchange	33.24	30.53	0.83	0.93	0.71	0.72	12
Missed Debt Service Payments	37.12	34.00	1.16	1.01	0.95	0.90	225
<b>All</b>	<b>35.49</b>	<b>31.00</b>	<b>1.17</b>	<b>1.00</b>	<b>0.97</b>	<b>0.87</b>	<b>351</b>

Only about one third of the observations in our sample resulted from firms that filed directly for bankruptcy. More than 60% resulted from missed debt service payments that subsequently led to bankruptcy filings. Twelve observations resulted from firms that initiated but did not complete the distressed exchange offers before filing for bankruptcy protection.

The market does not seem to distinguish between initial events of missed debt service payments or direct bankruptcy filing. The undiscounted median for both these events is virtually the same, though the undiscounted mean is higher (1.23) for firms filing for bankruptcy directly than for firms missing debt payments (1.16). While the discounted mean also for firms filing bankruptcy directly is higher, the median is lower than similar metrics for firms missing debt payment prior to filing for bankruptcy, suggesting a more skewed distribution for firms filing for bankruptcy directly. Statistically, the discounted means for these two default events are not different at a 95% confidence level, suggesting that the market, on average, successfully anticipates which missed debt service payments events will eventually turn into bankruptcy filings.

While it is difficult to draw statistical inferences from the small sample of firms that initiated but did not complete distressed exchanges, their defaulted bonds did substantially under-perform the rest – regardless of whether performance is measured by undiscounted or discounted, mean or median, price-ratios. One possible explanation is that the market price at default reflected the usual assumption that the exchange offer would succeed, but subsequent adverse developments led to a bankruptcy filing and also lower firm valuations around emergence. The low average emergence prices associated with this part of the sample may reflect sample selection bias as the bankruptcies could not have been anticipated at the time of the announcement of exchange offer.

### Default Price

Since there is more “upside” available for bonds that are priced low at default than for bonds that are priced high, it is reasonable to expect that the ratio of emergence-to-default prices may vary systematically with the price at default. To isolate the potential effect of price on this ratio, we divide the sample into 25 percent buckets, as displayed in Exhibit 6.

## Exhibit 6 – Ratio of the Emergence Price to the Default Price by Price at Default

Default Price	Default Prices		Ratio of Emergence Price to Default Price				Number of Observations
	Mean	Median	Undiscounted		Discounted		
			Mean	Median	Mean	Median	
LE 25	14.36	15.00	1.36	1.00	1.10	0.87	140
GT 25 LE 50	37.29	35.50	1.03	0.87	0.87	0.79	129
GT 50 LE 75	61.42	61.11	1.09	1.11	0.92	0.94	60
GT 75	88.72	87.50	1.02	1.08	0.90	0.99	22
<b>All</b>	<b>35.49</b>	<b>31.00</b>	<b>1.17</b>	<b>1.00</b>	<b>0.97</b>	<b>0.87</b>	<b>351</b>

For issues priced below 25%, the mean undiscounted price-ratio is 1.36, with a median ratio of 1.00. For issues priced between 25% and 50%, the mean undiscounted price-ratio is only 1.03 and the median is only 0.87. This finding suggests that bonds with low prices at default are systematically underpriced relative to those that are priced higher at default. However, as one moves further up in the initial default price, this observation no longer applies. Issues priced between 50% and 75% of par have an undiscounted price-ratio of 1.09 and a median of 1.11. Issues priced higher than 75% of par at default have a mean ratio of 1.02 and a median of 1.08. The discounted price-ratios also tell a very similar story where the means and medians for the two groups are close to 1.00.

In conclusion, only the lowest price issuers appear underpriced on average. But the skewness of distribution appears to be driving this finding because the median ratio of discounted emergence-to-default prices of bonds priced low at default is 0.87. So even if low priced bonds are underpriced on average, the typical low-priced bond is overpriced by 13% at default.

### ***Time in Bankruptcy***

The longer the time it takes a firm to emerge from the reorganization process, the larger the expected loss in enterprise value.<sup>12</sup> If the length of the bankruptcy process is imperfectly anticipated at the time of default, then one might expect that longer reorganization processes to result in lower ratios of discounted emergence prices to prices at default. If, however, the length of bankruptcy is correctly anticipated, the initial default prices ought to reflect those expectations, leaving no reason for the time in bankruptcy to be correlated with the ratio of discounted emergence prices to default prices.

For our sample, the time period from default to bankruptcy resolution averaged almost 600 days. Exhibit 7 presents a variety of bond price statistics for various subsamples of issuers, grouped by the length of time between their initial defaults and their bankruptcy resolutions.

