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HIGH YIELD

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Recovery Trends: Any Usefulness Whatsoever?

United States

High Yield

We believe the attention paid by investors to long-run average recovery rates on defaulted bonds is defensible on the grounds that they have a reasonably important bearing on an investment decision. It is harder to make such a case for investors' scrutiny of the annual, quarterly, and monthly fluctuations in recovery rates. As we shall show, the short-run variability of recovery rates, particularly within priority classes (senior secured, senior unsecured, subordinated) contains a great deal of statistical noise. Standard economic indicators explain the fluctuations up to a point, but it appears doubtful that investors can forecast the fluctuations accurately enough to profit by their efforts.[1]

Defining the Recovery Rate

In the following discussion, we define a defaulted bond's "recovery rate" as its quoted price, shortly after default, as a percentage of principal amount. (Observe that for a zero coupon bond with accreted value of $800 per $1,000 face amount, at a price of 50, or $500 per $1,000 face amount, the recovery rate is $320 / $800 = 40.) The price immediately after default represents the market's estimate of the present value of the recoveries that bondholders will ultimately recover on their claims, based on an appropriate discount rate and an assumption about the length of the period required for resolution of the claims.

There are several reasons why we define the recovery rate as the post-default price, rather than ultimate recovery, which would be eminently suitable for certain analyses. For one thing, post-default prices on currently defaulting bonds are observable in the current period, while ultimate recoveries are not.[2] Additionally, the primary objective of high yield bond investors is generally current income.[3] By and

Note: Research assistance provided by J. Kevin Lee.

[1] For a different approach to the analysis of recovery rates, see Martin S. Fridson, M. Christopher Garman, and Kathryn Okashima, "Recovery Rates: The Search for Meaning," *This Week in High Yield* (March 17, 2000), pp. 8-15.

[2] Indeed, accurate measurement of ultimate recoveries is problematic in view of the fact that claims in bankruptcy are often settled in part with securities for which no active markets exist. The obscurity factor prevented Altman and Eberhart (1994) from achieving 100% success in obtaining ultimate recoveries on the defaulted issues in their initial sample. To be sure, the quality of prices for recently defaulted bonds is imperfect as well. For at least a short period following default, however, deep markets commonly exist in the defaulting company's bonds. At that point, valuation is not complicated by the a need to price packages of securities that include thinly traded stocks or warrants.

[3] The vast majority of high yield bond funds list current income as their primary objective, with capital gains a secondary consideration. To be sure, current income is not a primary objective for fully funded pension plans, many of which invest in high yield bonds.

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large, returns on defaulted issues are realized only in the form of capital appreciation, since they pay no current interest.[4] Defaulted bonds are not high yield, but rather "no-yield" securities, an entirely different asset class that appeals primarily to distressed-debt buyers, also known as "vulture capitalists." When a bond misses a coupon or principal payment, therefore, a high yield investor's exit point is likely to be shortly after default, at an exit price approximating the post-default level, rather than at the point of ultimate recovery.

The Value of Long-Run Average Recovery Rates

Edward Altman of New York University, Moody's Investors Service, and Standard & Poor's publish long-run average recovery rates on corporate bonds. These sources also calculate recovery rates by priority level. The observations cover a sufficiently long period, dating back to 1970 in Moody's case, to make the averages statistically valid.

Long-run average recovery rates have some bearing on the decision to use high yield bonds as a permanent asset class

For some investors, at least, long-run average recovery rates have a bearing on an important investment decision. That decision is whether to adopt high yield bonds as an asset class, as opposed to underweighting or overweighting the sector for short-run advantage. In resolving the issue, institutions are likely to consider how much incremental return they can expect to earn above the return on default-risk-free Treasuries.

Note that it is not necessary to refer to recovery rates to tackle this problem. If analysts are willing to take history as their guide, they can answer the question directly by calculating the annual return differentials between the two sectors and averaging them. For the period 1980-1999, high yield bonds' mean annual total return advantage over Treasuries was 198 basis points. (See **Exhibit 1**.)

