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Author(s): Paul Asquith, David W. Mullins, Jr., Eric D. Wolff

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Original Issue High Yield Bonds: Aging Analyses of Defaults, Exchanges, and Calls

PAUL ASQUITH, DAVID W. MULLINS, JR., and ERIC D. WOLFF*

ABSTRACT

This paper presents an aging analysis of 741 high yield bonds and finds default, exchange, and call percentages substantially higher than reported in earlier studies. By December 31, 1988, cumulative defaults are 34 percent for bonds issued in 1977 and 1978 and range from 19 to 27 percent for issue years 1979–1983 and from 3 to 9 percent for issue years 1984–1986. Exchanges are also a significant factor although they often are followed by default. Moreover, a significant percentage of high yield debt, 26–47 percent for 1977–1982, has been called. By December 31, 1988, approximately one third of the bonds issued in 1977–1982 has defaulted or been exchanged, and an additional one third had been called. On average, only 28 percent of these issues are still outstanding. There is no evidence that early results for more recent issue years differ markedly from issue years 1977 to 1982.

THE DEVELOPMENT OF THE original issue high yield bond market represents one of the most successful innovations in recent financial history.¹ From its inception, a major impetus behind the growth of the new issue high yield bond market has been the argument that risk-adjusted returns are high. Specifically, it is argued that defaults on high yield bonds, while higher than those on investment grade bonds, are low relative to their coupon rate, i.e., that their higher coupon rates more than compensate for the default risk. This apparent market inefficiency has been attributed to outdated conventions used by rating agencies and bond investors, both of whom supposedly fail to see the true risk/return characteristics of high yield bonds.

* Asquith is at the Massachusetts Institute of Technology. Mullins is on leave from the Harvard Business School at the U.S. Department of the Treasury. This research was performed while Mullins was on the faculty of the Harvard Business School and represents his personal views and not those of the U.S. Department of the Treasury. Wolff is at the U.S. Department of Justice. This research was performed while Wolff was at the Harvard Business School and represents his personal views and not those of the U.S. Department of Justice. We wish to acknowledge the assistance of First Boston, Drexel Burnham Lambert, Morgan Stanley, and Salomon Brothers for making default data available. Thanks are also due to the Division of Research, Harvard Business School for providing financial support. In addition, we wish to thank Ben Bisconti and Darquise Cloutier for their assistance with data collection and Paul Bonner for his computer analysis. We also wish to thank Steve Buser, Greg Hradsky, Michael Jensen, Tim Luehrman, Bob Merton, René Stulz, and the referee for this journal, as well as the participants at the University of Chicago and Harvard University Finance Seminars, for their comments. Finally, special thanks are due to Bruce MacLennan for his research assistance.

¹ The growth in this market can be viewed as a process of securitization. Low rated firms previously borrowed from insurance companies and banks. Development of the public high yield market allowed the securitization of these private placements.

Attempts to verify empirically the risk/return characteristics of the original issue high yield debt market are difficult because of data limitations. Since 1977 marks the beginning of the original issue high yield debt market,² there is only a limited history of its performance through time and none through a full range of economic and capital market conditions. Second, corporate bonds are primarily an institutional market with little or no trading on organized exchanges. Most trading is done over-the-counter with only a few market makers, particularly with smaller issues. Thus, there is no reliable, centralized data source, and broker/dealers consider their over-the-counter, institutional trading data proprietary.

Notwithstanding these serious data limitations, Blume and Keim (1987, 1988) have studied the risk/return characteristics of high yield debt. They find that high yield debt produces higher realized returns and lower standard deviations of returns than either investment grade or Treasury bonds over the period 1977–1987 but not over the period 1982–1987. These mixed results may partially reflect the difficulty in obtaining accurate transaction-based return data on a large sample of bonds. While Blume and Keim provide important insights into the risk/return characteristics of high yield debt, this issue remains an important topic for future research.

Default studies of high yield bonds have generally supported a positive view of this market. A series of early studies (e.g., Altman and Nammacher (1985), Altman (1987), Altman and Nammacher (1987), and Weinstein (1987)) have documented low default rates for high yield bonds. These studies have reported annual default rates in the 1–3 percent range, with Altman and Nammacher (1987) finding an average default rate of 1.5 percent for 1978–1986. These rates, while higher than the default rate on investment grade bonds, are offset by the 3–5 percent spread in yields between high yield and investment grade bonds. These studies showing consistently low default rates have convinced many of the proposition that the high yield debt market has low risk-adjusted default rates.³

There are, however, several problems which bias downward the reported default rates in these high yield studies. One source of bias is the failure to account properly for exchanges.⁴ Some studies drop exchanged bonds from their high yield bond samples. If exchanges reflect increased risk, exchanged bonds should have a higher default rate than initial issues. Even if exchanged bonds are not eliminated from a sample, distressed exchanges may be used to avoid technical

² 1977 was the first year public high yield bond issues exceeded five issues or \$110 million.

³ These low annual default rates are also reported in research reports and in the financial press. For example, see Fridson, Wahl, and Jones in Morgan Stanley's January 1988 *High Performance* and in a Morgan Stanley March 1988 report titled "The Anatomy of the High Yield Debt Market: 1987," or Carney in *Business Week* (3/30/87), who quotes a default rate at 1.22 percent, and Douglas Hallett in the *Wall Street Journal*, who cites a junk bond default rate of 1.6 percent a year.

⁴ An exchange offer involves the holders of an existing bond accepting a new security in exchange for that bond. Nondistressed exchanges allow a corporation to readjust its capital structure quickly. A distressed exchange allows a corporation which may have trouble meeting its debt obligations to reduce them. The new security usually has lower coupons, or delayed sinking funds and principal payments. Sometimes the securities exchanged are equity or have an equity component. Exchange offers may be either registered with the SEC or unregistered if they meet requirements under Section 3(a)(9) of the Securities Act of 1933.

default, thereby reducing the reported rate of default. As a result, the reported default rate might understate the actual incidence of financial distress by issuers and losses by bondholders.

Second, traditional studies of high yield bond defaults have not properly considered the aging of the bonds. Studies such as those by Altman and Nam-macher (1985, 1987), Altman (1987), and Weinstein (1987) measure the default rate by dividing the amount of defaults in a given year by the par value of all outstanding issues.⁵ This definition of default rate ignores the important effect of bond age on default risk. If bond default rates are not stationary through time but rise with bond age, and if there is a rapid growth in new issue volume year to year, default rates are severely biased downward by this measure. An alternative way to measure default risk is to consider defaults over time within a cohort of bonds issued at the same time.

In his most recent paper on high yield debt, Altman (1989) employs an aging concept, "cumulative bond mortality," which utilizes cohort issue years. "Cumulative bond mortality" measures default rates on bonds that have been outstanding for equal periods of time and adjusts the size of the denominator for calls, maturities, previous defaults, and sinking funds. This technique avoids the aging bias of earlier studies, and Altman finds ten-year cumulative mortality rates of 6.64 percent for BB bonds and 31.91 percent for B bonds, and five-year rates of 31.17 percent for CCC bonds. These latter two cumulative rates are much higher than the rates that would result from cumulating the average yearly default rates cited above and in footnote 3. This mortality technique, because it divides defaults only by bonds still outstanding, may produce percentages somewhat higher than the total percentage defaulting on any original yearly sample.

The objective of this paper is to present an analysis of the high yield bond market which avoids the two methodological difficulties noted above: failure to consider exchanges and the aging of bonds. It specifically incorporates the concept of aging in an analysis of defaults, exchanges, and calls for an exhaustive data base of all original issue public high yield corporate bonds issued between January 1, 1977 and December 31, 1986. For these 741 bonds, all relevant events are examined through December 31, 1988.

The results are striking. A buy-and-hold investor who purchased a portfolio of all high yield bonds issued in 1977 and 1978 would, by December 31, 1988, experience a default rate of 34 percent. Of the bonds issued in the years 1979–1983, between 19 and 27 percent default by December 31, 1988. Default rates for issue years 1984–1986 range from 3 to 9 percent by December 31, 1988.

The effect of bond age on the default rate is clearly evident in these results. Default rates are lower immediately after issue and rise over time. By the time these defaults occur, the overall market is much larger due to the rapid growth in new issue volume. This growth makes the high default rates of old bonds appear small relative to the size of the overall market, which is dominated by recently issued bonds with low default rates.

⁵ This is the cumulated new issue volume at par value over several years. This number is often adjusted by subtracting calls, maturities, and upgrades and by adding downgrades and registered private placements.

This study also examines exchanges because of their potential use in avoiding default through a reorganization of claims. The results confirm that, by December 31, 1988, a significant fraction of bonds issued (up to 31 percent for some years) have been subject to exchanges. However, a significant proportion of exchanges are followed by default and are included in the default results reported above. Thus, these results do not support the argument that exchanges are completely effective in eliminating defaults for high yield bonds. They do, however, point to the importance of not dropping exchanged bonds and their successors from any study of the high yield market.

In addition to defaults and exchanges, this study examines calls of original issue high yield bonds. A significant percentage of the bonds issued were called by December 31, 1988. The percentage called for the earlier issue years 1977–1982, where call protection can be considered to have expired, ranges from 26 to 47 percent.

Summing the aged results for defaults, exchanges, calls, and maturities gives a picture far different from the common perception of a stable market with low defaults. By December 31, 1988, only a relatively small fraction of high yield bonds originally issued in years 1977–1982 remain outstanding. On the down side, approximately one third of bonds issued in these years have defaulted or have been exchanged. An additional one third have been called, requiring investors to reinvest. Only a small fraction of original issue high yield bonds has been paid off through sinking funds or at maturity. By December 31, 1988, the residual issues which have neither defaulted nor been called or matured represent only 28.1 percent of the original issues of 1977–1982.