#### **Exhibit 7 – Ratio of the Emergence Price to the Default Price by Time in Bankruptcy**

Days Spent in Bankruptcy	Default Prices		Ratio of Emergence Price to Default Price				Number of Observations
	Mean	Median	Undiscounted		Discounted		
			Mean	Median	Mean	Median	
LE 200	38.96	32.50	1.01	1.00	0.98	0.99	52
GT 200 LE 400	31.93	26.50	1.23	1.12	1.14	1.06	89
GT 400 LE 600	34.57	30.00	1.15	0.93	0.98	0.90	76
GT 600 LE 800	34.23	34.67	0.96	0.78	0.73	0.62	63
GT 800	39.53	34.33	1.43	1.05	0.96	0.77	71
<b>All</b>	<b>35.49</b>	<b>31.00</b>	<b>1.17</b>	<b>1.00</b>	<b>0.97</b>	<b>0.87</b>	<b>351</b>

The exhibit does not reveal any systematic relationship between time in bankruptcy and the ratio of emergence to default prices. However, as expected, longer bankruptcies (>600 days) correspond to lower median discounted ratios. Bonds associated with bankruptcies that were resolved in between 200 and 400 days do appear to have been underpriced at default relative to both bonds in which bankruptcies were resolved more quickly and the ones that were resolved more slowly. This finding is simply a statistical anomaly without any meaningful economic interpretation. Overall, the market appears to anticipate the length of the bankruptcy process, so time to resolution has no systematic effect on the realized ratio of the discounted price at emergence to the price at default. If anything, our evidence seems to show that emergence time is imperfectly anticipated by investors, but on average they are able to discount for time in bankruptcy.

### ***Year of Bankruptcy Filing***

Our analysis shows that on a pooled basis, over a twenty-three-year time period, average prices at emergence when discounted at the single-B index rate of return are roughly equal to prices at default. A rather distinct credit cycle, however, has characterized this time period, with two striking peaks in default rates (1990 and 2002) and various periods of tight credit spreads and high returns on speculative-grade bonds.

In Exhibit 8, we explore whether the relationship between prices at emergence and prices at default has varied at different phases of the credit cycle. For this purpose, we divide the sample into three sub-periods: before 1992, 1993-1998, and 1999-2004.

#### **Exhibit 8 – Ratio of the Emergence Price to the Default Price by Year of Bankruptcy Filing**

Year of Bankruptcy Filing	Default Prices		Ratio of Emergence Price to Default Price				Number of Observations
	Mean	Median	Undiscounted		Discounted		
			Mean	Median	Mean	Median	
Before 1992	31.44	28.81	1.19	1.02	0.92	0.81	116
1993-1998	38.54	35.00	1.34	1.13	0.99	0.91	107
1999-2004	36.62	32.75	1.02	0.94	1.00	0.92	128
<b>All</b>	<b>35.49</b>	<b>31.00</b>	<b>1.17</b>	<b>1.00</b>	<b>0.97</b>	<b>0.87</b>	<b>351</b>

12. Franks and Torous (1989) argue that a longer reorganization process has a negative wealth effect on bondholders. Therefore, a longer reorganization process is more likely to create incentives for bondholders to accept violations of the Absolute Priority Rule to expedite the reorganization process. There are two empirical implications of such an argument. Should the market anticipate an early resolution, the default prices would reflect such expectations. On the hand, if the reorganization process is going to take longer, the emergence prices would be lower.

At first glance, the time period between 1993 and 1998 seems like an era when the return on defaulted bonds was unusually high compared to the other two time periods. The mean undiscounted ratio of emergence-to-default prices was 1.34 in this middle period, compared to 1.19 and 1.02 for the periods before and after, respectively. However, the middle period was also one of unusually strong performance on single B-rated bonds, so that the mean ratio of the discounted emergence price to the default price was in fact only 0.99. This suggests that there was no under-pricing at default during the middle period.

## Multivariate Framework

In this section, we analyze whether various characteristics systematically affect the discounted price-ratio in a multiple regression setting. In the regression presented in Exhibit 9, the dependent variable is the ratio of emergence price-to-default price and the independent variables are dummy variables representing all the various subgroups we have considered in the previous sections.<sup>13</sup>

**Exhibit 9 – Multivariate Regression of the Ratio of the Discounted Price at Emergence to the Price at Default against Various Subgroups of the Sample**

