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# The Resiliency of the High-Yield Bond Market: The LTV Default

CHRISTOPHER K. MA, RAMESH P. RAO, and RICHARD L. PETERSON*


## ABSTRACT

This paper investigates the resiliency of the new-issue high-yield bond market by examining the changes in implied default rates of such bonds before and after the largest high-yield bond default, i.e., the LTV bankruptcy. Specifically, the paper compares implied default probabilities of high-yield bonds during the post-LTV period calculated from actual new-issue yields with instrumental default probabilities calculated on the assumption that the default had not occurred. A comparison of these probabilities reveals that the market's perception of default on the high risk segment of the bond market increased significantly after the LTV bankruptcy. However, the effect was transitory, lasting only six months. Thus, the market was resilient to a major default.


IN RECENT YEARS, HIGH-YIELD debt has become a significant segment of the corporate bond market. The main source of the growth has come from new issues of high-yield corporate bonds, rather than an increase in "fallen angels."[1] The driving force behind this new breed of high-yield debt growth has been its use as a means to tap the capital markets to finance increasingly common leveraged buyouts, hostile takeovers, and major corporate restructurings. The market acceptance of high-yield bonds was further enhanced by empirical evidence that net returns on a diversified portfolio of low-grade bonds exceeded those on high-grade bonds while the volatility of their monthly returns was no greater.[2]

The frenzied pace of growth in the high-yield debt market, however, has been accompanied by increasing concerns from various quarters.[3] Critics have char-

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[1] High-yield bonds are also known by such other versatile names as "junk" bonds, "low-rated" bonds, and "speculative-grade" bonds.

[2] In a detailed examination of default rates on low-grade bonds, Altman and Nammacher (1985, 1987) and Altman (1987) estimated the default rate to be 1.53 percent for the period 1974–1985. This compares with an average of 0.173 percent for all corporate bonds over the same period. Further, they conclude that, even after adjusting for the default loss rate, high-yield bonds yielded a respectable return of 16.1 percent over the period of study. Blume and Keim (1987), on the other hand, show that the risk of high-yield bonds as measured by monthly return volatility over the period 1982–1986 was lower than corresponding risk estimates for long-term U.S. government and investment-grade corporate bonds and equities.

[3] See, for example, Wall Street Journal, July 31, 1986, July 21, 1986, September 20, 1985, May 14, 1985, and April 29, 1985.

acterized the high-yield bond market as a house of cards ready to collapse with the slightest whiff of an economic downturn. Detractors appear to suggest that the market for high-yield bonds is "built on sand," with a price structure that does not reflect the risk inherent in these securities. Others suggest that a crisis, such as a major bankruptcy or an economic downturn, could cascade into a wave of defaults engulfing the entire high-yield debt market. The projection of a contagion effect no doubt stems from the thin equity cushion and high debt service requirements that are typical of most high-yield debt issuers. The situation could be exacerbated if a major default caused lenders to demand higher interest rates on credit extended to high-yield debt issuers, thereby causing the already suspect financial condition of such issuers to worsen. Thus, the resiliency of the high-yield debt market subsequent to adverse economic events has been seriously questioned.

The concern with market resiliency of high-yield debt was brought into sharp focus in 1986 when the high-yield debt market suffered the largest corporate failure until that time—the bankruptcy of the LTV Corporation.[4] The filing of bankruptcy by the LTV corporation and its various subsidiaries threw \$1.766 billion into default, representing fifty-six percent of total debt defaulting in 1986. The significance of the LTV bankruptcy is that it represents the first major default on new high-yield debt that was issued as a result of takeover contests and reorganizations. Therefore, examining the change in investors' default risk perceptions after the LTV bankruptcy provides a test of the resiliency of the high-yield debt market.

Previous studies have explored the impact of prominent cases of default on bonds that were originally investment grade.[5] While some studies find that major defaults on investment-grade securities could affect the pricing of similar issues shortly after default, the extant evidence fails to indicate a permanent impact on the interest cost structure. These results, however, are not totally surprising inasmuch as all of these studies dealt with bonds that were originally investment grade. For such bonds, the default component in their original pricing is not substantial, and any default of any unrelated issuer is likely to be viewed as an isolated case of mismanagement or fiscal irresponsibility. Consequently, a widespread and permanent impact may not be evident. However, this is not necessarily true in the new-issue high-yield debt market, where the pricing structure is strongly affected by the perceived default probability of the issuer.

