

BONDS AND BOND VALUATION

QUESTIONS:

- What's the **VALUE OF THE DEBT**?

Need this to determine the value of the equity!

- What's the **COST OF DEBT**?

Need this and the **debt value** for the WACC

$$WACC = r_e(L) \frac{E}{E + D} + r_d(1 - t_c) \frac{D}{E + D}$$

- Note that r_d is the *expected cost* of debt = the *expected return* \neq *promised return*

Of course we could calculate the WACC in some other way.

For example, when $T = 0$:

$$r(U) = WACC = \frac{r_e(L) + rf_{debt} \frac{D}{E} (1 - t_c)}{1 + \frac{D}{E}}$$

SOME PRELIMINARIES

BOND BETAS

- Can be *computed* from return data (see Chapter 11 of book for example for Boeing)
- There is no commercial source for bond betas (as far as we know?—see Arthur Warga's web site and see article in *Financial Management*, Spring 1996)
- Can be *imputed* from the SML for debt, if we know the *expected return*

IMPUTING A BOND BETA

Debt SML (reminder):

$$E(r_d) = rf_{debt} + \beta_d [E(r_m) - rf_{debt}(1 - t_c)]$$

where

$E(r_d)$ = expected return on debt security

rf_{debt} = return on riskless debt

$E(r_m)$ = return on equity market portfolio

t_c = marginal corporate tax rate

$$\beta_d = \frac{Cov(\tilde{r}_m, \tilde{r}_d)}{Var(\tilde{r}_m)} = \text{debt beta wrt equity market portfolio}$$

If we know expected return on debt we can calculate the debt β

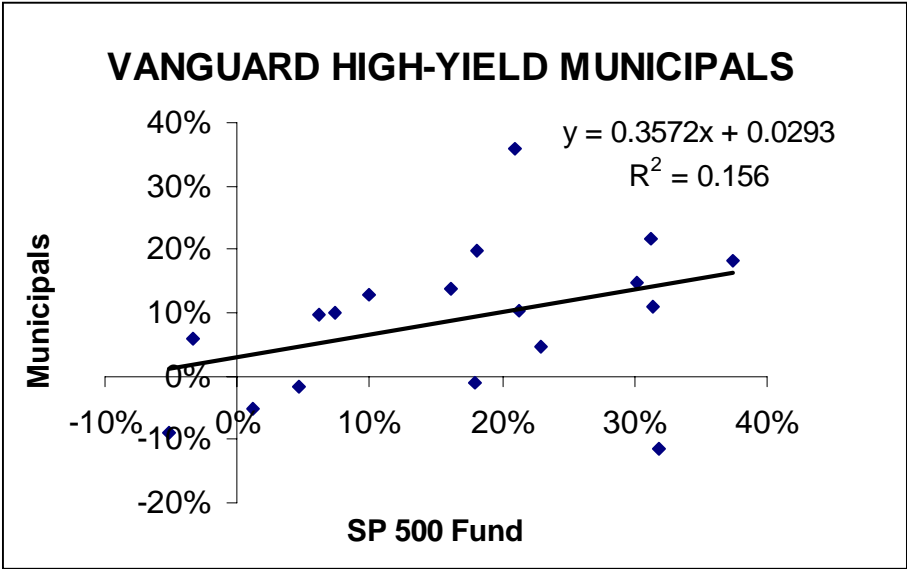
	A	B	C	D	E	F
3	market risk premium	8.40%	<-- Brealey and Myers			
4	risk-free rate	6.69%	<-- AAA bond rate, 10 year corporates			
5	corporate tax rate, t_c	36%				
6	slope of SML	10.81%	<-- market risk premium + t_c *risk-free			
7						
8	expected bond return	8.00%				
9						
10	implied beta	0.1212	<-- (B8-B4)/B6			

BETAS FOR SELECTED VANGUARD FUNDS

Note: The source is Vanguard's Web site--<http://majestic1.vanguard.com>

This is **not** meant to be a scientific study!