Variable	Estimate	t-statistic
Intercept	1.37	6.24
Variables		
- Sr. Secured	0.98	0.88
- Senior Sub	0.32	-1.01
- Sub	0.87	0.19
- Price $\leq$ 25	<b>0.04</b>	<b>2.48</b>
- 51 $\geq$ Price $\leq$ 75	0.08	-0.55
- Price $\geq$ 75	0.43	-0.53
- Time in Bankruptcy $\leq$ 200	0.31	-0.8
- 200 < Time in Bankruptcy $\leq$ 400	0.56	0.47
- 600 < Time in Bankruptcy $\leq$ 800	0.77	1.52
- Time in Bankruptcy >800	<b>0.11</b>	<b>1.99</b>
- Before 1992	0.08	1.04
- After 1998	<b>-0.04</b>	<b>-2.11</b>
- Distressed Exchange	0.46	-0.57
- Missed Debt Payments	0.19	1.56
Adjusted R <sup>2</sup>		0.04
<u>Omitted Variables</u>		
Seniority	Senior Unsecured	
Default Price	25 > Price $\leq$ 50	
Time in Bankruptcy	400 > Time in Bankruptcy $\leq$ 600	
Credit Cycle	Year 1993 -1998	
Initial Default Event	Bankruptcy Filing	

The multivariate analysis is also unsuccessful in isolating any explanatory variables that significantly impact the price-ratio in any meaningful way. Time spent in bankruptcy beyond 800 days only seems to have a significant impact on returns, though it is highly unlikely that investors can *ex ante* anticipate the amount of time a firm is most likely to spend in bankruptcy. Default prices below 25% of par do raise the expected ratio, but by only 4%. The impact of bankruptcies that were resolved after 1998 is statistically, but not economically, significant, as they reduce the expected ratio by only 2%.

13. A multivariate regression on a truncated sample with the top and bottom 10% of the observations removed also showed insignificant relationships between the discounted price-ratio and the various explanatory variables.

## Mean Absolute Errors Using Default Prices as Estimators of Emergence Prices

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So far we have shown that default prices, on average, are reasonable estimators of discounted emergence prices. We have not, however, yet examined how accurate default prices are as predictors of discounted emergence prices. In Exhibit 10 we compare the mean absolute forecast errors when using the default price to predict the discounted emergence to the average absolute error around the mean of the discounted emergence prices.

### Exhibit 10 - Mean Absolute Prediction Errors around the Forecasted Discounted Emergence Price

	Mean Absolute Percentage Errors		Reduction in Mean Error by Using the Default Price
	Forecast Based on the Default Price	Forecast Based on Sample Mean	
All Security Classes	15.6	24.1	35.5%
- Senior Secured	16.7	21.0	20.3%
- Senior Unsecured	16.3	26.2	37.8%
- Senior Subordinated	13.7	19.8	31.0%
- Subordinated	16.6	20.3	18.3%

The average forecast error is 15.6 cents on the dollar using the default price, compared to 24.1 cents using the mean of emergence prices, implying a 35.5% reduction in error. While this reduction in forecast error using the default price is substantial, a large proportion of the variation still remains to be explained.

Exhibit 10 also displays the mean absolute error reduction (in cents per dollar) achieved by forecasting using the default price for each security class, where the benchmarks for the comparisons are the mean absolute errors around the means conditioned on security class. The forecast error reduction by using the default price is still about one third, although there is some variation around this number by security class. The variance reduction appears greater in the middle of the distribution (senior unsecured and senior subordinated securities) than in the tails (senior secured and general subordinated).

## Summary

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In this *Special Comment*, we analyze the relationship between the prices of securities at default and just prior to emergence from the reorganization process under Chapter 11 of the US Bankruptcy Code. Based on a sample of 303 firms with 528 bond issues, representing 351 security classes of debt, that filed for and emerged from Chapter 11 between 1982 and 2004, we find that while on average the ratio of discounted emergence price to price at default is roughly one, the median of the ratio is less than one. Further analysis reveals that there is little systematic variation in the mean ratio of discounted emergence to default prices across various subsets of the data, including seniority classes, initial default events, prices at default, time spent in bankruptcy, and years of default. We also find that prices at default are informative, but noisy, predictors of the discounted prices at emergence. The use of default prices to predict discounted emergence prices reduces the mean absolute forecast error by one-third compared to the unconditional variation around the mean of discounted emergence prices.

## Related Research

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### **Special Comments:**

[Debt Recoveries for Corporate Bankruptcies, June 1999, \(46119\)](#)

[The Investment Performance of Bankrupt Corporate Debt Obligations, February 2000 \(53599\)](#)

[Recovery Rates on Defaulted Corporate Bonds and Preferred Stocks, 1982-2003, December 2003 \(80272\)](#)

[Determinants of Recovery Rates on Defaulted Bonds and Loans for North American Corporate Issuers: 1983-2003, December 2004, \(90593\)](#)

*To access any of these reports, click on the entry above. Note that these references are current as of the date of publication of this report and that more recent reports may be available. All research may not be available to all clients.*

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