Exhibit 1: Net Yield versus Actual Total Return Spread
1980-1999

	Percent
Yield Spread: Merrill Lynch 175 Index versus Ten-Year Treasuries, Annual Mean, 1980-1999	4.48
Default Rate: Par-Amount Basis, Annual Weighted Mean, 1980-1999	3.26
Recovery Rate: Par-Amount Basis, Weighted Mean for All Defaulting Issues, 1980-1999	41.5
Net Yield Advantage Yield Spread - Default Loss Rate = Yield Spread - [Default Rate x (1-Recovery Rate)] = 4.48 - [3.26 x (1- .415)]	2.57
Actual Total Return Spread, Annual Mean, 1980-1999 Merrill Lynch 175 Index versus Intermediate Treasuries	1.98

Source: Edward I. Altman, New York University.

Comparing the asset classes in such manner is satisfactory for investors who are indifferent between income and capital gains/losses. Tax and regulatory considerations, however, make it imperative for some institutions to decompose the total return spread. Looking at the components of return separately is also essential for investors who want to incorporate specific assumptions about future credit performance into their decision on whether to invest in high yield bonds.

4 Exceptions to the rule generally involve secured issues. Ultimate recoveries for holders of secured debt commonly include credit for accrued interest during the reorganization period. In effect, the secured holders are compensated for not having seized their collateral and sold it, which might have precluded the company's successful reorganization. If cash flow before interest on unsecured debt is sufficient, the bankruptcy judge may even allow interest to be paid *during* the reorganization period.

Average returns are not precisely equivalent to yield minus net default losses

Exhibit 1 shows that the recovery rate is one factor in an equation that analysts can use to reconstruct, in rough terms, how the high yield sector's total return spread was achieved. With the same formula, yield spread minus the default loss rate, analysts can incorporate into projected returns their own assumptions about future yield spreads, default rates, and recovery rates. Note, however, that the historically estimated net yield advantage (257 basis points) is not equivalent to the actual return advantage (198 basis points). Contributing to the discrepancy are measurement errors arising from the imperfect comparability of the data series employed in the analysis. In addition, the generally declining trend of interest rates during the observation period favored Treasuries over the less interest-rate-sensitive high yield bonds.

All the same, it seems reasonable to suppose that some investors would elect not to enter the high yield sector if they found that recovery rates had been, for sake of discussion, 15% instead of 41.5% during 1980-1999. A change of that magnitude would reduce the net yield advantage from 257 basis points to 171 basis points, with comparable implications for the actual total return spread. Long-run recovery rates, in short, make a difference in an important investment decision.

Fluctuations in the Recovery Rate

Average recoveries have changed little over many decades

Long-run average recovery rates have approximated 40% of principal amount for many years. For the period 1900-1943, Hickman (1958) reports average figures of 43% for large issues that were rated investment grade five years before default and 35% for large issues that were rated noninvestment grade five years before default.[5] The United States Bankruptcy Code underwent two major overhauls during the twentieth century, but they had little impact on average post-default market prices of corporate bonds.

While the long-run average rates have scarcely budged over the decades, the annual variability is considerable, as shown by Altman's series (**Exhibit 2**). Since 1986, annual recoveries have been as high as 75.9% (1987) and as low as 23.4% (1990) of par. Even lower annual recoveries occurred in the period before 1986, when defaulting debt totals of less than $1 billion a year created immense statistical noise.

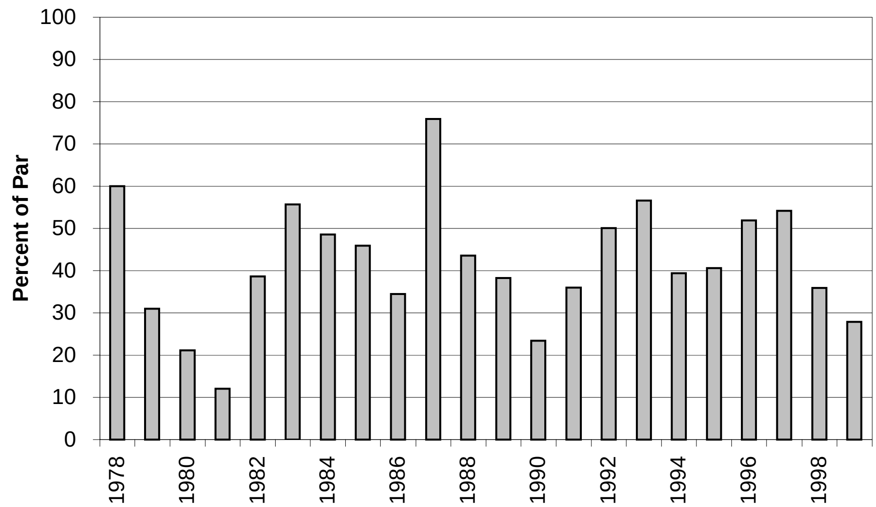
Year-to-year fluctuations in recovery rates are large enough to make forecasting the swings seem worthwhile