The major findings of the study are that the high-yield bond market demonstrates surprisingly strong resiliency. The evidence indicates that there was a sharp upward revision in the market's assessment of future default probabilities on new issues of high-yield debt immediately following LTV's declaration of bankruptcy. The effect, however, was transitory, lasting six months or less. The

[4] The LTV Corporation filed for protection under Chapter 11 of the federal bankruptcy code on July 17, 1986. (See the Wall Street Journal, July 18, 1986, p. 3 for further details.)

[5] See Forbes and Peterson (1975), Gramlich (1976), Hoffland (1977), and Kidwell and Trzcinka (1982 and 1983) with regard to the New York City crisis, Jaffee (1975) and Kidwell and Trzcinka (1979) with regard to the effect of the Penn-Central Crisis, and Peavy and Hempel (1987) with regard to the *WPSS* default.

remainder of this study is organized as follows: Section I describes the empirical design, which includes a description of the sample and of the methodology used to test the hypothesis. Sections II and III present the empirical results. Finally, Section IV summarizes the paper and presents conclusions.

## I. Empirical Design

### A. Methodology

The methodology is designed to test the hypothesis that the LTV bankruptcy caused a revision in the probability of default perceived by investors in the high-yield bond market. The hypothesis is tested by examining whether the LTV bankruptcy caused a change in the implied default risk premium or yield spread inherent in the pricing of new-issue high-yield bonds. In Section II, this is done by comparing the probabilities of default implied in the actual yields of high-yield bonds issued after the LTV bankruptcy and those implied from estimated instrumental yields assuming that the LTV event had not occurred. Essentially, for each new issue of high-yield bonds beginning in July 1986, we first compute the instrumental yields using a pricing model estimated in the pre-LTV environment. The estimated yield gives us the projected interest cost of a bond assuming that the LTV bankruptcy did not occur. Furthermore, based on the actual yield and the instrumental yield for each issue, we estimate the default probability implied from each yield. The comparison of default probabilities for actual yields relative to those estimated from instrumental yields enables us to test the hypothesis that the LTV crisis affected the subjective default probabilities in the low-grade, high-yield bond markets. In Section III we estimate the pooled cross-section, time-series model developed below to explain the yield spread for high-yield bonds directly, with dummy variables used to identify changes in yield spreads that occurred after the LTV default.

### B. A Model to Estimate Yields

Previous studies have identified a fairly consistent set of macroeconomic variables and issuer/issue characteristics to explain the yield on risky bonds.[6] Generally, it is acknowledged that the yield spread between a risky bond and a riskless bond is determined by the likelihood of default of the issuing firm, stage of the economic cycle, market uncertainty at the time of the issue, the maturity and marketability of the issue, and other issue characteristics such as conservative sinking fund provisions, etc. For high-yield bond pricing, we also include an additional variable, the purpose of the issue; takeover high-yield bonds have higher yields than otherwise similar non-takeover high-yield bonds. (See Rao and Ma (1988).) Identifying the purpose of the issue allows us to measure the impact of bond purpose and uncertainty of the use of the funds on yield spreads. Thus, the model used in this study is

$$YS = f(PUR, RATG, DUR, SIZE, CV, BC) \tag{1}$$

[6] See, for instance, Benson, Kidwell, Koch, and Rogowski (1981), Fisher (1959), Jaffee (1975), Yawitz (1978), and Kessel (1971).

where

$YS$ = Yield spread measured as the difference between the yield to maturity on a bond relative to the yield for constant-maturity Treasury bonds with a duration approximately equal to the duration of the bond at the time of issue. Because of high and risky coupon payments, a high-yield bond's pricing is likely to be more closely related to its duration than its maturity.[7]

$PUR$ = Dummy variable to capture the purpose of the issue. Two dummy variables were used: ($P1$, $P2$), where $P1 = 1$ if the bond was used to finance a specific impending acquisition or to refinance a previously undertaken loan that was used to consummate a merger or acquisition and $P2 = 1$ if the issue was to finance future takeovers where no specific target was identified.

$RATG$ = A series of dummy variables used to capture default risk based on Moody's ratings. A total of five dummy variables were used ($BA2$, $BA3$, $B1$, $B2$, *and* $B3$), with the excluded set being bonds with a $BA1$ rating. The expected sign is positive, with the magnitude of the coefficient increasing monotonically from $BA2$ to $B3$.