Year Ended	Vanguard Index 500 Portfolio	Lehman Bond Index Portfolio	Municipal Bond Limited-Term	High Yield Corporate	Long-Term U.S. Treasury	Short-Term Federal	High-Yield Municipals	GNMA	Lehman 3-year Municipal Bond Index
December 31	Portfolio	VBIF	VMBF	VFISF	VUSTX	VSGBX	VWAHX	VFIIIX	
1996	22.9%	3.6%	4.1%	9.5%	-1.3%	4.8%	4.50%	5.2%	4.4%
1995	37.4%	18.2%	8.6%	19.2%	30.1%	12.3%	18.10%	17.0%	8.9%
1994	1.2%	-2.7%	0.1%	-1.7%	-7.0%	-0.9%	-5.10%	-1.0%	0.7%
1993	9.9%	9.7%	6.3%	18.2%	16.8%	7.0%	12.70%	5.9%	6.2%
1992	7.4%	7.1%	6.4%	14.2%	7.4%	6.2%	9.90%	6.8%	6.4%
1991	30.2%	15.2%	9.5%	29.0%	17.4%	12.2%	14.70%	16.8%	10.3%
1990	-3.3%	8.6%	7.0%	-5.8%	5.8%	9.3%	5.90%	10.3%	7.2%
1989	31.4%	13.6%	8.1%	1.9%	17.9%	11.3%	11.10%	14.8%	7.7%
1988	16.2%	7.4%	6.4%	13.6%	9.2%	5.7%	13.80%	8.8%	4.6%
1987	4.7%	1.1%		2.7%	-2.9%		-1.60%	2.1%	
1986	18.1%			16.9%			19.70%	11.7%	
1985	31.2%			22.0%			21.70%	20.7%	
1984	6.2%			7.9%			9.70%	14.0%	
1983	21.3%			15.1%			10.40%	9.7%	
1982	21.0%			27.5%			35.90%	31.6%	
1981	-5.2%			9.4%			-8.80%	4.8%	
1980	31.9%			3.4%			-11.40%		
1979	18.0%			5.5%			-1.20%		
1978	5.9%								
1977	-7.8%								
beta wrt SP		0.3374	0.1129	0.3587	0.5843	0.1908	0.3572	0.3590	0.1137



CALCULATING THE EXPECTED RETURN OF A **ONE YEAR** BOND—A SIMPLE EXAMPLE

F = face value of the bond

P = price of bond

C = annual coupon rate of the bond

π = probability that the bond will **not** default
at end of year

λ = fraction of bond's value bondholders collect
upon default

- The *expected end-of-year cash flow* is:

$$E(CF) = \pi \cdot (1 + C) \cdot F + (1 - \pi) \cdot \lambda \cdot F$$

- The *expected return from the bond* (i.e., the cost of debt):

$$E(r_d) = \frac{E(CF)}{P} - 1 = \frac{\pi \cdot (1 + C) \cdot F + (1 - \pi) \cdot \lambda \cdot F}{P} - 1$$

SIMPLE SPREADSHEET EXAMPLE

	A	B	C	D	E
1	EXPECTED RETURN ON A ONE-YEAR BOND				
2	with an adjustment for default probability				
3	Assumes that face value equals 1				
4					
5	coupon rate	16%			
6	market price	0.98			
7	π	90%	<-- Non-default probability		
8	λ	80%	<-- Recovery percentage		
9					
10	Expected CF	112.400%	<-- $=B7*(1+B5)+(1-B7)*B8$		
11	Expected return	14.694%	<-- $=(B7*(1+B5-B8)+B8)/B6-1$		