On the face of it, portfolio managers would find it worthwhile to try to anticipate fluctuations of this magnitude. By way of illustration, suppose that in a given year, 5% of outstanding high yield debt defaults. Assume that on January 1, the market already recognized that the coming year's defaulters were at high risk of failure and assigned them an average price of 60. Let us put the average price for the remainder of the universe (including other distressed issues that do not default during the year) at 90. At a recovery rate of 25% (approximating the minimum observed since 1986), defaulting issues reduce the market's total return by 255 basis points. At a 75% recovery rate (approximating the maximum observed since 1986), the damage comes to only 85 basis points.[6] For institutions that hope to outperform through asset allocation, the 170-basis-point difference could be large enough to tip the balance between overweighting and underweighting the high yield sector for the year ahead.

5 For small issues, Hickman's figures are 47% for issues that were rated investment grade five years before default and 35% for issues that were rated noninvestment grade five years before default. Hickman (1958), pp. 192-193.

6 Under the stated assumptions, the year's defaulting issues represent 3.4% of outstanding market value at the beginning of the year. Multiplying 3.4% x (1 minus the recovery rate) produces losses of 85 and 255 basis points, respectively, for recovery rates of 75% and 25%. These figures are before taking into account the presumed loss of one-half year's accrued interest upon default and do not annualize the impact of the loss of principal, which may occur at any point during the year for a particular bond.

Exhibit 2: Weighted Price after Default
Annually, 1978 - 1999



Source: Edward I. Altman, New York University.

Executing such a strategy depends on being able to forecast the fluctuations in recoveries. As with any time series, anyone who proposes to forecast the changes should first demonstrate an ability to explain past changes. This does not mean, as many Wall Street pundits seem to believe, merely describing a plausible cause-and-effect relationship between A and B. Rather, explaining the historical record consists of demonstrating a statistical correlation between the two series, keeping in mind that correlation does not prove causation.

Plausible determinants of recovery rates swings include…

Logical candidates to explain the variance in recovery rates, with their expected signs and accompanying rationales, include the following:

DEFAULT RATE (-)

A surge in the default rate might cause recovery rates to decline, for two reasons:

…default volume…

- An increase in the supply of distressed debt, relative to the demand, as represented by capital at the disposal of venture capital funds.
- An increase in the bankruptcy courts' caseload could cause investors to expect longer periods for resolution of claims and, therefore, to assign lower present values to those claims.

TREASURY BILL YIELD (-)

…discount rates on assets…

An increase in short-term interest rates reduces the present value of expected future recoveries. In addition, rising interest rates, at least to the extent that the rise in nominal rates also reflects a rise in the real rates, may restrain economic growth and, therefore, reduce corporations' future expected cash flows. That would, in turn, reduce the future value of the assets to be used in settling claims in bankruptcy.

TREASURY YIELD CURVE (+)

…availability of investment capital…

Steepening of the yield curve encourages investment in financial assets by increasing the positive interest rate spread that can be captured by borrowing in the short-term markets to buy longer-lived assets. The positive impact on financial assets in general may affect distressed bonds, many of which are owned by leveraged investment funds. Additionally, by encouraging investment, the steepening of the yield curve can lead to an upturn in economic growth, with positive implications for the value of defaulted companies' future asset values.

GROWTH IN REAL GROSS DOMESTIC PRODUCT (+)

…economic growth.

A broad pickup in economic growth can increase the expected future cash flows of defaulted companies and, by extension, the future value of their assets.

Exhibit 3 summarizes the output of simple regressions of these four variables against the recovery rate. All signs were as predicted. Furthermore, all variables except the default rate explained at least 15% of the variance in the recovery rate and were significant at the 90% confidence level or higher. These results indicate that the recovery rate does not simply fluctuate meaninglessly over time. Rather, its movements are related to the discount rate applied to expected recoveries at the end of bankruptcy, the availability of capital for investment in financial assets, and the health of the economy.