$DUR$ = Duration of the bond calculated on the assumption that the bond will be called at the end of the call deferment period. The expected sign is positive. Duration to first call is used rather than maturity because high-yield bond issues are generally considered the first candidates to be called, ceteris paribus.

$SIZE$ = Issue size in millions of dollars. Previous studies generally have documented that larger-size issues have lower yield premiums. This is attributed to economies of scale arising from the selling effort and fixed costs associated with the flotation process.

$CV$ = Dummy variable equal to one if bond is convertible, zero otherwise. The expected sign is negative.

$BC$ = A variable measuring the stage of business cycle. This is computed by the difference in the average yield on Moody's AAA corporate bond index and Moody's thirty-year Treasury bond index in the month of issuance. Previous studies by Jaffe (1975) and others have documented that yield differentials fluctuate with credit risk over the business cycle. The expected sign is positive.

### *C. A Model to Estimate Default Probabilities from Bond Yields*

To estimate the default probability implied in yields, we rely on the theoretical work of Bierman and Hass (1975), Yawitz (1977), and Yawitz, Maloney, and

[7] The Treasury bond yield series used were average "constant-maturity" rates. Thus, we calculated the duration of each constant-maturity yield by assuming that a new Treasury bond of that maturity was issued at par carrying the current day's appropriate constant-maturity rate. Since the duration did not match exactly when calculating the yield spread, we used the constant-maturity yield of the Treasury bond with a duration closest in length to the duration of the new high-yield issue. Because the Treasury yield curve usually is relatively flat at longer maturities, and duration and maturity differ little for short maturities, the empirical results obtained in the paper were very similar regardless of whether the yield spread was obtained by using yields for constant-maturity T-bonds with a maturity or a duration equal to the duration of the high-yield bond.

Ederington (1983). Given a recovery rate on promised payments, the following relationship holds in a perfect market:

$$\sum_{t=1}^{n-1} \frac{P^tC + P^{t-1}(1 - P)g(C + 1)}{(1 + i)^t} + \frac{P^n(C + 1) + P^{n-1}(1 - P)g(C + 1)}{(1 + i)^n}$$
$$= \sum_{i=1}^{n} \frac{C}{(1 + r)^t} + \frac{1}{(1 + r)^n}, \qquad (2)$$

where

$n$ = number of periods to maturity;
$C$ = coupon rate on the risky bond per period;
$P$ = probability of the firm surviving from one period to the next;
$r$ = yield on the risky bond;
$i$ = yield on an otherwise identical riskless bond; this is proxied by the yield on the Moody's Treasury bond index in the month of issuance for bonds with a duration approximately equal to the duration of the bond;
$g$ = proportion of the sum of the period's coupon and face value of the bond that would be paid as settlement if default were to occur. In this we are guided by the findings of Altman and Nammacher (1987) on default losses in the high-yield bond market. They estimate the recovery rate to have averaged forty-one percent for the period 1975–1985.

The left-hand side in the above equation is the present value of the certainty-equivalent stream of cash flows from the risky bond discounted at the risk-free rate; the right-hand side is the risky stream of cash flows from the bond discounted at the risk-adjusted discount rate. From the above equation, given the known parameters, $r$, $i$, $n$, $C$, and $g$, one can compute the probability of survival from one period to the next ($P$) or its complement, the default probability $(1 - P)$.[8]

The probability of default is calculated using both observed yields and instrumental yields estimated from (1). The comparison of the default probability implied by the actual yields, $1 - Pa$, and that implied by the instrumental yields, $1 - Pe$, enables us to test the null hypothesis, i.e., $1 - Pa = 1 - Pe$.[9] The difference in theoretical default probabilities is tested using both parametric ($t$-test) and nonparametric (Wilcoxon) tests.

## II. Empirical Results: Implied Probabilities

The sample used in the tests consists of all high-yield bonds with Moody's ratings of *BA*1, *BA*2, *BA*3, *B*1, *B*2, and *B*3 that have all the requisite data and were issued between January 1980 and May 1987 as reported in *Moody's Bond Survey.*

[8] Evidence developed by Kim (1988) indicates that the implied default probability measure developed by Fons (1987) provides a better estimate of near-term high-yield bond default probabilities than either the traditional risk premium (the actual bond rate minus the riskless bond yield) or the relative risk premium (the bond yield divided by the riskless bond yield).