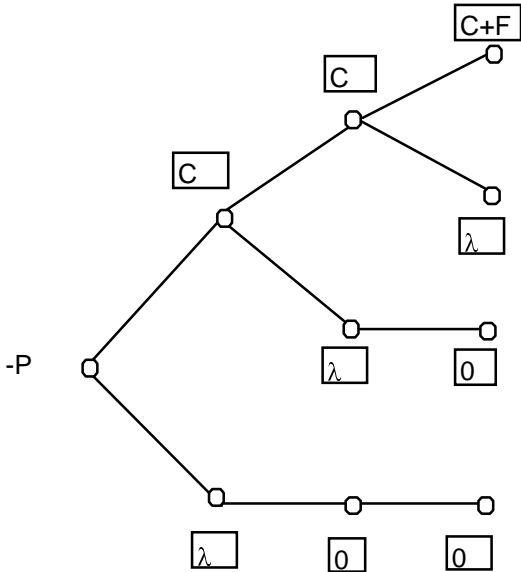
CALCULATING RISK ADJUSTED EXPECTED BOND RETURNS

A MORE GENERAL MODEL

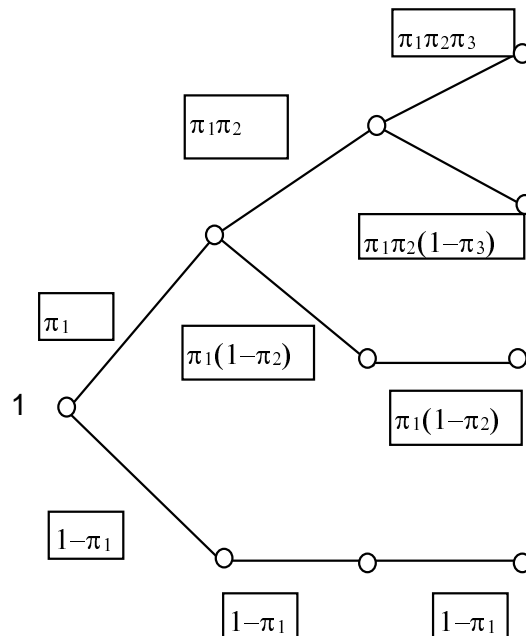
Start with a 3 period bond which has the following characteristics:

- C is the bond coupon rate
- P is the bond price
- F is the bond's face value
- π_n is the probability of non-default in period n , conditional on non-default in periods 1, ..., $n-1$.
- λ_n is the recovery ratio in period n

The associated payoffs are given by the following tree:



The probabilities on the payoff tree look like:

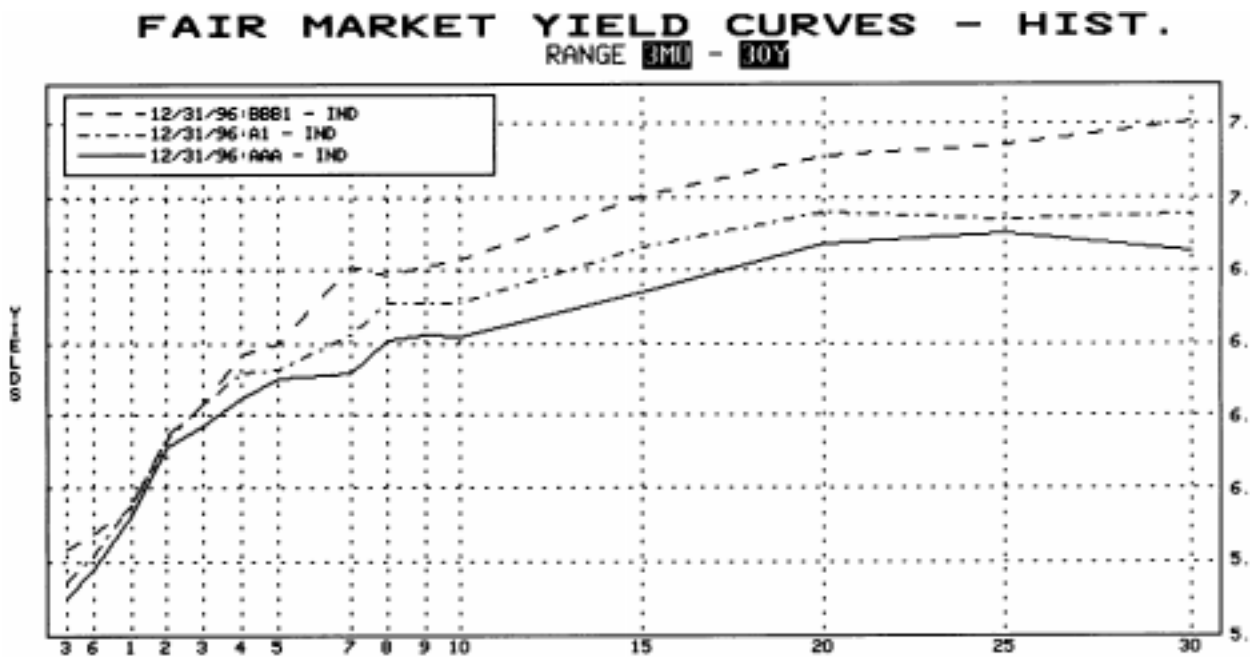
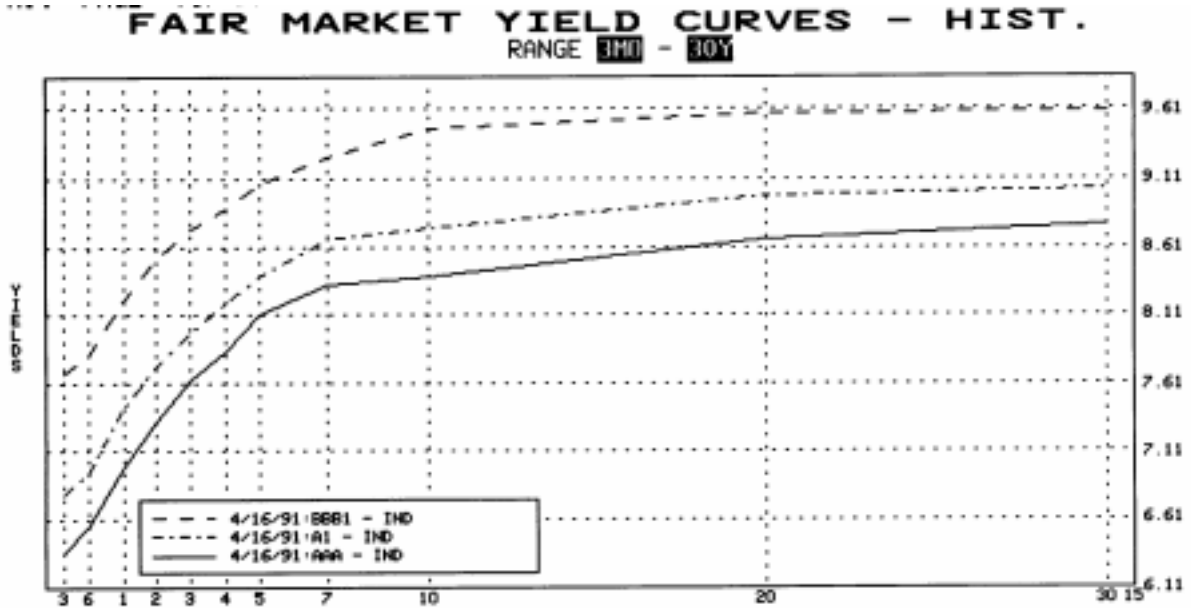