Exhibit 3: Individual Regressions against Recovery Rate [1]
Annually, 1978-1999

	Sign	Percentage of Variance Explained (R^2)	t-statistic
Default Rate [2]	-	1.0	-0.46
Treasury Bill Yield [3]	-	24.1	-2.52**
Treasury Yield Curve [4]	+	35.2	3.30**
Growth in Real Gross Domestic Product [5]	+	15.2	1.89*

* Significant at 90% confidence level.
** Significant at 95% confidence level.
1 Weighted by par amount.
2 Par-amount basis.
3 90-day maturity.
4 10-year rate minus 90-day rate.
5 Year-over-year.
Sources: Edward I. Altman, New York University; Bloomberg; Merrill Lynch Economics.

The more pertinent question for portfolio managers, however, is whether it is feasible to forecast changes within an accuracy range that contributes usefully to an investment decision. To answer this question, we constructed a multiple regression model from the variables in Exhibit 3 that we found to be significantly correlated with the recovery rate. Further investigation disclosed a high (46.5%) autocorrelation between the Treasury bill yield and the Treasury yield curve, making it impossible for them both to show independent explanatory power within the same model. We therefore chose the Treasury yield curve, on the basis of its higher percentage-of-variance-explained, and combined it with growth in real Gross Domestic Product to create a two-variable model.

T-Bill rates and the yield curve explain almost half of the variance in recovery rates

Our two-variable model explained 46.2% of the annual variance in the recovery rate during 1978-1999. (See **Exhibit 4**.) Further refinements in specification of the variables might nudge that figure higher. We suspect, however, that a high percentage of the variance will remain unexplained under almost any formulation.

In any given year, recovery rates are strongly influenced by an unsystematic factor, namely, the specific sample of companies that default. The industry mix of a given year's crop of defaulters explains only a bit of that unsystematic variance. Altman and Kishore (1996) found that of 18 very broadly defined industry classifications, only two had average recoveries that were statistically different (in both cases higher) than the others. The two groups that distinguished themselves in this respect were public utilities and chemicals/petroleum/plastics manufacturers. Unless these two sectors appear likely to dominate the default statistics in a given year, an analyst who hopes to improve upon the multiple regression model's forecast must perform a great deal of bottoms-up analysis of asset values, without even knowing in advance which companies will default. On the face of it, the probability of success seems low.

Exhibit 4: Multiple Regression Analysis of Recovery Rate
Annually, 1978 - 1999

R^2: 46.2%

	Coefficient	t-statistic	P-value
Intercept	22.89	4.21	0.00
Treasury Yield Curve	6.91	3.31**	0.00
Growth in Real GDP	2.40	1.96*	0.06
R Square	46.2%		
Adjusted R Square	40.5%		
Observations	22		

* Significant at 90% confidence level.
** Significant at 95% confidence level.
Sources: Edward I. Altman, New York University; Bloomberg; Merrill Lynch Economics.

It's important to quantify the model's accuracy

On balance, the evidence indicates that if the multiple regression model's forecast is the best available tool, then attempting to anticipate changes in the recovery rate is a forlorn hope. **Exhibit 5** shows the calculations required to quantify the precision of Exhibit 4's model in the following fashion:

> How wide a band must I set around the single-point forecast in order to ensure that my forecast will be outside the range only 10% of the time?

Exhibit 5: Multiple Regression Formula for Recovery Rate

$Y = 22.89 + 6.91x_1 + 2.40x_2$

Where:

Y = Percentage recovery rate
x_1 = Treasury yield curve (ten-year rate minus 90-day rate)
x_2 = Growth in Real Gross Domestic Product (year-over-year increase)

90% Confidence Level = Y ± 19.33*

* $Y \pm Se\ t(df; \alpha/2)$
$Y \pm 11.18\ (1.729)$
$Y \pm 19.33$

Degrees of freedom = 19

Source: Merrill Lynch & Co.

The answer is 19.33 percentage points on either side of the point forecast. With such a wide berth, the multiple regression model of recovery rates has little practical value.

Either a large fall or a large rise can be consistent with the forecast!