[9] Fons (1987) used the formulation in (2) to relate calculated default probabilities to actual default probabilities and various macroeconomic factors.

Descriptive statistics for the entire sample are presented at the bottom of Table I.

Table II presents the least-squares estimate of the relationship in (1) using the 506 high-yield bonds issued from January 1980 through June 1986. The regression model explains seventy-nine percent of the cross-sectional variation in yield spreads, and its coefficients are generally significant and have the expected signs. The only exceptions were *P*2, SIZE, and *BA*2. *P*2 (which denoted issues used to finance unspecified takeovers) was not significant even though the coefficient for *P*1 (which denotes bonds used to finance or refinance specific acquisitions) is significantly greater than the omitted (non-takeover) category. The coefficient

**Table I**

**Sample Statistics Obtained from *Moody's Bond Survey*, All Issues from January 1980 through May 1987**

Sample period: January 1980–May 1987.

| Variable | |
|---|---|
| Number of issues | 698 |
| Non-takeover issues | 373 |
| Takeover issues (issued to finance or refinance both specific and nonspecific aquisitions) | 325 |
| Non-convertible issues | 428 |
| Convertible issues | 270 |
| Average issue size | $86.3 million |
| Range | $10–900 million |
| <25 million | 136 |
| 25–50 million | 232 |
| 50–75 million | 91 |
| 75–100 million | 88 |
| >100 million | 151 |
| Average yield to maturity (%) | 11.57% |
| Average coupon rate (%) | 11.14% |
| Average years to maturity | 16.2 years |
| <10 years | 212 |
| 10–15 years | 167 |
| 15–20 years | 184 |
| >20 years | 135 |
| Average duration[a] | 3.25 |
| <=2 years | 89 |
| 2–6 years | 573 |
| >6 years | 36 |
| Average years to call | 3.8 years |
| Agency ratings | |
| *BA*1 | 32 |
| *BA*2 | 76 |
| *BA*3 | 79 |
| *B*1 | 89 |
| *B*2 | 287 |
| *B*3 | 135 |

[a] The duration is computed using the call deferment period in lieu of the actual maturity.

**Table II**

**Estimates of Regression Equation for Yield Spreads on High-Yield Debt Generated with Data Obtained from *Moody's Bond Survey* (all issues from January 1980 through May 1987) and U.S. Treasury Constant-Maturity Yield Series**

| | |
|---|---|
| $YS$ = | Yield spread on new issue versus T-bond with the same duration. |
| $P1$ = | Dummy variable for bonds issued to finance or refinance specific mergers or acquisitions. |
| $P2$ = | Dummy variable for bonds issued to finance unspecified mergers or acquisitions. |
| $BA2, \cdots, B3$ = | Dummy variables to reflect Moody's bond rating categories, = 1 if in category; the omitted category is $BA1$. |
| $DUR$ = | Duration to first call for the new issue. |
| $SIZE$ = | Size of the new issue in millions of dollars. |
| $CV$ = | Dummy variable that equals one for convertible bonds. |
| $BC$ = | Business conditions as measured by the yield spread between Moody's thirty-year AAA bond and thirty-year Treasury bond series. |

Regression estimate:

$$\begin{aligned} YS = \; & \underset{(3.588)^{*}}{1.2269} + \underset{(2.110)^{**}}{0.3391\,P1} + \underset{(0.124)}{0.0184\,P2} + \underset{(0.1353)}{0.4203\,BA2} + \underset{(2.3131)^{**}}{0.7347\,BA3} \\ & + \underset{(2.659)^{*}}{0.8477B1} + \underset{(4.384)^{*}}{1.2452B2} + \underset{(5.570)^{*}}{1.7011B3} + \underset{(2.378)^{**}}{0.0886DUR} + \underset{(1.369)}{0.0011SIZE} - \underset{(-33.539)^{*}}{5.0603CV} + \underset{(8.293)^{*}}{1.2647BC} \end{aligned}$$

$R^2 = 0.7940$, $F$-ratio $= 173.05$, prob $> F = 0.0001$, $df = 494$

* Significant at one percent level.