Results for these early years do not appear anomalous. Early year default results for issue years 1983–1986 are equal to or worse than those for issue years 1977–1982. Of course, these early year results do not necessarily predict similar future default rates.

I. Data and Methodology

This paper examines all public original issue high yield corporate bonds, often called “junk bonds,” issued between January 1, 1977 and December 31, 1986. These are bonds rated below investment grade, i.e., BB/Ba or below at time of issue. A starting date of 1977 was chosen as the first year since there were very few original issues of high yield bonds before that year. (In 1976 only five high yield bonds, par value \$105.0 million, were publicly issued. In the first half of 1977, only eight such bonds were issued; in the second half, eighteen bonds were issued.) Bonds that had been downgraded from investment grade, called “fallen angels,” were not included.⁶

Moody's and Standard and Poor's ratings were used as a screen, with bonds rated BBB or above by S&P or Baa or above by Moody's not included. A bond not rated by one agency was included if the other agency rated it below investment

⁶ Fallen angels may behave differently from original issue high yield bonds since there has already been a negative “event” that caused downgrading. This event may either increase or decrease the likelihood of another such event.

grade. Thus, no bond in the sample was considered investment grade by either major rating agency.⁷ Bonds not rated by either agency, double NR's, were not included in the sample even though some lists of high yield securities include some of these bonds. There are many double NR's, usually small issues, but there is no agreement among investment banks on which of these bonds should be classified as high yield. Banks include different double NR bonds in their high yield lists depending on whether those bonds were sold or are traded by that firm's high yield group.

The sample bonds were identified by examining the calendar of new securities issued in *Moody's Bond Survey* and *S&P's Bond Guide* over the period from 1977 to 1986. This list was checked against Securities Data Corporation's listing of high yield bonds.⁸ Convertible bonds were also excluded from the sample because of their equity component.

After identifying the original issue high yield corporate bond universe, all bonds' histories were followed until December 31, 1988 for credit events including defaults, bankruptcies, exchanges, calls, repurchases, debt-equity swaps, mergers, and puts by holders.⁹ These histories were obtained from several sources including each firm's 10K's and Annual Reports, *S&P Credit Week*, *Capital Changes Reporter*, *S&P Called Bond Record*, *S&P Bond Guide*, *Moody's Bond Survey*, the *Wall Street Journal*, Salomon Brothers' list of defaulted bonds, Drexel's list of defaulted and exchanged bonds, and First Boston's list of defaults and exchanges. Since none of these sources was complete, additional information for some of the bond histories was obtained by contacting the firm or the bond's trustee.

Table I presents summary data on the sample of original issue public high yield bonds for the period 1977–1986.¹⁰ As Table I shows, this market has grown rapidly in total issues, dollar amount, and average size of issue. The amount of original issue high yield debt per year was relatively stable until 1981, averaging slightly over \$1 billion per year. It then grew rapidly to almost \$31 billion in new issues in 1986. In fact, 1986 represents 27 percent of all issues and 43 percent of all par value issued since January 1, 1977. New issues in 1985 and 1986 together constitute 47 percent of issues and 64 percent of par value issued through December 31, 1986. The average size (in par value) of new issues increased from approximately \$30 million per issue in the late 1970s to \$155 million in 1986.

⁷ Bonds rated BBB by one agency and below BBB by the other, "split triple B's," are sometimes considered high yield.

⁸ The universe of bonds collected from Moody's and S&P matched with Security Data Corp. (SDC) in 738 cases. There were four bonds listed by SDC that were not included in Moody's or S&P. Ratings may have come later after issue date. Also, three bonds listed in Moody's or S&P are not in SDC. They were left in the sample so that it contains the complete Moody's and S&P lists.

⁹ Exchanges involve the substitution of one or more securities for the original bond. These successor securities were also followed forward in time for future credit events.

¹⁰ Statistics on the size of the market and par value issue volume presented in Table I closely parallel those of underwriters (such as Drexel Burnham Lambert) and researchers (such as Altman) once differences in sample definitions are accounted for. In particular, the total is different from some studies because it excludes 1) issues not rated by both major rating agencies (double NR's) and 2) issues rated investment grade by one agency and below investment grade by the other rating agency (split triple B's). The sample also includes only original public issues, thus excluding "fallen angels" and private bond issues which are subsequently taken public.

Table I
**New Issuances of High Yield Bonds by Number of Bonds
 and Par Amount for Issue Years 1977–1986**

High yield bonds are all bonds rated below investment grade at issue date by Moody's and Standard & Poor's. Par value is the customary method used to state the size of the high yield market.

Issue Year	Number Issued	Amt. Issued (\$ Millions)	Average Issue Amount	<i>N</i>	Average Coupon	<i>N</i>	Average YTM	<i>N</i>
			(\$ Millions)		%		%	
1977	26	908	34.08	26	10.466	26	10.714	17
1978	51	1,442	28.28	51	11.416	51	11.631	34
1979	41	1,263	30.81	41	12.284	41	12.633	32
1980	37	1,223	33.05	37	13.596	36	14.709	28
1981	24	1,240	51.67	24	14.793	21	17.395	18
1982	41	2,490	60.73	41	13.772	40	16.832	29
1983	74	6,003	81.12	74	12.049	72	13.928	35
1984	102	11,552	113.26	102	14.349	74	15.577	61
1985	145	14,463	99.75	145	13.773	127	14.290	110
1986	200	30,949	154.75	200	12.471	188	12.636	173
Total	741	71,533	96.54	741	12.917	676	13.653	537

Average yield to maturity rose steadily from 1977 to its peak of 17.4 percent in 1981 and declined to 12.6 percent by 1986. The 741 new public issues of high yield corporate debt during 1977–1986 had an aggregate par value of \$71.5 billion.

II. Results

A. Defaults

Table II presents cumulative defaults through December 31, 1988 for high yield bonds issued from 1977 through 1986. Default is defined as declaration of default by the bond trustee, the filing of bankruptcy by the issuing firm, or the assignment of a D rating by S&P for a missed coupon payment. If the bond has been exchanged for other securities, default is also defined as a default of the securities for which the original bond was exchanged.

The results presented in Table II document that default percentages are high for “older” bond issues. An investor who bought and held all high yield bonds issued in 1977 and 1978 would experience, by December 31, 1988, cumulative defaults of 34 percent. Buying and holding all new issues in the years 1979–1983 would, by December 31, 1988, produce cumulative defaults ranging from 19 to 27 percent. Cumulative defaults are much lower for “younger” bonds. The issue years of 1984–1986 produced cumulative defaults of 3–9 percent through December 31, 1988.¹¹

¹¹ These default rates are not directly comparable to Altman's (1989) cumulative mortality rates. This is both because Altman separates his sample by rating classes and because Altman reduces the denominator by calls, maturities, defaults, and sinking funds, thus increasing the annual mortality rate. Calculating Altman's cumulative mortality rates using our data base yields cumulative rates of 21.11 percent and 41.78 percent after ten years for BB and B rated bonds and 37.50 percent after six years for CCC bonds. These percentages are higher than Altman (1989). Our twelve-year cumulative mortality rates for BB and B bonds are 28.18 percent and 44.35 percent, respectively. A probable reason for our higher defaults is our tracking of exchanges.

Table II
Cumulative Defaults for Original Issue High Yield Bonds
until 12/31/88 by Year of Issue

High yield bonds are all bonds rated below investment grade at issue date by Moody's and Standard & Poor's. Defaults are defined as a declaration of default by the bond's trustee, filing of bankruptcy by the firm, or assignment of a D rating by S&P for a missed coupon payment.

Issue Year	Total Issued		Total Defaulted ^a		Cumulative % of Total Defaulted	
	Number	Amount (\$ Millions)	Number	Amount (\$ Millions)	Number	Amount (\$ Millions)
1977	26	908	6	308	23.08	33.92
1978	51	1,442	17	494	33.33	34.26
1979	41	1,263	12	312	29.27	24.70
1980	37	1,223	12	337	32.43	27.56
1981	24	1,240	4	260	16.67	20.97
1982	41	2,490	11	646	26.83	25.94
1983	74	6,003	16	1,153	21.62	19.21
1984	102	11,552	15	1,084	14.71	9.38
1985	145	14,463	10	510	6.90	3.53
1986	200	30,949	17	2,519	8.50	8.14
Total	741	71,533	120	7,623		

^a If the original bond has been exchanged for other securities and no longer exists, default is also defined as a default of the securities for which the bond was exchanged.

The importance of aging on default rates is illustrated clearly in Table III. This table reports year by year default rates and cumulative default percentages for each issue year.¹² Default rates are low for the first several years after issue. In fact, for seven of the ten issue years, there are no defaults in the first year after issue, and, for three of the issue years, there are no defaults in the first two years. These low early year default rates lead to low cumulative default percentages, ranging from 0 to 8 percent three years after issue, with the majority in the 3–6 percent range.¹³

Yearly default rates increase with time, and, thus, older bonds have much higher cumulative default percentages. Seven years after issue, cumulative defaults rise to 18–26 percent for the issue years 1978–1982 although no 1977 issues had defaulted seven years after issue. Eleven and twelve years after issue date, cumulative defaults are 34 percent for the two relevant years, 1977 and 1978. Because a methodology which properly considers aging is employed, the default percentages presented in Table III are much higher than those reported in many earlier studies.

¹² Default within the n th year is defined as a default within $n \times 365$ days of the issue date. Thus, bonds are grouped by issue date within cohorts of issue years (January to December), but credit events are defined in time elapsed since issue date.

More detail on year-by-year default rates are included in Tables AI, AII, and AIII.

¹³ Table AIII shows that average aged default rates by years since issue date are their lowest in years 1, 2, and 3 (in that order).

The average aged default rate for n years is defined as the average n -year default rate over all issue years; i.e., the average aged default rate for the first year is the weighted average number of defaults which occur during all first years. Table AII presents the year-by-year calculations.