To illustrate, let us fill in the forecast formula in Exhibit 5 with the historical mean values of the Treasury yield curve (1.66 percentage points) and year-over-year change in real Gross Domestic Product (3.14%). Solving for the recovery rate, Y = 22.89 + (6.91 x 1.66) + (2.40 x 3.14) = 41.90.[7] In order to achieve 90% confidence, we must set a band of plus/minus 19.33 around that point forecast. The resulting range, 22.56 to 61.22, covers 19 of the 22 observations in our 1978-1999 test period. This is radically different from being able to say, for example,

[7] Investors can derive some confidence in the validity of the multiple regression model from the fact that the forecast generated by the mean values of the two explanatory variables is essentially identical to the 41.87 mean of the recovery rate series.

that there is a 90% chance that the actual recovery rate will fall in a range of 39.89 to 43.89. Prudent investors might premise decisions on the latter information, but not on a 38.66-percentage-point forecast range.[8]

Spurious Changes in Recovery Rates by Priority Class

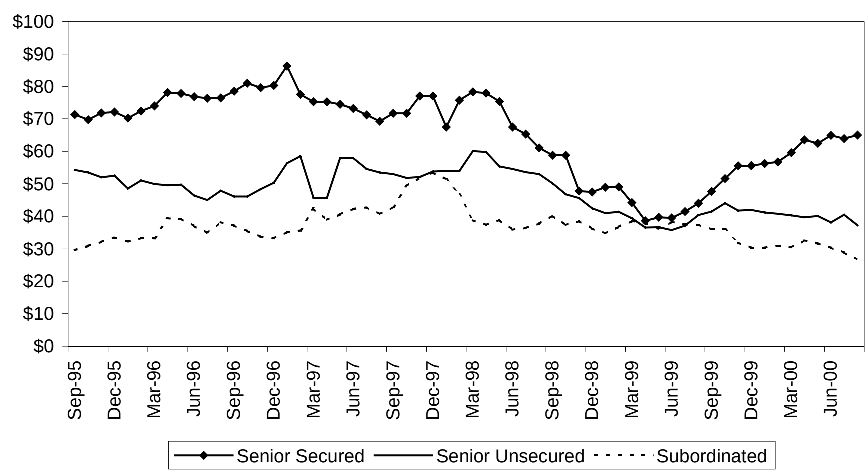
In addition to Altman's time series of average recovery rates across all priority classes, Moody's publishes a series that breaks down the data by senior secured, senior unsecured, and subordinated levels. (See **Exhibit 6**.) At first blush, the series suggests a plausible strategy for enhancing total returns. Portfolio managers may be able to add value by shifting assets from a priority class with declining recoveries to a priority class with rising recoveries.

Since May 1999, according to Moody's, recovery rates on senior secured and subordinated debt have moved in opposite directions

For example, in May 1999, the trailing-twelve-months recovery rates for all three classes were closely clustered, with senior secured at 39.68, senior unsecured at 36.66, and subordinated at 36.08. By the beginning of August 2000, the senior secured rate had soared to 65.01, while the surbordinated rate had plummeted to 26.67; senior unsecured was nearly unchanged, at 37.24. With hindsight, it would have been wise to swap out of distressed subordinated issues into distressed senior secured issues.

The problem is that the apparent divergence in recoveries by asset class is surely spurious. Altman's figures for recoveries in all classes during the May 1999 to August 2000 period show a slightly declining trend. Barring a sweeping change in the Bankruptcy Code or its administration by the courts, neither of which occurred during the period, opposite-direction movements by two classes within a period must represent statistical noise. The transparent folly of trying to forecast statistical noise makes a nonstarter of the strategy of swapping among priority classes in anticipation of recoveries declining in one class while rising in another. (We shall address the case of *relative* declines among classes below.)

Exhibit 6: Trailing 12-Month Defaulted Bond Prices (Per US$ Par) By Seniority Class
Monthly, September 1995 - July 2000



Source: Moody's Investors Service.

[8] In fact, the accuracy of the regression analysis may be much lower than Exhibit 4 suggests. The multiple regression model assumes a normal distribution. This assumption is violated in at least one way: The distribution is truncated, i.e., the recovery rate cannot be lower than 0%. As it happens, though, a histogram suggests that the distribution of recovery rates approximates normality.