** Significant at five percent level.

for size is not significant, suggesting that economies of scale are not as significant for issuing and marketing high-yield bonds as investment-grade bonds. The coefficients for the rating dummies increase monotonically, and all but $BA2$, which is closest in quality to the omitted category, are significant.[10]

Table III presents mean default probabilities based on the actual and instrumental yields for various months beginning in July 1986, the month LTV declared bankruptcy, and ending in May 1987.[11] Also summarized for each month are the number of issues, the number of cases where default probabilities estimated from actual yields exceed those estimated from the instrumental yields, and the significance of the difference using both the $t$-test and the Wilcoxon test statistic.

For the month of July 1986 the statistics are split between the two halves of the month to reflect better the time of the LTV bankruptcy, which occurred on July 17, 1986. Interestingly, the figures show that there was no significant increase in implied default probabilities in the first half of July 1986; however, there was a significant increase in the second half of the month. This suggests that the declaration of bankruptcy by LTV caused a systematic upward revision in estimated default probabilities for low-grade bonds issued immediately after the LTV bankruptcy. This upward revision persisted through December 1986. Note that the difference between the default probabilities implied in the actual yield and in the instrumental yield began to narrow in September. However, it sharply increased in November and December, after Ivan Boesky was indicted and the high-yield bond market was placed under a regulatory cloud. Beginning early in 1987, no significant difference in default probabilities using actual and instrumental yields is evident.

In sum, the evidence in Table III indicates that the LTV crisis caused only a short-lived increase in the high-yield bonds' estimated default probabilities, as the effect lasted six months at most and then dissipated.

## III. Empirical Results: Yield Spreads

The default probability model generates results that depend monotonically, but not linearly, upon yield spreads. For that reason, many previous researchers have used spreads as a proxy for default probabilities. Thus, to investigate the robust-

[10] To ensure that the yield-spread model is well specified (equation (1)), we split the sample into an estimation sample and a test sample and examined the residuals in the test sample for possible biases. The estimation sample comprised eighty percent of the total sample selected randomly, while the remaining twenty percent of the observations served as the test sample. The estimation sample is used to generate the coefficients for equation (1) which were then used to estimate the yield spreads for the test sample observations. The estimated yield spreads for the test sample were then compared to the actual yield spreads. A check of the residuals in the test sample showed no bias. Specifically, a $t$-test of the null hypothesis of mean zero residuals could not be rejected at the one percent level of significance. The residual test was also conducted by various rating classes, and, as before, the null hypothesis of mean zero residuals could not be rejected at conventional levels of significance. These results indicate that the model is well specified and that the error structure is not biased.

[11] The estimated default probabilities are not substantially higher than those estimated by Fons for higher yielding bonds. While default probabilities using this methodology are relatively high (at up to ten percent), when we consider that estimated losses upon default are barely more than half the principal amount, the estimated default rates for high-yield bonds do not seem excessive.

**Table III**

**Comparison of Post-LTV Default Probabilities Using Actual Versus Instrumental Yields of New-Issue High-Yield Bonds to Calculate Implied Default Probabilities from the Bierman-Hass-Yawitz Model**

Source: (1) The number of new high-yield issues was determined from *Moody's Bond Survey* from July 1986 through May 1987. (2) Actual implied default probabilities were calculated from actual new-issue rates and terms, taken in comparison with prevailing Treasury bond rates. (3) Instrumental yields were calculated using the regression (presented in Table II) to estimate instrumental-yield spreads as $YS = 1.2269 + 0.3391$ (for bonds issued to finance or refinance specific mergers and acquisitions) + 0.0184 (for bonds used to finance nonspecific mergers or acquisitions) + 0.0886 times the duration to first call + 0.0011 times the size of the new issue in millions of dollars + 1.2647 times the yield spread between Moody's AAA Yield Series and Treasury bond series −5.0603 if the bond is convertible + rating-related risk premia as follows: $+0.4203\ BA2$, $+\ 0.7347BA3$, $+\ 0.8477B1$, $+\ 1.2452B2$, $+\ 1.7011B3$. The implied yield spread added to the Treasury bond rate for a T-bond with the same duration gives the yield that would be expected to apply based only on the objective terms surrounding the new issue. Based on that yield, the implied default probability was calculated, and then column (4) records the number of issues where the implied default probabilities estimated from actual yields exceeded calculated default probabilities obtained after estimating instrumental yields. The $t$-tests and Wilcoxon chi-square tests presented in columns (5) and (6) were calculated to determine whether statistically significant differences existed in implied and actual default probabilities each month.