Table III
Aged Defaults for High Yield Bonds Grouped by Year of Issue

In this table an n th year default is defined as a default within $n \times 365$ days of the issue date. High yield bonds are all bonds rated below investment grade at issue date by Moody's and Standard & Poor's. Defaults are defined as a declaration of default by the bond's trustee, filing of bankruptcy by the firm, or assignment of a D rating by S&P for a missed coupon payment.

Issue Year	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th	Total
Panel A: % of Par Amount Defaulted in n th Year After Issue													
1977	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.71	3.63	19.27	3.30	0.00 ^a	33.92
1978	0.00	8.32	0.00	1.39	0.00	7.91	4.85	3.12	5.55	1.39	1.73 ^a	—	34.26
1979	0.00	0.00	5.54	1.11	2.38	6.73	1.98	0.00	5.78	1.19 ^a	—	—	24.70
1980	0.00	0.57	2.45	0.00	0.00	13.90	6.30	1.88	2.45 ^a	—	—	—	27.56
1981	0.00	6.05	0.00	8.06	6.85	0.00	0.00	0.00 ^a	—	—	—	—	20.97
1982	1.00	2.41	1.61	11.49	0.00	9.44	0.00 ^a	—	—	—	—	—	25.94
1983	0.00	0.00	6.08	7.83	4.80	0.50 ^a	—	—	—	—	—	—	19.21
1984	2.29	1.99	2.03	3.06	0.00 ^a	—	—	—	—	—	—	—	9.38
1985	0.00	0.80	2.28	0.45 ^a	—	—	—	—	—	—	—	—	3.53
1986	2.73	3.84	1.57 ^a	—	—	—	—	—	—	—	—	—	8.14
Panel B: Cumulated % of Par Amount Defaulted for x Years After Issue													
1977	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.71	11.34 ^a	30.62	33.92	33.92 ^a	33.92
1978	0.00	8.32	8.32	9.71	9.71	17.61	22.47	25.59	31.14	32.52	34.26 ^a	—	34.26
1979	0.00	0.00	5.54	6.65	9.03	15.76	17.74	17.74	23.52	24.70 ^a	—	—	24.70
1980	0.00	0.57	3.03	3.03	3.03	16.93	23.22	25.10	27.56 ^a	—	—	—	27.56
1981	0.00	6.05	6.05	14.11	20.97	20.97	20.97	20.97 ^a	—	—	—	—	20.97
1982	1.00	3.41	5.02	16.51	16.51	25.94	25.94 ^a	—	—	—	—	—	25.94
1983	0.00	0.00	6.08	13.91	18.71	19.21 ^a	—	—	—	—	—	—	19.21
1984	2.29	4.28	6.32	9.38	9.38 ^a	—	—	—	—	—	—	—	9.38
1985	0.00	0.80	3.08	3.53 ^a	—	—	—	—	—	—	—	—	3.53
1986	2.73	6.57	8.14 ^a	—	—	—	—	—	—	—	—	—	8.14

^a May be incomplete; i.e., entire sample may not have been outstanding for x years.

Table III also indicates no trend toward improvement in aged default rates in more recent issue years. Issue years 1982–1986 have average early year default rates equal to or worse than issue years 1977–1981. In fact, the most recent issue year in the sample, 1986, exhibits the highest first year default rate and is second among all ten issue years in cumulative default percentages two and three years after issue.

Table IV gives unaged yearly default rates calculated by taking the amount of defaults in a given year and dividing by cumulative new issues since 1977. This is similar to the methodology¹⁴ used to calculate default rates in Altman (1987), Altman and Nammacher (1985, 1987), Fridson et al. (1988a, b), and Weinstein (1987), and by Drexel Burnham Lambert.¹⁵ Table IV demonstrates that replicating this methodology on the sample here yields results similar to those reported elsewhere. Annual default rates calculated in this manner average under 2 percent from 1980 to 1986, and the “unaged” cumulative default percentage, calculated as cumulative defaults divided by cumulative new issues, is 10.66 percent by December 31, 1988. This clearly demonstrates that it is the use of the aging methodology, not differences in the database, which causes our higher default percentages.

Table V provides further insight into the reason for these low unaged default rates. This table presents the average issue age of the original issue public high yield bond market. Average issue age is defined as average time since issue date for all bonds in the sample.¹⁶ Because of the rapid growth in new issue volume, the average age of the overall market actually declined for several years and has hovered around two years.

As a result, default rates which do not consider bond age, such as those in Table IV, produce biased results. As the aging analysis in Table III demonstrates, default rates do not increase until several years after issue. By then, the larger default rates on old bonds appear small relative to the size of the overall market, now dominated by bonds issued in the previous year or two. An aging methodology is necessary to produce a clear view of the default experience of a buy-and-hold investor.

The illusion of low unaged default rates calculated as in Table IV can be sustained only as long as the explosive growth in new issues continues. Once growth slows, as it inevitably must, the overall market will no longer be dominated by recently issued bonds with lower default rates. With slower growth in new issue volume, the average age of the overall high yield bond market will grow, revealing higher aged default percentages such as those reported in Table III.¹⁷

¹⁴ See footnote 5.

¹⁵ Drexel (1989) using this methodology finds, “Between 1971–1988, annual high yield default rates (including “fallen angels”) have averaged about 2%” (p. 7). Also, in Figure 1.9 of Drexel (1989), the “original issue high yield only” default rates average 0.95 percent for 1977–1988.

¹⁶ Average issue age is calculated by summing the par amount of the bond times the days since issue date and dividing that sum by the par amount of all bonds issued times 365 days. There is no adjustment made here for bonds which are called, mature, default, or exchange. If there were, the average issue age would presumably decrease since “older” bonds would be more likely, on average, to have experienced these events.

¹⁷ The defaults presented in Table III are given as a percentage of par amount issued. Table AI also gives defaults as a percentage of bonds issued. A third way to calculate defaults is as a percentage

Table IV
Yearly Default Percentages for Original Issue High Yield Bonds Calculated without Aging

High yield bonds are all bonds rated below investment grade at issue date by Moody's and Standard & Poor's. Defaults are defined as a declaration of default by the bond's trustee, filing of bankruptcy by the firm, or assignment of a D rating by S&P for a missed coupon payment. Default percentages are calculated as the number (or \$ amount) of defaults in a given year divided by the universe of all high yield bonds issued through that year.

Year	Number Defaults	Amount Defaulted (\$ Millions)	Total Number Issued Since 1/1/77	Total Amount Issued Since 1/1/77 (\$ Millions)	Defaults %	
					Number	\$
1977	0	0	26	908	0.00	0.00
1978	0	0	77	2,350	0.00	0.00
1979	1	20	118	3,613	0.85	0.56
1980	1	100	155	4,836	0.65	2.08
1981	2	107	179	6,076	1.12	1.77
1982	7	145	220	8,566	3.18	1.69
1983	4	125	294	14,569	1.36	0.86
1984	8	303	396	26,121	2.02	1.16
1985	13	821	541	40,584	2.40	2.02
1986	37	2,104	741	71,533	4.99	2.94
Total ^a	120	7,623	741	71,533	16.19	10.66

^a From 1/1/77 to 12/31/88.

Finally, it should be noted that the aged default rates reported in this paper are not necessarily indicative of future default rates. The sample studied here covers a period of generally falling interest rates, rising stock prices, and good economic conditions (except for a brief 1982 recession). Further adversity in capital markets and/or economic conditions could produce higher default rates. In addition, because of the youth of this market, few of the issuers were required to make principal payments during the sample period. With the added burden of sinking fund and maturity payments, future default rates could be higher even without a worsening of the economy. On the other hand, more underwriter and investor experience with the creditworthiness of high leverage or low rated firms, greater liquidity in the secondary market for high yield bonds, and a more active role for exchange offers may lower future default rates.

of firms issuing. This approach would be important if a disproportionate number of firms with multiple issues defaulted, particularly in the early sample years when issue numbers were smaller. In fact, this is not the case; the 741 issues are by 499 different firms, and the 120 defaults are by eighty-one different firms. This makes the per-bond default percentage of 16.19 percent almost identical to the per-firm default percentage of 16.23 percent. Furthermore, since most firms with multiple bonds issue in several different years, the yearly per-firm default rate is higher than the per-bond default rate for eight of the ten sample years, including 1977, 1978, and 1979 (with per-firm default rates of 24.00 percent, 34.69 percent, and 30.00 percent, respectively).

Table V
The Average Issue Age^a of All High
Yield Bonds Issued After January
1, 1977, Until the Date Given

High yield bonds are all bonds rated below investment grade at issue date by Moody's and Standard & Poor's. Average issue age is defined as the amount of bonds issued multiplied by the time since issue date divided by the total amount issued.

Bonds Issued after 1/1/77 until the Date Below	Average Issue Age Weighted by Par Value of Issues
12/31/77	0.48 years
12/31/78	0.85 years
12/31/79	1.36 years
12/31/80	1.87 years
12/31/81	2.39 years
12/31/82	2.50 years
12/31/83	2.28 years
12/31/84	2.01 years
12/31/85	2.07 years
12/31/86	1.94 years

^a Formally, the par amount of each bond is multiplied by the number of days since issue. This weighted amount is summed and then divided by the cumulative par amount issued. For example, if an equal amount of bonds is issued every year for ten years, the average age at the end of ten years is five years. If more bonds are issued at the beginning of the period, the average age is > five years. If more are issued at the end of the period, the average is < five years.