At every node the upper branch is the non-default probability.

Multiplying these two trees node by node gives the expected bond payoffs. Taking the IRR gives the expected return on the bond.

Formal model comes later.

Note that it's possible that the expected return on the yield curves below are all equal to the AAA rate (this could happen with *risk neutrality*):



Long-Term Senior Debt Rating Symbols

Investment-Grade Ratings			Speculative-Grade Ratings		
S&P and others	Moody's	Interpretation	S&P and others	Moody's	Interpretation
AAA	Aaa	Highest Quality	BB+ BB BB-	Ba1 Ba2 Ba3	Likely to fulfill obligations; ongoing uncertainty
AA+ AA AA-	Aa1 Aa2 AA3	High Quality	B+ B B-	B1 B2 B3	High-risk obligations
A+ A A-	A1 A2 A3	Strong Payment Capacity	CCC+ CCC CCC-	Caa	Current vulnerability to default or in default (Moody's)
BBB+ BBB BBB-	Baa1 Baa2 Baa3	Adequate Payment Capacity	C D	Ca D	In bankruptcy or default, or other marked shortcomings

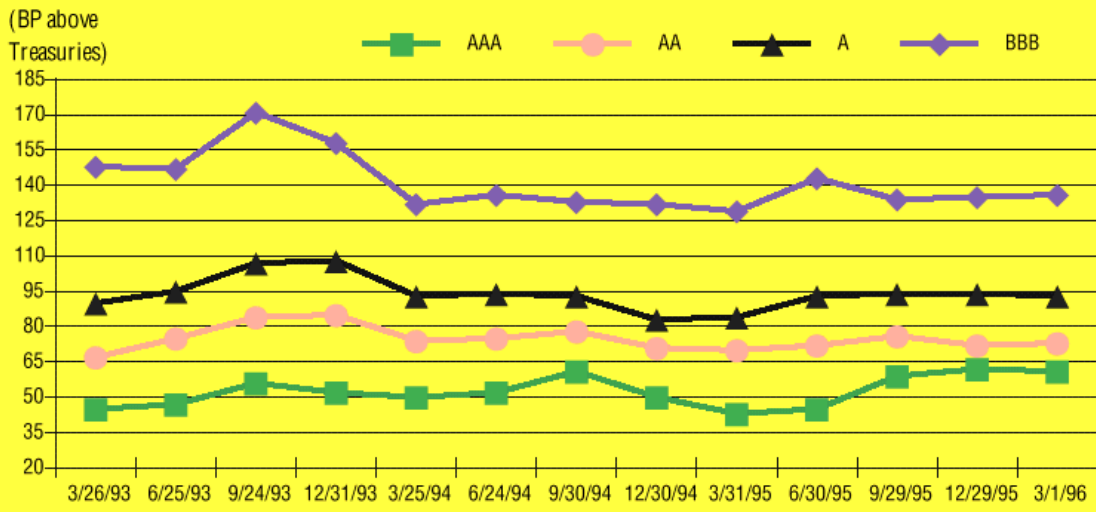
Spreads between Corporate Bonds and U.S. Treasuries 1973-1987 Averages