| Time Period | No. of Issues in Period (1) | Implied Default Probabilities Calculated from Actual Yields (Average Value) (2) | Implied Default Probabilities Calculated from Instrumental Yields (Average Value) (3) | Number of Issues Where Actual > Instrumental Implied Default Probability (4) | $t$-Value and Significance (5) | Wilcoxon Chi-Squared Value and Significance (6) |
|---|---|---|---|---|---|---|
| Pre-LTV Default | | | | | | |
| July 1–15/86 | 23 | 8.63 | 8.46 | 13 | 0.40 | 0.35 |
| Post-LTV Default | | | | | | |
| July 16–30/86 | 18 | 9.44 | 7.51 | 15 | 3.46* | 9.85* |
| Aug. 86 | 34 | 9.94 | 8.28 | 28 | 2.75* | 13.36* |
| Sept. 86 | 22 | 8.85 | 7.11 | 19 | 3.21* | 5.73** |
| Oct. 86 | 20 | 8.82 | 7.28 | 18 | 3.19* | 8.01* |
| Nov. 86 | 17 | 9.88 | 7.46 | 13 | 3.58* | 5.91** |
| Dec. 86 | 16 | 9.40 | 6.73 | 15 | 8.83* | 22.4* |
| Jan.–Feb. 87 | 13 | 7.80 | 6.47 | 7 | 1.39 | 0.13 |
| Mar.–Apr. 87 | 18 | 6.02 | 6.56 | 4 | −1.30 | 2.88 |
| May 87 | 11 | 6.54 | 6.08 | 7 | 1.34 | 1.11 |

* Significant at the one percent level.

** Significant at the five percent level.

ness of these findings to the measure of default risk perceptions, we conducted an alternative test based only upon yield spreads. The test employs a dummy-variable regression model to estimate yield spreads on new issues of high-yield debt. Specifically, it estimates the yield-spread relationship described in equation (1) over the entire sample period from January 1980 through May 1987, using dummy variables for various months after the LTV bankruptcy. The advantage of this approach is that it makes full use of the information after the LTV bankruptcy to estimate the parameters of the yield-spread model. The results of the pooled cross-section, time-series estimation of equation (1) are presented in Table IV.[12] These results indicate that, after controlling for other factors, yield spreads on new issues of high-yield bonds increased significantly in the post-LTV crisis period for approximately six months. Beginning in early 1987, however, the effect appears to have dissipated. These results are consistent with the findings from the default premium tests. They also imply that the temporary changes in the yield spread that occurred immediately after the LTV default did not result from a permanent shift in the structure of the yield-spread model.

[12] A referee appropriately noted that the equation estimated in Table IV may overstate the effect of yield changes in the post-LTV period if the model is inappropriately specified. Because of the pooled cross-section, time-series methodology, any month-specific error in the model would be represented $n_i$ times in the residuals of the model, where $n_i$ is the number of high-yield security issues floated in month $i$. In order to eliminate the multiplication of error that is possible in a cross-section, time-series framework, we reran the model two ways, both of which confirmed the results presented in the text. The first approach used the average yield spread for all high-yield bonds issued in month $i$ as the dependent variable and also averaged all independent variables for all high-yield bonds issued that month. This converted our model to a strict time-series model, but it reduced our degrees of freedom substantially. In addition, the rating variables no longer made sense. Furthermore, even though all other (non-rating) variables retained the expected signs, the average duration variable was no longer significant. However, a dummy variable for the second half of July through year end 1986 was strongly and significantly positive, as would be expected if, as we posit, a positive "LTV effect" existed. The results were:

$$
\begin{aligned}
YS = \; & \underset{(1.278)}{1.282} + \underset{(2.050)^{**}}{1.325\,P1} + \underset{(0.552)}{0.269\,P2} - \underset{(-0.239)}{0\,.231\,BA} \underset{(-0.205)}{-0.252\,BA3} \\
& \underset{(-0381)}{-0.421\,B1} + \underset{(0.815)}{0.715\,B2} + \underset{(0.975)}{1.021\,B3} + \underset{(0.692)}{0.075\,DUR} \\
& \underset{(1.903)^{**}}{+0.049\,SIZE} - \underset{(-11.770)^{*}}{4.881\,CV} + \underset{(2.583)^{**}}{1.038\,BC} + \underset{(2.7880)^{*}}{1.318\,DUM\ LTV},
\end{aligned}
$$

$$R^2 = 0.8404,\ F = 25.45,\ \text{prob}\ F < 0.0001,\ df = 58,$$

where all variables are monthly averages of values applicable to each bond issue (see Table II for basic variable definitions) and *DUM LTV* is a dummy variable that equals one for all bonds issued from the last half of July through December 1986.