B. Exchanges

Exchanges are important in analyzing high yield bonds since they may be used to avoid the event of default by a reorganization of claims. In a distressed situation, a firm may offer bondholders the opportunity to exchange the bond for securities with less current service burden (e.g., by a lower coupon rate, a delayed sinking fund, or a combination exchange of bonds and common stock).¹⁸ Such distressed exchange offers, if not properly considered, might understate the

¹⁸ Such distressed exchanges might represent a more efficient method of reorganizing claims than default and/or bankruptcy. See Jensen (1989) for a fuller discussion of this issue. Exchanges which occur after bankruptcy and default, and which represent a formal reorganization of claims are not included in the results. There are eleven such exchanges, representing \$581 million in par value of bonds.

incidence of firm financial distress as well as the size of losses experienced by bondholders since the terms of the exchange should reflect a significant probability of default on the old debt. Furthermore, if exchanges are not followed afterwards, defaults on the newly issued bonds (and on any residual amount of untendered old bonds) will be ignored.

The results in Table VI confirm that, by December 31, 1988, a significant percentage of the bonds issued in the early sample years have been subject to exchanges. Four of the first five issue years have cumulative exchange percentages in excess of 17 percent. Cumulative exchanges for more recent issue years are between 2 and 14 percent.

The results presented in Table VII illustrate, however, that exchange offers have not always been successful in avoiding default. For all issue years, excluding 1984 and 1985, a significant fraction of exchanges, 18–89 percent, are followed by default on the securities received in the exchange offer. These defaults are included in the default results reported in Tables II, III, and IV. Of all exchanges, slightly less than one third are followed by default, more than half are followed by no other event by December 31, 1988, and the remaining 9 percent are called or are paid off at maturity. Table VI shows that exchanges not followed by default are a small fraction of total issue amount for most issue years. Thus, these results do not support the argument that exchange offers succeed in

Table VI
Cumulative Successful Exchanges for Original Issue High Yield Bonds
until 12/31/88 by Year of Issue

This table does not include exchanges subsequent to default or bankruptcy. It also does not include debt-equity swaps. High yield bonds are all bonds rated below investment grade at issue date by Moody's and Standard & Poor's. Defaults are defined as a declaration of default by the bond's trustee, filing of bankruptcy by the firm, or assignment of a D rating by S&P for a missed coupon payment.

Issue Year	Number of Issues Exchanged ^a	Amount of Issues Exchanged (\$ Millions)	% of Total Issues Exchanged		% of Total Issues Exchanged with No Subsequent Default ^b	
			Number	Amount	Number	Amount
1977	6	281	23.08	30.95	11.54	15.75
1978	10	290	19.61	20.11	7.84	9.02
1979	4	56	9.76	4.43	2.44	1.11
1980	7	212	18.92	17.33	8.11	6.13
1981	6	365	25.00	29.44	20.83	24.19
1982	4	180	9.76	7.23	4.88	0.80
1983	8	820	10.81	13.66	5.41	7.58
1984	7	555	6.86	4.80	6.86	4.80
1985	7	470	4.83	3.25	4.83	3.25
1986	3	480	1.50	1.55	1.00	1.07
Total	62	3,709	8.37	5.19	5.13	3.48

^a For an additional eleven issues in the sample (par value \$581 million), the issue was exchanged after a default or bankruptcy.

^b As of 12/31/88. This is the percentage of all issues in the sample that have been exchanged without any subsequent default. A high percentage of exchanged bonds subsequently default. (See Table VII.) A small percentage eventually mature or are called. (See Table VII.)

Table VII
Amounts and Percentages of Successful Exchanges That Have Defaulted, Matured, or Been Called from the
Exchange until 12/31/88 by Year of Issue

This table does not include exchanges made subsequent to a default or bankruptcy. Percentages are calculated for the sample of total successful exchanges.

Issue Year	Exchanges/No Other Events				Exchange/Default				Exchange/Call or Maturity			
	Number	Amount (\$ Millions)	% Number	% Amount	Number	Amount (\$ Millions)	% Number	% Amount	Number	Amount (\$ Millions)	% Number	% Amount
1977	0	0	0.00	0.00	3	138	50.00	49.11	3	143	50.00	50.89
1978	4	130	40.00	44.83	6	160	60.00	55.17	0	0	0.00	0.00
1979	1	14	25.00	25.00	3	42	75.00	75.00	0	0	0.00	0.00
1980	2	50	28.57	23.58	4	137	57.14	64.62	1	25	14.29	11.79
1981	3	240	50.00	65.75	1	65	16.67	17.81	2	60	33.33	16.44
1982	1	10	25.00	5.56	2	160	50.00	88.89	1	10	25.00	5.56
1983 ^a	4	455	50.00	55.49	4	365	50.00	44.51	0	0	0.00	0.00
1984	6	455	85.71	81.98	0	0	0.00	0.00	1	100	14.29	18.02
1985	7	470	100.00	100.00	0	0	0.00	0.00	0	0	0.00	0.00
1986	2	330	66.67	68.75	1	150	33.33	31.25	0	0	0.00	0.00
Totals ^b	30	2,154	48.39	58.07	24	1,217	38.71	32.81	8	338	12.90	9.11

^a One of the defaulted bonds in 1983, par value \$85 million, was later called when the issuing company was acquired by another firm. To avoid double-counting, the bond is only classified as a default.

^b Total percentages are of total exchanges and are not the average of the yearly percentages.

eliminating defaults, although they may reduce their number or change their timing.

C. Calls and Maturity

Table VIII reports cumulative call percentages for high yield bonds. Between 26 and 47 percent of the bonds issued in the first six years, 1977–1982, have been called by December 31, 1988. This partially reflects the sharp decline in interest rates beginning in 1982. It may also reflect required calls associated with asset sales or an improvement in some bonds' credit ratings. Thus, for a large percentage of the high yield market, lower interest rates and/or good performance by the issuers are translated into calls, requiring bondholders to reinvest. In contrast, only 3–14 percent of the bonds issued in 1983–1986 have been called by December 31, 1988. Given normal call protection periods and lower coupon rates (see Table I), this is not surprising.

The high cumulative call percentages for early issue years raise the question of whether call provisions were correctly priced for these issues. In view of the possibility of upgrading lower grade bonds, and the larger inherent equity component, one would expect the call options on such bonds to be more valuable than call options on investment grade debt.¹⁹ Exploring the issue of upgrades, of the 116 calls in our sample, 42.2 percent came after upgrades, 13.8 percent came after downgrades, and 44.0 percent had no change in rating since issue. For A rated bonds issued in 1977–1986, the percentage of calls after upgrade was 29.4 percent, 38.1 percent came after downgrades, and 32.5 percent had no change.²⁰

Maturity results are given as part of Table IX. The original issue high yield bond market has been primarily long term, and only 2.19 percent of the total value of all issues in the sample had reached maturity by December 31, 1988. For three of the early years, 1978–1980, no bonds have yet matured.

D. Summary Results on Defaults, Exchanges, Calls, and Maturity

Table IX contains summary aged results for defaults, exchanges, calls, and maturities and presents a more detailed picture of this market than previous studies. By December 31, 1988, about one third (32.5 percent) of the high yield bonds issued in years 1977–1982 have defaulted or have been exchanged. Another third (34.7 percent) of the issues have been called and a small percentage (4.5 percent) have matured. Thus, by December 31, 1988, only 28.1 percent of the original issues of 1977–1982 have not defaulted, exchanged, been called or matured.

Results for more recent issue years show fewer defaults and calls. However,

¹⁹ For example, the value of the call option on AA utility bonds has been estimated as 50–70 basis points. For high yield debt, both sensitivity to interest rate changes and the possibility of improving credit quality of the firm may lead to a higher call option spread. Blume and Keim (1987), however, find lower price volatility for high yield debt, perhaps because of shorter duration.

²⁰ A selection process identical to that for high yield bonds (as described in Section II) was performed for all original issue bonds rated A/A by Moody's and S&P in order to serve as a comparison. There were 1224 such bonds issued between 1977 and 1986, representing \$134.46 billion in par value at issue. Complete results on this sample are not presented in this paper.

Table VIII
Cumulative Calls for all High Yield Bonds until
12/31/88 by Year of Issue

High yield bonds are all bonds rated below investment grade at issue date by Moody's and Standard & Poor's.

Issue Year	Number of Issues Called	Amount of Issues Called (\$ Millions)	Cumulative % of Total Issues Called	
			Number	Amount
1977	9	296	34.62	32.60
1978	13	373	25.49	25.87
1979	13	414	31.71	32.78
1980	11	368	29.73	30.09
1981	8	345	33.33	27.82
1982	15	1,174	36.59	47.15
1983	12	790	16.22	13.16
1984	14	1,059	13.73	9.17
1985	16	2,024	11.03	13.99
1986	5	937	2.50	3.03
Total	116	7,780	15.65	10.88

Table IX
Cumulative Disposition of Original Issue High Yield Bonds by
Percentage of Par Amount Issued until 12/31/88 by Year of Issue

In this table an n th year default is defined as a default within $n \times 365$ days of the issue date. High yield bonds are all bonds rated below investment grade at issue date by Moody's and Standard & Poor's. Defaults are defined as a declaration of default by the bond's trustee, filing of bankruptcy by the firm, or assignment of a D rating by S&P for a missed coupon payment.

Issue Year	Total Issued (%)	Defaults %	Exchanges (Still Outstanding)	Calls %	Maturities %	Residual Outstanding ^a %
	(% Millions)		%			
1977	908	33.92	0.00	32.60	9.59	24.12
1978	1,442	34.26	9.02	25.87	0.00	30.86
1979	1,263	24.70	1.11	32.78	0.00	41.41
1980	1,223	27.56	4.09	30.09	0.00	38.27
1981	1,240	20.97	19.35	27.82	2.42	29.44
1982	2,490	25.94	0.40	47.15	10.84	15.66
1983	6,003	19.21	7.58	13.16	5.83	54.22
1984	11,552	9.38	3.94	9.17	4.60	72.91
1985	14,463	3.53	3.25	13.99	0.00	79.23
1986	30,949	8.14	1.07	3.03	0.97	86.68
Total	71,533	10.66	3.01	10.88	2.19	73.27

^a Does not adjust for sinking funds and partial repurchases. If these were included, the residual percentage would be lower.

the aging analysis of defaults in Tables III and AI–AIII demonstrates that cumulative defaults for later issue years are similar to those for bonds from early issue years at comparable ages. Call rates are lower, however, due presumably to call protection and a leveling off of interest rates. Thus, while a much larger

percentage of recent issues remain outstanding without default, there is no evidence suggesting a fundamental change in the nature of the market.