A simple illustration shows that the apparent divergence must be spurious

To understand why the recent trend in the Moody's serious must be spurious, let us consider the simple case in which just two companies default in a given year. In **Exhibit 7**, Year 1's two defaulting issuers, Companies A and B, both have debt outstanding at all three priority levels. The mean expected recovery rate at the end of bankruptcy across all levels is 70.0% in Year 1. In Year 2, **Exhibit 8** shows, that rate holds steady at 70.0%. Mean recovery rates nevertheless rise in the senior secured category (to 64.0% from 57.6%) and in the senior unsecured category (to 40.0% from 32.0%). At the same time, the recovery rate *declines* in the subordinated category. Inspection reveals, however, that the changes in priority-class recovery rates between Year 1 and Year 2 are purely a function of differences in capital structures between Year 1's defaulters (Companies A and B) and their Year 2 peers, Companies C and D. For example, the comparatively light concentration of Company D's capital structure in senior secured debt produces an increase in mean recoveries for that class. Carrying the analysis forward one additional year (**Exhibit 9**), a drop in mean expected recoveries to 57.5% from 70.0% produces declines in mean recovery rates at all three seniority levels. In summary, if the mix of capital structures remains constant from one period to the next, a rise (drop) in expected recoveries at the end of bankruptcy raises (lowers) recovery rates in all classes. Recovery rates in different asset classes move in opposite directions, as Moody's reports that they have since May 1999, only because of a change in the mix of capital structures of defaulting companies.[9]

Exhibit 7: Recoveries by Priority Class
Under Absolute Priority – $ Million
Year 1 – Illustration

	Expected Recovery at End of Bankruptcy (Claim $/Recovery $/Recovery as % Claim)						Net Present Value * as Percent of Principal		
	Company A			Company B			Company A	Company B	Mean
Total Claims	**500**	**400**	**80.0**	**600**	**360**	**60.0**	**51.2**	**38.4**	**44.8**
Senior Secured	75	75	100.0	450	360	80.0	64.0	51.2	57.6
Senior Unsecured	125	125	100.0	100	0	0.0	64.0	0.0	32.0
Subordinated	400	200	50.0	50	0	0.0	32.0	0.0	16.0

MEAN EXPECTED RECOVERY AS PERCENT OF TOTAL CLAIMS: 70.0%.

* Assumes two-year reorganization period. Discount rate: 25%.

9 Other varieties of statistical noise may also contribute to anomalous movements in recovery rates among priority classes. For instance, the stylized examples shown in Exhibits 7-10 assume strict observance of absolute priority. That is, senior secured holders' claims are fully satisfied before senior unsecured holders receive any satisfaction. Similarly, subordinated holders receive nothing unless senior unsecured holders are fully satisfied. In practice, holders sometimes receive more than they are entitled to under strict priority, thanks to the partial veto power over the plan of reorganization that the Bankruptcy Code accords to each creditor class. To some extent, the market may be able to anticipate such deviations from absolute priority in the final resolution of the bankruptcy, for example, through knowledge that a combative investor has gained control of a junior class of securities. Such distortions should be reflected in recoveries, as defined in this study, i.e., market prices shortly after default.

Exhibit 8: Recoveries by Priority Class
Under Absolute Priority – $ Million
Year 2 – Illustration

	Expected Recovery at End of Bankruptcy (Claim $/Recovery $/Recovery as % Claim)						Net Present Value * as Percent of Principal		
	Company C			Company D			Company C	Company D	Mean
Total Claims	**500**	**400**	**80.0**	**600**	**360**	**60.0**	**51.2**	**38.4**	**44.8**
Senior Secured	350	350	100.0	200	200	100.0	64.0	64.0	64.0
Senior Unsecured	200	50	25.0	100	100	100.0	16.0	64.0	40.0
Subordinated	100	0	0.0	300	60	20.0	0.0	12.8	6.4

MEAN EXPECTED RECOVERY AS PERCENT OF TOTAL CLAIMS: 70.0%.

* Assumes two-year reorganization period. Discount rate: 25%.

Exhibit 9: Recoveries by Priority Class
Under Absolute Priority – $ Million
Year 3 – Illustration

	Expected Recovery at End of Bankruptcy (Claim $/Recovery $/Recovery as % Claim)						Net Present Value * as Percent of Principal		
	Company E			Company F			Company E	Company F	Mean
Total Claims	**500**	**300**	**60.0**	**600**	**330**	**55.0**	**38.4**	**35.2**	**36.8**
Senior Secured	350	300	85.7	200	200	100.0	54.8	64.0	59.4
Senior Unsecured	200	0	0.0	100	100	100.0	0.0	64.0	32.0
Subordinated	100	0	0.0	300	30	10.0	0.0	6.4	3.2

MEAN EXPECTED RECOVERY AS PERCENT OF TOTAL CLAIMS: 57.5%.