The second equation estimated used a pooled cross-section, time-series approach through the first half of July 1986 and then treated each month or half-month subsequent to the LTV event as if a single bond were issued at that time with the characteristics of the average high-yield bond issued that month. In that way, any bias in the model in the post-LTV period would enter the model only once each month, rather than $n_i$ times. The extended results were very similar to those reported in the text; even the coefficients were very close in magnitude. The only difference of note was that the coefficient for *JAN* 1987 was no longer significant.

**Table IV**

**Yield Spreads Before and After the LTV Default: Pooled Cross-Section, Time-Series Estimates Generated with Data Obtained from *Moody's Bond Survey* (January 1980 through May 1987) and U.S. Treasury Constant-Maturity Yield Series**

| | |
|---|---|
| $YS$ = | Yield spread on new issue versus T-bond with the same duration. |
| $P1$ = | Dummy variable for bonds issued to finance or refinance specific mergers or acquisitions. |
| $P2$ = | Dummy variable for bonds issued to finance unspecified mergers or acquisitions. |
| $BA2, \cdots, B3$ = | Dummy variables to reflect Moody's bond rating categories, = 1 if in category; the omitted category is $BA1$. |
| $DUR$ = | Duration to first call for the new issue. |
| $SIZE$ = | Size of the new issue in millions of dollars. |
| $CV$ = | Dummy variable that equals one for convertible bonds. |
| $BC$ = | Business conditions as measured by the yield spread between Moody's thirty-year AAA bond and thirty-year Treasury bond series. |

$AUG$ 86, $SEP$ 86, ..., $MAY$ 87 = dummy variables that take the value of one for all bonds issued in that month.

$JY186$ and $JY286$ = dummy variables that take the value of one in the first and last halves of July 1986, respectively, since the LTV default occurred in mid-month.

$$
\begin{array}{lllllllll}
YS = & 1.306 + & 0.350\,P1 + & 0.047\,P2 + & 0.410\,BA2 + & 1.708\,BA3 + & 0.832\,B1 + & 1.208\,B2 + & 1.674\,B3 \\
 & (3.172)^{*} & (1.88)^{***} & (0.271) & (1.09) & (1.856)^{***} & (2.192)^{**} & (3.528)^{*} & (4.589)^{*} \\
 & +\ 0.082\,DUR + & 0.00056\,SIZE - & 5.089\,CV + & 1.282\,BC + & 0.048\,JY186 + & 1.014\,JY286 & & \\
 & (1.820)^{***} & (0.688) & (-28.494)^{*} & (6.877)^{*} & (0.123) & (2.350)^{**} & & \\
 & +\ 1.038\,AUG\,86 + & 0.830\,SEP\,86 + & 0.748\,OCT\,86 + & 1.136\,NOV\,86 + & 1.546\,DEC\,86 + & & & \\
 & (3.227)^{*} & (2.208)^{**} & (1.898)^{***} & (2.677)^{*} & (3.520)^{*} & & & \\
 & +\ 1.846\,JAN\,87 - & 0.251\,FEB\,87 - & 0.262\,MAR\,87 - & 0.262\,APR\,87 + & 0.422\,MAY\,87 & & & \\
 & (2.665)^{*} & (-0.376) & (-0.372) & (-0.522) & (0.815) & & &
\end{array}
$$

$R^2 = 0.7019$, $F = 69$, prob $> F = 0.001$, $df = 674$

* Significant at one percent level.

** Significant at five percent level.

*** Significant at ten percent level.

## IV. Conclusions

In contrast to previous conjectures, the high-yield bond market demonstrates surprisingly strong resiliency. This study compares implied default probabilities during the post-LTV period using actual yields and instrumental yields that assumed that the default has not occurred. A comparison of these default probabilities and the corresponding yield spreads reveals that the market's perception of default probabilities applicable to the high risk segment of the bond market increased significantly after the LTV bankruptcy. However, the effect was transitory, lasting only six months. The findings indicate that the high-yield bond market is resilient with respect to a major default.

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