The summary of aging results also underscores the extent to which the outstanding high yield market is dominated by recently issued "young" bonds. This dominance is due not only to the rapid growth in new issue volume but also to the attrition in outstanding issues due to defaults, calls, and principal payments.²¹ This attrition accelerates with issue age, thereby diminishing the outstanding balance of older issues.

E. Other Results

Table X presents data, by S&P rating, on the composition of high yield bond issues and on cumulative defaults.²² One notable result is the shift toward CCC rated issues in later issue years. Prior to 1983, the original issue public high yield corporate bond market was comprised almost exclusively of BB and B rates issues. This reduction in initial credit quality since 1983 raises the question of whether defaults may prove higher in future years. Cumulative default percentages by S&P rating demonstrate that B rated issues exhibit higher default percentages than BB rated issues for seven of the ten issue years. While inferences in early issue years about CCC rated issues are limited by the small issue amounts, their cumulative defaults are higher than BB or B rated issues for four of the last five issue years. For the entire sample, the default percentage is 5.37 percent for BB bonds, 12.44 percent for B bonds, and 11.39 percent for CCC bonds. This lower percentage for CCC bonds is probably explained by their lower average age. The average issue age is 2.45 years for BB bonds, 1.90 years for B bonds, and 1.21 years for CCC bonds.

Stratifying the sample by industry shows that neither issues nor defaults are concentrated in a few industries. This is not surprising given the tremendous growth in the high yield bond market and the fact that economic conditions may differ by sectors of the economy. There are at least twenty-seven industries with over \$1 billion in par value issued. In addition, there are twelve industries with over \$200 million in defaults.²³ These twelve industries are energy, steel, industrial machinery and equipment, miscellaneous manufacturing, toys and sporting goods, ship transportation, utilities, credit companies, mortgage bankers, real estate, motion picture production, and hospitals/healthcare.

Table XI presents underwriter market share and default percentages by issue year for original issue high yield bonds. The dominant underwriter, Drexel Burnham Lambert, increased its new issue market share from under one third during 1977–1980 to 53–63 percent in 1981–1985 before dropping to 45 percent in 1986. Of the total sample of high yield bonds, more than half were underwritten by Drexel. Table XI also presents defaults by underwriter for each issue year.

²¹ Sinking funds and partial repurchases would reduce the amount of older bonds even further.

²² S&P ratings were used except in cases where S&P did not rate the bond. For these bonds, the comparable Moody's rating was used.

²³ This second set of industries are not all contained in the first set. Four of the industries with over \$200 million in defaults have less than \$1 billion in par value issued. They are miscellaneous manufacturing, toys and sporting goods, ship transportation, and hospitals/health care.

Table X

Distribution by Issue Year of Original Issue High Yield Bonds by S&P Rating at Time of Issue and Cumulative Defaults from Issue Date until December 31, 1988 by Issue Year and S&P Rating

High yield bonds are all bonds rated below investment grade at issue date by Moody's and Standard & Poor's. Defaults are defined as a declaration of default by the bond's trustee, filing of bankruptcy by the firm, or assignment of a D rating by S&P for a missed coupon payment.

Issue Year	Total Issued (\$ Millions)	Share of Market by Rating Class as % of Total Issues			Total Market	Cumulative Default %		
		BB	B	CCC or Below		By Rating Class		
						BB	B	CCC or Below
1977	908	42.62	55.95	1.43	33.92	6.46	55.71	0.00
1978	1,442	28.29	70.87	0.83	34.26	35.54	34.15	0.00
1979	1,263	27.95	65.80	6.25	24.70	33.99	21.42	17.72
1980	1,223	26.00	71.95	2.04	27.56	16.67	32.27	0.00
1981	1,240	24.27	75.73	0.00	20.97	0.00	27.69	NA
1982	2,490	44.38	54.02	1.61	25.94	22.62	26.47	100.00
1983	6,003	27.90	63.85	8.25 ^a	19.21	0.00	24.99	39.39 ^a
1984	11,552	29.48	59.34	11.18	9.38	2.94	10.80	18.89
1985	14,463	31.72	54.62	13.67	3.53	4.36	3.92	0.00
1986	30,949	13.24	69.05	17.71	8.14	0.00	9.08	10.57
Total ^b	71,533	23.26	63.58	13.16	10.66	5.37	12.44	11.39

^a One bond issue for \$35 million was rated below CCC. This CC bond issue defaulted during its first year out.

^b This is the total amount and percentages for all years together. It differs from an average yearly percentage with each year weighted equally since later years represent a larger share of all issues.

Issues underwritten by Drexel exhibit lower default percentages than do the aggregate issues of all other underwriters. In every year except for 1985, Drexel has a lower cumulative default percentage on its issues than all other underwriters taken together. If the defaults are further categorized by rating class and year of issue, Drexel has lower or equal default rates in each year for all CCC's and for nine of the ten years for both B's and BB's. These differences may be explained by Drexel's experience and expertise in the high yield market and by other underwriters' attempts to penetrate the market by underwriting less creditworthy issues.

Finally, after 1980, high yield debt increasingly began to be used for funding mergers and leveraged buyouts.²⁴ LBO high yield debt constitutes 24.2 percent, 24.6 percent, and 21.0 percent of the total par value issued in 1984, 1985, and 1986, respectively, and totals \$12.9 billion. This LBO debt is 18.6 percent of the total 1977–1986 sample. Three LBO bonds, totalling \$704 million par value, have defaulted by December 31, 1988. All are associated with one transaction, the 1986 LBO of Revco Drug Stores. This makes the default percentage for all LBO debt

²⁴ The following statistics are only for LBO debt and contain no merger and acquisition debt not related to an LBO.

Table XI

**Share of Original Issue High Yield Bonds Issued and
Cumulative Default Percentages by Underwriter Measured
in Par Value of Issue by Year of Issue with the Entire Issue
Allocated to the Lead Underwriter**

High yield bonds are all bonds rated below investment grade at issue date by Moody's and Standard & Poor's. Defaults are defined as a declaration of default by the bond's trustee, filing of bankruptcy by the firm, or assignment of a D rating by S&P for a missed coupon payment.

Year	Total Issued (\$ Millions)	Share of Market as % of Total Issues ^a		Cumulative Defaults %		
		DBL ^b	Non-DBL ^b	Total Market	DBL Issues ^c	Non-DBL Issues ^c
1977	908	14.98	85.02	33.92	22.06	36.01
1978	1,442	26.35	73.65	34.26	29.74	35.88
1979	1,263	32.30	67.70	24.70	23.53	25.26
1980	1,223	34.18	65.82	27.56	20.33	31.30
1981	1,240	63.23	36.77	20.97	20.41	21.93
1982	2,490	54.42	45.58	25.94	3.32	52.95
1983	6,003	54.02	45.98	19.21	17.21	21.56
1984	11,552	60.10	39.90	9.38	4.68	16.47
1985	14,463	60.87	39.13	3.53	3.92	2.92
1986	30,949	44.90	55.10	8.14	0.79	14.13
Total	71,533	50.84	49.16	10.66	5.13	16.37

^a DBL is Drexel Burnham Lambert.

^b The average issue age (as defined in Table V) is 1.85 years for DBL issues and 2.03 years for non-DBL issues.

^c The cumulative defaults for DBL and non-DBL are the percentages of DBL and non-DBL issues for a given year that default by December 31, 1988. The weighted average (not the sum) of these two percentages gives the total market cumulative default percentage for each year.

5.47 percent, but even fewer implications can be drawn from this subsample given its short history and single defaulting firm.

III. Return Implications

While our results do provide some insight into high yield bond returns, we do not explicitly calculate returns here. The best evidence to date on high yield bond returns is presented in Blume and Keim (1988), and their results are mixed. For the sample period 1977–1987, they find that monthly realized returns on high yield bonds (0.89 percent) exceed returns on both Treasury bonds (0.76 percent) and investment grade bonds (0.78 percent). However, their data source (the S&P Bond Guide) for the first five years of this sample period, 1977–1981, likely includes a significant number of “fallen angels,” bonds issued as investment grade and subsequently downgraded. These bonds might be expected to have different return characteristics than original issue high yield bonds. Furthermore, the prices in the S&P guide are a combination of transaction prices, bid and ask prices, and matrix prices.

For the sample period 1982–1987, Blume and Keim (1988) find that high yield bonds underperform both Treasury bonds and investment grade bonds by a substantial margin. The monthly realized return average is 1.26 percent for high yield bonds, 1.39 percent for Treasuries, and 1.46 percent for investment grade bonds. Their data sources for this sample period are Drexel Burnham Lambert and Salomon Brothers. While this database is not as likely to be dominated by fallen angels and there is no matrix pricing, only bonds included in Drexel's and Salomon Brothers' high yield bond indices are used. This may introduce selection bias since these indices are not composed of randomly selected bonds. Instead, bonds are periodically selected to enter and leave the indices. When bonds are selected to leave the indices, Blume and Keim find substantially negative returns for the following two months.

Thus, Blume and Keim's work illustrates a significant problem—the difficulty in obtaining accurate transactions-based return data on a complete (or random) sample of original issue high yield bonds.