* Assumes two-year reorganization period. Discount rate: 25%.

Anticipating Non-Spurious Changes in Relative Recoveries among Priority Classes

Fluctuations in expected recoveries produce non-spurious changes in relative recoveries within the capital structure

Conceivably, swaps to higher or lower levels in the capital structure may make sense for the portfolio manager who expects a change in expected recoveries at the end of bankruptcy to shift recovery rates at all priority levels in the same direction, but by different magnitudes. **Exhibit 10** shows that a sudden drop in expected recovery at the end of bankruptcy, to 60.0% from 70.0%, reduces the recovery rate on the senior unsecured class by more (to 12.8% from 32.0%) than it does the senior unsecured class (unchanged at 64.0%). A well-timed swap between classes might enable a portfolio manager to capitalize on changes in relative recovery rates among asset classes. (Using Exhibit 10's data for illustration, the unnamed shock on Day 2 drops the ratio of senior secured to senior unsecured recovery rates to 12.8%/64.0% = 20.0% from 32.0%/64.0% = 50.0%.) Again, the ability to profit from the proposed active management strategy depends on being able to explain the historical variance and thereby forecast future variance.

To address the analyzability of non-spurious changes in relative recovery rates among priority classes, we converted Moody's series (Exhibit 6) into three recovery rate ratios to be used as dependent variables:

- Subordinated as a percentage of senior secured.
- Subordinated as a percentage of senior unsecured.
- Senior unsecured as a percentage of senior secured.

Using only the end-of-quarter observations, we calculated simple regressions of the independent variables previously employed in Exhibit 3 against each ratio.

T-Bill yields explain part of the variance in relative recoveries

Exhibit 11 shows that the Treasury bill yield explained 50.8% of the variance in the subordinated/senior secured ratio, with statistical significance at the 95% confidence level. The other variables did not help to explain the ratio's fluctuations. Similarly, the Treasury bill yield explained 28.3% of the variance in the subordinated/senior unsecured ratio (**Exhibit 12**), with 95% confidence, and no other variable contributing materially. In both cases the sign was negative, that is, a rise in the discount rate for future recoveries caused the recovery rate of the lower-priority claims to decline relative to the recovery rate of the higher-priority claims.

Exhibit 10: Recoveries by Asset Class Under Absolute Priority – $ Million
Company X (Illustration)

Day 1	Expected Recovery at End of Bankruptcy (Claims $	/Recovery $	/Recovery as % Claim)	Net Present Value* as Percent of Principal
Total Claims	**400**	**300**	**75.0**	**48.0**
Senior Secured	200	200	100.0	64.0
Senior Unsecured	200	100	50.0	32.0
Day 2				
Total Claims	**400**	**240.0**	**60.0**	**38.4**
Senior Secured	200	200.0	100.0	64.0
Senior Unsecured	200	40.0	20.0	12.8

* Assumes two-year reorganization period. Discount rate: 25%.

T-Bill yields are the only significant variable

Exhibit 11: Individual Regressions against Subordinated/Senior Secured Ratio, Quarterly, July 1995 - June 2000

	Sign	Percentage of Variance Explained (R^2)	t-statistic
Default Rate	+	4.7	0.94
Treasury Bill Yield	-	50.8	-4.31*
Treasury Yield Curve	-	6.1	-1.08
Growth in Real Gross Domestic Product	+	0.4	0.28

* Significant at 95% confidence level.
Sources: Moody's Investors Service, Bloomberg, Merrill Lynch Economics.

Exhibit 12: Individual Regressions against Subordinated/Senior Unsecured Ratio, Quarterly, July 1995 - June 2000

	Sign	Percentage of Variance Explained (R^2)	t-statistic
Default Rate	+	2.6	0.69
Treasury Bill Yield	-	28.3	-2.66*
Treasury Yield Curve	+	0.1	0.12
Growth in Real Gross Domestic Product	+	2.7	0.71

* Significant at 95% confidence level.
Sources: Moody's Investors Service, Bloomberg, Merrill Lynch Economics.