Rating	Basis Points
AAA	43
AA	73
A	99
BBB	166
BB	299
B	404
CCC	724

Note: Based on equally weighted averages of monthly spreads per rating category. Spreads for BB and B represent data for 1979-1987 only; spreads for CCC, data for 1982-1987 only.

Source: Altman, *Journal of Finance*, 1989

U.S. INDUSTRIAL OPTION-ADJUSTED SPREADS (BY RATING CATEGORY)



Nine+ years maturity and minimum \$100 million outstanding. Source: Standard & Poor's BondComp.

RATING CLASSIFICATION OF NEW ISSUERS

	1981		1982		1983		1984	
	No.	%	No.	%	No.	%	No.	%
AAA	5	6.49	14	13.08	13	7.47	4	2.9
AA	9	11.69	14	13.08	28	16.09	17	12.32
A	20	25.97	30	28.04	36	20.69	27	19.57
BBB	9	11.69	15	14.02	30	17.24	17	12.32
BB	14	18.18	16	14.95	26	14.94	31	22.46
B	19	24.68	17	15.89	35	20.11	39	28.26
CCC	1	1.3	1	0.93	6	3.45	3	2.17
Investment Grade	43	55.84	73	68.22	107	61.49	65	47.1
Speculative Grade	34	44.16	34	31.78	67	38.51	73	52.9

	1985		1986		1987		1988	
	No.	%	No.	%	No.	%	No.	%
AAA	25	7.1	24	7.45	18	5.81	17	6.51
AA	60	17.05	17	5.28	32	10.32	38	14.56
A	81	23.01	45	13.98	40	12.9	50	19.16
BBB	49	13.92	31	9.63	35	11.29	40	15.33
BB	58	16.48	54	16.77	63	20.32	33	12.64
B	76	21.59	136	42.24	112	36.13	77	29.5
CCC	3	0.85	15	4.66	10	3.23	6	2.3
Investment Grade	215	61.08	117	36.34	125	40.32	145	55.56
Speculative Grade	137	38.92	205	63.66	185	59.68	116	44.44

	1989		1990		1991		1992	
	No.	%	No.	%	No.	%	No.	%
AAA	5	2.49	13	9.03	11	5.67	9	3.06
AA	38	18.91	34	23.61	44	22.68	32	10.88
A	39	19.4	44	30.56	68	35.05	59	20.07
BBB	20	9.95	18	12.5	27	13.92	55	18.71
BB	36	17.91	17	11.81	27	13.92	67	22.79
B	60	29.85	10	6.94	8	4.12	67	22.79
CCC	3	1.49	8	5.56	9	4.64	5	1.7
Investment Grade	102	50.75	109	75.69	150	77.32	155	52.72
Speculative Grade	99	49.25	35	24.31	44	22.68	139	47.28

	1993		1994		1995		1996	
	No.	%	No.	%	No.	%	No.	%
AAA	7	1.3	11	2.16	8	2.1	10	2.1
AA	36	6.7	43	8.43	27	7.09	23	4.82
A	104	19.37	167	32.75	71	18.64	80	16.77
BBB	106	19.74	85	16.67	79	20.73	97	20.34
BB	125	23.28	85	16.67	81	21.26	129	27.04
B	155	28.86	114	22.35	111	29.13	137	28.72
CCC	4	0.74	5	0.98	4	1.05	1	0.21
Investment Grade	253	47.11	306	60	185	48.56	210	44.03
Speculative Grade	284	52.89	204	40	196	51.44	267	55.97