One potential solution to this problem is to use return simulations, but these have other weaknesses. Inputs for simulations include coupon spreads between high yield bonds and a benchmark bond (e.g., Treasury bonds); sequences of defaults, exchanges, calls, sinking funds, and maturities; high yield bond prices (i.e., retention values) at default, exchange, and call; reinvestment prices and strategies for all “mortality” events; and, finally, a hypothetical cash-out terminal value for the portfolio of high yield bonds.

There are problems with most of these inputs. For example, coupon spreads compare callable high yield bonds with Treasury bonds, many of which are noncallable or callable only after a long call protection period. High yield coupons include compensation for the probability that rates decline and/or the bond is upgraded and the issuer calls the bond. The effect is to truncate the upper tail of the callable bond's return distribution, while there is no such truncation for noncallable Treasury bonds. Two possible adjustments are to subtract the call option value from high yield bond coupon rates to produce a coupon comparable to Treasury yields or to compare spreads of high yield bonds to callable corporate bonds.²⁵ However, without some adjustments, simulations based upon stated coupon spreads do not capture the option characteristics of call provisions.

There are also problems with the assumed sequences of mortality events (defaults, exchanges, calls). First, this is still a young market. The realized incidence of defaults, exchanges, calls, and the like represents only one draw from the distribution, and there is little reason to believe that this draw is the mean—the expected result. Also, many of the events are affected by interest rate changes. It is internally inconsistent to use historical incidences produced under one set of interest rate changes in simulations which assume no interest rate volatility.

However, the most serious deficiency in using simulations is the lack of real price data as inputs for reinvestment strategies and for the end-of-period cash-out terminal value of the bond portfolio. For example, Altman (1989) and

²⁵ However, as noted above in Section II.C, the value of call options on high yield bonds may not be the same as their value on investment grade bonds.

Goodman (1989) in their corporate bond return simulations assume that all bonds that do not default (or are not subject to any other mortality event) sell at par. This is a critical assumption which has an important impact on simulated returns. Their justification is that, because interest rates are not assumed to vary, all nondefaulting bonds should sell at par. This assumption is not correct for bonds subject to low early-year and higher later-year default probabilities. Even with no change in interest rates, if the bonds are callable, such bonds should sell below par in their early years. It is these price declines in the early years that constitute the mechanism through which realized returns below stated coupon rates are achieved. In later years, higher default incidences reduce the stated yield.

Were such bonds not to sell below par in the earlier years, a "free money" game would exist. Investors could buy newly issued bonds, pocket most of the high coupons while early-year defaults were low, and then sell the bonds at par before the higher later-year defaults appeared.

Thus, even in the absence of interest rate volatility, the default sequence itself produces bond prices below par. Terminal value assumptions that all nondefaulting bonds sell at par can substantially overstate the simulated return on high yield bonds. Moreover, high yield bond prices are obviously affected not only by the default sequence and interest rate changes but also by changes in the value of the firm.

As an empirical matter, despite generally falling interest rates during the 1980's, our sample bonds were selling at an average price of about 90 percent of par in late 1987 and 1988. A comparable sample of Treasury bonds was priced at 106 in late 1988.²⁶ Lower terminal values for high yield bonds and higher values for Treasuries suggest that simulations based upon the assumption of par values overstate the relative returns on high yield bond.²⁷

Even if transaction returns can be calculated, or if realistic inputs are entered for return simulations, there are still difficulties in deciding how to interpret them. As noted earlier, this market is still new, and historical incidences represent

²⁶ These prices are taken from a sample of 288 high yield bonds that had neither defaulted nor exchanged. Prices are desk prices supplied by First Boston, Drexel Burnham Lambert, Morgan Stanley, and Salomon Brothers. Treasury bond prices are from a sample of thirty Treasury bonds selected to match issue dates and maturities over the period 1977-1986. Treasury bond prices were collected from the *Wall Street Journal*.

²⁷ Our sample data allow us to illustrate a hypothetical simulation. Assume the following: a spread of high yield coupon to Treasuries of 400 basis points, our historical sequence of defaults with retention values at 40 percent of par, calls at an average premium of 104 percent of par, exchanges at a retention value of 70 percent of par, and a terminal cash-out value at 90 percent of par for high yield bonds and 106 percent of par for the Treasury bonds. The spreads and call prices above are both averages from our sample of high yield bonds. The retention values are taken from a sample of ninety-one defaulted and seventeen exchanged bonds with desk prices supplied by First Boston and Drexel Burnham Lambert. The terminal values are as described in footnote 26 above.

The result is a simulated ten-year return advantage of only 115 basis points for high yield bonds over Treasuries. These return spreads may be far below the basis point premium required to offset other types of risk such as systematic risk and the value of the call option. Simulations performed in an analogous manner on our sample of A rated bonds (see footnote 20) produce simulated return spreads to Treasury bonds roughly the same as our simulated high yield return spreads.

not the mean but only one draw from the distribution. As with stock price performance, a full range of economic and capital market conditions will be required to assess accurately high yield performance. In addition, few of the bonds issued to date have entered a period requiring repayment of principal—another reason for caution.

Further, it is not true that, after adjusting for defaults, “return spread results [of corporate bond returns versus Treasury returns] should be insignificantly different from zero.”²⁸ Default risk is only one type of risk. Even after adjusting for defaults, returns on high yield bonds may require a risk premium over Treasury returns. Whether one characterizes this risk premium as a systematic risk premium or as an interest rate risk premium, expected high yield bond returns should include compensation for this market risk as well as for default risk. Blume and Keim (1987) estimate a beta of 0.30 for their sample of high yield bonds over the period 1982–1986. Coupled with a market risk premium of 5–8 percent, this translates to an expected return spread of 150–240 basis points for high yield bonds versus risk-free bonds. High yield realized returns adjusted for default must therefore beat risk-free returns by more than this spread to produce superior risk-adjusted returns.

Finally, a liquidity-related premium may need to be included in high yield expected returns, a point Altman (1989) makes. This factor may be especially important in comparing high yield bonds to Treasury bonds due to the dramatic differences in liquidity in the two markets.

What does all this mean? Not much, we suspect. Simulated returns with hypothetical terminal values and numerous other hypothetical inputs are inferior to realized returns calculated from actual transactions. Furthermore, the best evidence to date, Blume and Keim (1988), reports mixed results on the performance of high yield bonds versus benchmark bonds. What is needed is accurate transactions-based return data over a full range of economic and capital market conditions and a complete (or random) sample of high yield bonds. In our view, the return performance of high yield bonds remains an important topic for future research.

IV. Conclusions

This study incorporates the age of high yield bond issues and reveals default percentages substantially higher than those reported in most previous studies. Buying and holding a portfolio of all bonds issued in 1977 and 1978 produces cumulative defaults exceeding 34 percent by December 31, 1988. Also, by this date, cumulative defaults range from 19 to 27 percent for issue years 1979–1983 and from 3 to 9 percent for issue years 1984–1986.

Cumulative defaults also rise more quickly as the time since issue increases. Cumulative defaults are generally in the 3–6 percent range three years after issue, increase to 18–26 percent seven years after issue (for all but the first of the issue years), and reach 34 percent eleven years after issue.

An aging analysis is necessary to measure clearly the default rates experienced

²⁸ From Altman (1989), Section V, pp. 920–921.

by a buy-and-hold investor. Cumulative defaults calculated without aging compare current defaults with the current size of the overall high yield bond market. However, current defaults actually reflect higher default rates on older bonds, and these defaults appear as a small fraction of the current market (which is dominated by the growth of newly issued bonds).

A significant portion of early high yield issues are also exchanged. However, many of these exchanges are followed by default on the securities received. Exchanges not followed by default are a small fraction of total issues for most issue years, so exchange offers do not eliminate all defaults, although they may reduce or delay them.

Moreover, a large percentage of high yield bonds from early issue years have been called by December 31, 1988. Cumulative calls for the issue years of 1977–1982 range from 26 to 47 percent, reflecting the sharp decline in interest rates beginning in 1982, the expiration of call protection, and possibly an increase in credit quality for some of the bonds in the sample. In contrast, a smaller percentage of post-1982 issues have been called.

Summary data for the early issue years 1977–1982 show that by December 31, 1988 about one third of these issues have defaulted or been exchanged, one third have been called, and only a small percentage have reached maturity. The residual issues, which have not defaulted, been exchanged, been called, or matured, represent only 28 percent, on average, of the original issues of 1977–1982.

As for future defaults, there is no evidence that bonds from later issue years will perform any better than bonds from earlier issue years. Cumulative default percentages for the first several years after issue have been higher for later issue years. Later issue years also contain a higher proportion of lower rated (i.e., CCC) issues. Finally, the defaults reported in this paper result primarily from difficulty in meeting interest payments. Relatively few bonds have been outstanding long enough to incur the added burden of principal repayment. All of these factors suggest that future default rates could be different from those reported here. Other factors that may affect default rates include more experience with high yield bonds by underwriters and investors, and conditions on both the capital market and the economy.

Returns on high yield bonds need to be analyzed as well. In an efficient market, the expected return on high yield bonds should be sufficient to offset the expected default rate and should include premiums for market-related or systematic risk and for the value of the option to call the bond. Analysis of returns should provide insight into whether market participants correctly incorporated these factors, including high default rates, in the pricing of high yield bonds. Only after more return analyses are complete can judgments of the risk/return characteristics of the high yield debt market be made.

Table AI

Aged Defaults for Original Issue High Yield Bonds Grouped by Year of Issue

High yield bonds are all bonds rated below investment grade at issue date by Moody's and Standard & Poor's. Defaults are defined as a declaration of default by the bond's trustee, filing of bankruptcy by the firm, or assignment of a D rating by S&P for a missed coupon payment.