Changes in relative recoveries are not entirely inexplicable, but neither are they highly predictable

These results suggest that the fluctuations in the ratios of recovery rates among priority classes are not entirely inexplicable. Unfortunately, the practical benefits of forecasts derived from Treasury bill yields alone are questionable. The 90% confidence ranges are plus/minus 0.19 in both cases. If, by way of example, the forecast for a given quarter happens to equal the subordinated/senior unsecured ratio's mean of 0.79, an outcome of either 0.60 or 0.98 would be consistent with the forecast. Furthermore, the confidence bands take in 90% of the test-period observations of the subordinated/senior secured ratio and 85% of the subordinated/senior unsecured ratio's observations.

Finally, both the Treasury bill yield (R^2 = 44.5%) and the Treasury yield curve (R^2 = 22.3%) explained material amounts of the variance of the senior unsecured/senior secured ratio, with high statistical significance (**Exhibit 13**). Moreover, these two variables had an autocorrelation of only -7.9%, with the consequence that when we combined them into a multiple regression model (**Exhibit 14**), both variables remained statistically significant. This two-variable model explained 61.6% of the variance in the senior unsecured/senior secured ratio, with a 90% confidence range of plus/minus 0.12.

Plugging in the observation-period mean levels of the two independent variables, we can forecast the ratio of the senior unsecured recovery rate to the senior secured recovery rate in a hypothetical period, using the formula in **Exhibit 15**:

$$Y = 1.79 – (0.10 \times 0.99) + (0.19 \times 4.99) = 0.74$$

The senior unsecured to senior secured ratio is more, but still not highly, predictable

Applying the confidence range of plus/minus 0.12, we conclude that if the forecasted ratio is 0.74, the actual ratio has a 90% probability of falling in the range of 0.62 to 0.86. That band is wide enough to cover 75% of the quarterly observations in our test period. We question how much practical value investors can derive from forecasting changes in relative recovery rates among asset classes with such limited accuracy. This is all in the context, incidentally, of considerable uncertainty regarding any mortal's ability to forecast either short-term interest rates or the shape of the yield curve with greater accuracy than the market consensus already embedded in security prices.

Exhibit 13: Individual Regressions against Senior Unsecured/Senior Secured Ratio, Quarterly, July 1995 - June 2000

	Sign	Percentage of Variance Explained (R^2)	t-statistic
Default Rate	+	3.6	0.82
Treasury Bill Yield	-	44.5	-3.80*
Treasury Yield Curve	-	22.3	-2.27*
Growth in Real Gross Domestic Product	-	0.2	-0.20

* Significant at 95% confidence level.
Sources: Moody's Investors Service, Bloomberg; Merrill Lynch Economics.

Conclusion

Long-run recovery rates have greater relevance to investment decisions than the short-run fluctuations

Recovery rates on defaulted bonds have some bearing on an institution's decision whether to choose high yield bonds as one of its permanent asset classes. In principle, as well, period-to-period fluctuations in recovery rates are relevant to shorter-run decisions to overweight or underweight the high yield sector. To date, however, research has not generated a sufficiently accurate forecasting model to support such a strategy. Another plausible active-management strategy would be for a dedicated high yield manager to swap between priority classes in anticipation of changes in relative recovery rates among senior secured, senior unsecured, and subordinated bonds. These series appear to be contaminated by a great deal of statistical noise, however. At least some of the movement in relative recovery rates is non-spurious, but once again, available forecasting methods do not appear accurate enough to support an active trading strategy.

Exhibit 14: Multiple Regression Analysis of Senior Unsecured/Senior Secured Ratio, Quarterly, July 1995 - June 2000

R^2: 61.6%

	Coefficient	t-statistic	P-value
Intercept	1.79	7.83	0.00
Treasury Yield Curve	-0.10	-2.75*	0.01
Treasury Bill Yield	-0.19	-4.17*	0.00

* Significant at 95% confidence level.

Sources: Moody's Investors Service, Bloomberg, Merrill Lynch Economics.

Exhibit 15: Multiple Regression Formula for Senior Unsecured/Senior Secured

$Y = 1.79 - 0.10x_1 - 019x_2$

Where:

Y = Ratio of Senior Unsecured recovery rate to Senior Secured recovery rate
x_1 = Treasury yield curve (ten-year rate minus 90-day rate)
x_2 = Treasury bill yield (90-day maturity)

90% Confidence Level = Y ± 0.12*

* $Y \pm Se\ t(df; \alpha/2)$
$Y \pm 0.07\ (1.740)$
$Y \pm 0.12$

Degrees of freedom = 17

Source: Merrill Lynch & Co.

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