Aged Defaults for All Bonds Issued in 1977 (Total Issued, 26 Bonds, \$908 Million Par Value)						
Years After ^a	Number Defaulted	Amount Defaulted (\$ Millions)	% Number Defaulted	Cumulative % Number Defaulted	% Amount Defaulted	Cumulative % Amount Defaulted
1st Yr	0	0	0.00	0.00	0.00	0.00
2nd Yr	0	0	0.00	0.00	0.00	0.00
3rd Yr	0	0	0.00	0.00	0.00	0.00
4th Yr	0	0	0.00	0.00	0.00	0.00
5th Yr	0	0	0.00	0.00	0.00	0.00
6th Yr	0	0	0.00	0.00	0.00	0.00
7th Yr	0	0	0.00	0.00	0.00	0.00
8th Yr	1	70	3.85	3.85	7.71	7.71
9th Yr	1	33	3.85	7.69	3.63	11.34
10th Yr	3	175	11.54	19.23	19.27	30.62
11th Yr	1	30	3.85	23.08	3.30	33.92
12th Yr ^b	0	0	0.00	23.08	0.00	33.92
Total	6	308	23.08	23.08	33.92	33.92

Aged Defaults for All Bonds Issued in 1978 (Total Issued, 51 Bonds, \$1,442 Million Par Value)						
Years After ^a	Number Defaulted	Amount Defaulted (\$ Millions)	% Number Defaulted	Cumulative % Number Defaulted	% Amount Defaulted	Cumulative % Amount Defaulted
1st Yr	0	0	0.00	0.00	0.00	0.00
2nd Yr	2	120	3.92	3.92	8.32	8.32
3rd Yr	0	0	0.00	3.92	0.00	8.32
4th Yr	1	20	1.96	5.88	1.39	9.71
5th Yr	0	0	0.00	5.88	0.00	9.71
6th Yr	4	114	7.84	13.73	7.91	17.61
7th	3	70	5.88	19.61	4.85	22.47
8th Yr	2	45	3.92	23.53	3.12	25.59
9th Yr	3	80	5.88	29.41	5.55	31.14
10th Yr	1	20	1.96	31.37	1.39	32.52
11th Yr ^b	1	25	1.96	33.33	1.73	34.26
Total	17	494	33.33	33.33	34.26	34.26

Table AI—Continued
 Aged Defaults for All Bonds Issued in 1979
 (Total Issued, 41 Bonds, \$1,263 Million Par Value)

Years After ^a	Number Defaulted	Amount Defaulted (\$ Millions)	% Number Defaulted	Cumulative % Number Defaulted	% Amount Defaulted	Cumulative % Amount Defaulted
1st Yr	0	0	0.00	0.00	0.00	0.00
2nd Yr	0	0	0.00	0.00	0.00	0.00
3rd Yr	4	70	9.76	9.76	5.54	5.54
4th Yr	1	14	2.44	12.20	1.11	6.65
5th Yr	1	30	2.44	14.63	2.38	9.03
6th Yr	2	85	4.88	19.51	6.73	15.76
7th Yr	1	25	2.44	21.95	1.98	17.74
8th Yr	0	0	0.00	21.95	0.00	17.74
9th Yr	2	73	4.88	26.83	5.78	23.52
10th Yr ^b	1	15	2.44	29.27	1.19	24.70
Total	12	312	29.27	29.27	24.70	24.70

Aged Defaults for All Bonds Issued in 1980
 (Total Issued, 37 Bonds, \$1,223 Million Par Value)

Years After ^a	Number Defaulted	Amount Defaulted (\$ Millions)	% Number Defaulted	Cumulative % Number Defaulted	% Amount Defaulted	Cumulative % Amount Defaulted
1st Yr	0	0	0.00	0.00	0.00	0.00
2nd Yr	1	7	2.70	2.70	0.57	0.57
3rd Yr	1	30	2.70	5.41	2.45	3.03
4th Yr	0	0	0.00	5.41	0.00	3.03
5th Yr	0	0	0.00	5.41	0.00	3.03
6th Yr	6	170	16.22	21.62	13.90	16.93
7th Yr	2	77	5.41	27.03	6.30	23.22
8th Yr	1	23	2.70	29.73	1.88	25.10
9th Yr ^b	1	30	2.70	32.43	2.45	27.56
Total	12	337	32.43	32.43	27.56	27.56

Aged Defaults for All Bonds Issued in 1981
 (Total Issued, 24 Bonds, \$1,240 Million Par Value)

Years After ^a	Number Defaulted	Amount Defaulted (\$ Millions)	% Number Defaulted	Cumulative % Number Defaulted	% Amount Defaulted	Cumulative % Amount Defaulted
1st Yr	0	0	0.00	0.00	0.00	0.00
2nd Yr	1	75	4.17	4.17	6.05	6.05
3rd Yr	0	0	0.00	4.17	0.00	6.05
4th Yr	1	100	4.17	8.33	8.06	14.11
5th Yr	2	85	8.33	16.67	6.85	20.97
6th Yr	0	0	0.00	16.67	0.00	20.97
7th Yr	0	0	0.00	16.67	0.00	20.97
8th Yr ^b	0	0	0.00	16.67	0.00	20.97
Total	4	260	16.67	16.67	20.97	20.97

Table AI—Continued
Aged Defaults for All Bonds Issued in 1982
 (Total Issued, 41 Bonds, \$2,490 Million Par Value)

Years After ^a	Number Defaulted	Amount Defaulted (\$ Millions)	% Number Defaulted	Cumulative % Number Defaulted	% Amount Defaulted	Cumulative % Amount Defaulted
1st Yr	1	25	2.44	2.44	1.00	1.00
2nd Yr	1	60	2.44	4.88	2.41	3.41
3rd Yr	1	40	2.44	7.32	1.61	5.02
4th Yr	3	286	7.32	14.63	11.49	16.51
5th Yr	0	0	0.00	14.63	0.00	16.51
6th Yr	5	235	12.20	26.83	9.44	25.94
7th Yr ^b	0	0	0.00	26.83	0.00	25.94
Total	11	646	26.83	26.83	25.94	25.94

Aged Defaults for All Bonds Issued in 1983
 (Total Issued, 74 Bonds, \$6,003 Million Par Value)

Years After ^a	Number Defaulted	Amount Defaulted (\$ Millions)	% Number Defaulted	Cumulative % Number Defaulted	% Amount Defaulted	Cumulative % Amount Defaulted
1st Yr	0	0	0.00	0.00	0.00	0.00
2nd Yr	0	0	0.00	0.00	0.00	0.00
3rd Yr	6	365	8.11	8.11	6.08	6.08
4th Yr	4	470	5.41	13.51	7.83	13.91
5th Yr	5	288	6.76	20.27	4.80	18.71
6th Yr ^b	1	30	1.35	21.62	0.50	19.21
Total	16	1,153	21.62	21.62	19.21	19.21

Aged Defaults for All Bonds Issued in 1984
 (Total Issued, 102 Bonds, \$11,552 Million Par Value)

Years After ^a	Number Defaulted	Amount Defaulted (\$ Millions)	% Number Defaulted	Cumulative % Number Defaulted	% Amount Defaulted	Cumulative % Amount Defaulted
1st Yr	4	265	3.92	3.92	2.29	2.29
2nd Yr	3	230	2.94	6.86	1.99	4.28
3rd Yr	3	235	2.94	9.80	2.03	6.32
4th Yr	5	354	4.90	14.71	3.06	9.38
5th Yr ^b	0	0	0.00	14.71	0.00	9.38
Total	15	1,084	14.71	14.71	9.38	9.38

Table AI—Continued
 Aged Defaults for All Bonds Issued in 1985
 (Total Issued, 145 Bonds, \$14,463 Million Par Value)

Years After ^a	Number Defaulted	Amount Defaulted (\$ Millions)	% Number Defaulted	Cumulative % Number Defaulted	% Amount Defaulted	Cumulative % Amount Defaulted
1st Yr	0	0	0.00	0.00	0.00	0.00
2nd Yr	4	115	2.76	2.76	0.80	0.80
3rd Yr	4	330	2.76	5.52	2.28	3.08
4th Yr ^b	2	65	1.38	6.90	0.45	3.53
Total	10	510	6.90	6.90	3.53	3.53

Aged Defaults for All Bonds Issued in 1986
 (Total Issued, 200 Bonds, \$30,949 Million Par Value)

Years After ^a	Number Defaulted	Amount Defaulted (\$ Millions)	% Number Defaulted	Cumulative % Number Defaulted	% Amount Defaulted	Cumulative % Amount Defaulted
1st Yr	6	845	3.00	3.00	2.73	2.73
2nd Yr	6	1,189	3.00	6.00	3.84	6.57
3rd Yr ^b	5	485	2.50	8.50	1.57	8.14
Total	17	2,519	8.50	8.50	8.14	8.14

^a "Years after" is calculated from the issue day; i.e., a bond issued on June 1, 1977 that defaults in May 1978 defaults during the first year. If the same bond defaulted in July 1978, the default would be during the second year.

^b May be incomplete; i.e., entire sample may not have been outstanding for *x* years.

Table AII
**Aged Default Rates^a for High Yield Bonds by Number of
 Years Since Issue Date**

High yield bonds are all bonds rated below investment grade at issue date by Moody's and Standard & Poor's. Defaults are defined as a declaration of default by the bond's trustee, filing of bankruptcy by the firm, or assignment of a D rating by S&P for a missed coupon payment.

Aged Default Rates				1 Year Out		
Issue Year	Number Defaulted	Amount Defaulted (\$ Millions)	Total Issued	Issue Amount (\$ Millions)	% Defaulted	
					Number	Amount
1977	0	0	26	908	0.00	0.00
1978	0	0	51	1,442	0.00	0.00
1979	0	0	41	1,263	0.00	0.00
1980	0	0	37	1,223	0.00	0.00
1981	0	0	24	1,240	0.00	0.00
1982	1	25	41	2,490	2.44	1.00
1983	0	0	74	6,003	0.00	0.00
1984	4	265	102	11,552	3.92	2.29
1985	0	0	145	14,463	0.00	0.00
1986	6	845	200	30,949	3.00	2.73
Total ^b	11	1,135	741	71,533		
Average Aged Default Rate ^c					1.48	1.59

Table AII—Continued

Aged Default Rates				2 Years Out		
Issue Year	Number Defaulted	Amount Defaulted	Total Issued	Issue Amount (\$ Millions)	% Defaulted	
		(\$ Millions)			Number	Amount
1977	0	0	26	908	0.00	0.00
1978	2	120	51	1,442	3.92	8.32
1979	0	0	41	1,263	0.00	0.00
1980	1	7	37	1,223	2.70	0.57
1981	1	75	24	1,240	4.17	6.05
1982	1	60	41	2,490	2.44	2.41
1983	0	0	74	6,003	0.00	0.00
1984	3	230	102	11,552	2.94	1.99
1985	4	115	145	14,463	2.76	0.80
1986	6	1,189	200	30,949	3.00	3.84
Total ^b	18	1,796	741	71,533		
Average Aged Default Rate ^c					2.43	2.51

Aged Default Rates				3 Years Out		
Issue Year	Number Defaulted	Amount Defaulted	Total Issued	Issue Amount (\$ Millions)	% Defaulted	
		(\$ Millions)			Number	Amount
1977	0	0	26	908	0.00	0.00
1978	0	0	51	1,442	0.00	0.00
1979	4	70	41	1,263	9.76	5.54
1980	1	30	37	1,223	2.70	2.45
1981	0	0	24	1,240	0.00	0.00
1982	1	40	41	2,490	2.44	1.61
1983	6	365	74	6,003	8.11	6.08
1984	3	235	102	11,552	2.94	2.03
1985	4	330	145	14,463	2.76	2.28
Total ^b	19	1,070	541	40,584		
Average Aged Default Rate ^c					3.51	2.64

Aged Default Rates				4 Years Out		
Issue Year	Number Defaulted	Amount Defaulted	Total Issued	Issued Amount (\$ Millions)	% Defaulted	
		(\$ Millions)			Number	Amount
1977	0	0	26	908	0.00	0.00
1978	1	20	51	1,442	1.96	1.39
1979	1	14	41	1,263	2.44	1.11
1980	0	0	37	1,223	0.00	0.00
1981	1	100	24	1,240	4.17	8.06
1982	3	286	41	2,490	7.32	11.49
1983	4	470	74	6,003	5.41	7.83
1984	5	354	102	11,552	4.90	3.06
Total ^b	15	1,244	396	26,121		
Average Aged Default Rate ^c					3.79	4.76

Table AII—*Continued*

Aged Default Rates				5 Years Out		
Issue Year	Number Defaulted	Amount Defaulted (\$ Millions)	Total Issued	Issue Amount (\$ Millions)	% Defaulted	
					Number	Amount
1977	0	0	26	908	0.00	0.00
1978	0	0	51	1,442	0.00	0.00
1979	1	30	41	1,263	2.44	2.38
1980	0	0	37	1,223	0.00	0.00
1981	2	85	24	1,240	8.33	6.85
1982	0	0	41	2,490	0.00	0.00
1983	5	288	74	6,003	6.76	4.80
Total ^b	8	403	294	14,569		
Average Aged Default Rate ^c					2.72	2.77

Aged Default Rates				6 Years Out		
Issue Year	Number Defaulted	Amount Defaulted (\$ Millions)	Total Issued	Issue Amount (\$ Millions)	% Defaulted	
					Number	Amount
1977	0	0	26	908	0.00	0.00
1978	4	114	51	1,442	7.84	7.91
1979	2	85	41	1,263	4.88	6.73
1980	6	170	37	1,223	16.22	13.90
1981	0	0	24	1,240	0.00	0.00
1982	5	235	41	2,490	12.20	9.44
Total ^b	17	604	220	8,566		
Average Aged Default Rate ^c					7.73	7.05

Aged Default Rates				7 Years Out		
Issue Year	Number Defaulted	Amount Defaulted (\$ Millions)	Total Issued	Issue Amount (\$ Millions)	% Defaulted	
					Number	Amount
1977	0	0	26	908	0.00	0.00
1978	3	70	51	1,442	5.88	4.85
1979	1	25	41	1,263	2.44	1.98
1980	2	77	37	1,223	5.41	6.30
1981	0	0	24	1,240	0.00	0.00
Total ^b	6	172	179	6,076		
Average Aged Default Rate ^c					3.35	2.83

Aged Default Rates				8 Years Out		
Issue Year	Number Default	Amount Defaulted (\$ Millions)	Total Issued	Issued Amount (\$ Millions)	% Defaulted	
					Number	Amount
1977	1	70	26	908	3.85	7.71
1978	2	45	51	1,442	3.92	3.12
1979	0	23	41	1,263	0.00	0.00
1980	1	0	37	1,223	2.70	1.88
Total ^b	4	138	155	4,836		
Average Aged Default Rate ^c					2.58	2.85

Table AII—Continued

Aged Default Rates				9 Years Out		
Issue Year	Number Default	Amount Defaulted (\$ Millions)	Total Issued	Issued Amount (\$ Millions)	% Defaulted	
					Number	Amount
1977	1	33	26	908	3.85	3.63
1978	3	80	51	1,442	5.88	5.55
1979	2	73	41	1,263	4.88	5.78
Total ^b	6	186	118	3,613		
Average Aged Default Rate ^c					5.08	5.15

Aged Default Rates				10 Years Out		
Issue Year	Number Default	Amount Defaulted (\$ Millions)	Total Issued	Issued Amount (\$ Millions)	% Defaulted	
					Number	Amount
1977	3	175	26	908	11.54	19.27
1978	1	20	51	1,442	1.96	1.39
Total ^b	4	195	77	2,350		
Average Aged Default Rate ^c					5.19	8.30

Aged Default Rates				11 Years Out		
Issue Year	Number Default	Amount Defaulted (\$ Millions)	Total Issued	Issued Amount (\$ Millions)	% Defaulted	
					Number	Amount
1977	1	30	26	908	3.85	3.30
Total ^b	1	30	26	908		
Average Aged Default Rate ^c					3.85	3.30

^a Aged default rates are defined as the number (or \$ amount) of bonds issued in a particular calendar year that default within x years after the issue date, e.g., 1977's Aged Default Rate for 2 years out is the number (or \$ amount) of bonds issued in 1977 that default between one year and two years after the issue day.

^b The totals will not equal the totals in Table III because only complete years (as of December 31, 1988) are used in calculating averages. For example, there have not been three complete years of history for all bonds issued in 1986, so the default rates for three years do not include 1986.

^c The average aged default rate is defined as the number (or \$ amount) of bonds that default in the n th year after issue date for all issue years. It is value weighted and is not the average of n th year rates for individual issue years.

Table AIII

Average Aged Default Rates for High Yield Bonds by Number of Years Since Issue Date

High yield bonds are all bonds rated below investment grade at issue date by Moody's and Standard & Poor's. Defaults are defined as a declaration of default by the bond's trustee, filing of bankruptcy by the firm, or assignment of a D rating by S&P for a missed coupon payment.

Years after	N ^a	Number of Issues	Amount of Issues (\$ Millions)	Yearly %	
				Number	Amount
1st Yr	10	11	1,135	1.48	1.59
2nd Yr	10	18	1,796	2.43	2.51
3rd Yr	9	19	1,070	3.51	2.64
4th Yr	8	15	1,244	3.79	4.76
5th Yr	7	8	403	2.72	2.77
6th Yr	6	17	604	7.73	7.05
7th Yr	5	6	172	3.35	2.83
8th Yr	4	4	138	2.58	2.85
9th Yr	3	6	186	5.08	5.15
10th Yr	2	4	195	5.19	8.30
11th Yr	1	1	30	3.85	3.30

^a Number of issue years in the sample which have a complete n th year after n th issue year; i.e., all issue years since 1977 have complete 1st years, but only one (1977) has a complete 11th year.

REFERENCES

- Altman, Edward I., 1987, The anatomy of the high-yield bond market, *Financial Analysts Journal* 43, July–August, 12–25.
- , 1989, Measuring corporate bond mortality and performance, *Journal of Finance* 44, 909–922.
- and Scott A. Nammacher, 1985, The default rate experience on high-yield corporate debt, *Financial Analysts Journal* 41, July–August, 25–41.
- and Scott A. Nammacher, 1987, *Investing in Junk Bonds* (John Wiley & Sons, Inc., New York).
- Bianco, Anthony, 1986, Junk bonds are starting to live up to their names, *Business Week* February 17, 64–65.
- Blume, Marshall E. and Donald B. Keim, 1987, Lower-grade bonds: Their risks and returns, *Financial Analysts Journal* 43, July–August, 26–33.
- and Donald B. Keim, 1988, Volatility patterns of fixed income securities (Wharton School working paper).
- Drexel Burnham Lambert, 1989, *1989 High Yield Market Report*.
- Fridson, Martin S., Fritz Wahl, and Steven B. Jones, 1988a, *The Anatomy of the High Yield Debt Market* (Morgan Stanley Credit Research).
- , Fritz Wahl, and Steven B. Jones, 1988b, New techniques for analyzing default risk, in: *High Performance* (Morgan Stanley Credit Research).
- Goodman, Laurie S., 1989, High yield default rates: Is there cause for concern? (Goldman, Sachs & Co., Fixed Income Research).
- Hallett, Douglas, 1987, Life insurance industry needs, *The Wall Street Journal* 29, July, 14.
- Jensen, Michael C., 1989, Active investors, LBO's and the privatization of bankruptcy (Harvard Business School working paper).
- Weinstein, Mark I., 1987, A curmudgeon's view of junk bonds, *Journal of Portfolio Management* Spring, 76–80.