ONE-YEAR TRANSITION MATRICES

Source: Standard & Poor's, February 1997

1981 Static Pool		Rating at year end (%)								
Initial Rating	Issuers	AAA	AA	A	BBB	BB	B	CCC	D	NR
AAA	85	89.41	10.59	0	0	0	0	0	0	0
AA	204	1.96	88.24	9.31	0	0	0	0	0	0.49
A	485	0	4.54	88.04	6.39	0.21	0	0	0	0.82
BBB	276	0	0	3.99	89.13	4.71	0	0	0	2.17
BB	229	0	0	0.87	5.24	59.39	30.57	0.44	0	3.49
B	86	0	0	1.16	0	4.65	82.56	3.49	2.33	5.81
CCC	13	0	0	0	0	0	7.69	84.62	0	7.69

1982 Static Pool		Rating at year end (%)								
Initial Rating	Issuers	AAA	AA	A	BBB	BB	B	CCC	D	NR
AAA	85	92.94	4.71	2.35	0	0	0	0	0	0
AA	220	0.45	90	5.91	0.45	0.45	0	0	0	2.73
A	480	0	4.38	83.33	9.38	0.63	0	0	0.42	1.88
BBB	298	0.34	0.34	3.02	79.53	9.06	0.34	0	0.34	7.05
BB	168	0	0.6	0	2.38	73.21	8.93	0	4.17	10.71
B	161	0	0	0.62	0.62	2.48	75.16	4.35	3.11	13.66
CCC	16	0	0	0	0	0	6.25	62.5	18.75	12.5

1983 Static Pool		Rating at year end (%)								
Initial Rating	Issuers	AAA	AA	A	BBB	BB	B	CCC	D	NR
AAA	95	76.84	20	1.05	0	0	0	0	0	2.11
AA	239	0.42	91.21	5.86	0.84	0	0	0	0	1.67
A	455	0.66	4.4	87.47	3.96	0.66	0	0	0	2.86
BBB	303	0	0.66	6.27	80.53	4.95	0.99	0	0.33	6.27
BB	174	0	0.57	1.15	2.87	72.99	11.49	0	1.15	9.77
B	155	0	0	0	0.65	3.23	78.71	0.65	4.52	12.26
CCC	18	0	0	0	5.56	0	16.67	77.78	0	0

1984 Static Pool		Rating at year end (%)								
Initial Rating	Issuers	AAA	AA	A	BBB	BB	B	CCC	D	NR
AAA	90	71.11	25.56	1.11	0	0	0	0	0	2.22
AA	288	1.39	93.06	3.82	1.04	0	0	0	0	0.69
A	470	0	2.34	91.28	3.62	0.43	0.21	0	0	2.13
BBB	301	0	0.33	10.3	77.41	5.98	1.99	0	0.66	3.32
BB	176	0	0	1.14	7.95	80.68	5.11	0	0.57	4.55
B	183	0	0	0	1.09	4.92	84.7	0.55	3.83	4.92
CCC	21	0	0	0	0	0	0	80.95	14.29	4.76

1985 Static Pool		Rating at year end (%)								
Initial Rating	Issuers	AAA	AA	A	BBB	BB	B	CCC	D	NR
AAA	72	93.06	4.17	0	0	0	0	0	0	2.78
AA	320	0.31	84.69	9.06	2.19	0	1.25	0.31	0	2.19
A	501	0.2	2	87.03	6.99	1.2	0	0	0	2.59
BBB	286	0	0.7	8.39	76.57	6.64	4.2	0	0	3.5
BB	202	0	0	0.99	4.46	74.75	10.4	1.49	1.49	6.44
B	210	0	0	0.95	0	2.38	83.33	0.48	6.19	6.67
CCC	21	0	0	0	0	0	33.33	57.14	9.52	0

1986 Static Pool		Rating at year end (%)								
Initial Rating	Issuers	AAA	AA	A	BBB	BB	B	CCC	D	NR
AAA	94	90.43	6.38	0	0	0	0	0	0	3.19
AA	346	1.16	88.15	5.2	0.87	0	0.58	0	0	4.05
A	574	0.17	5.57	75.61	8.54	1.39	1.57	0	0.17	6.97
BBB	319	0	0	6.27	74.92	8.15	2.82	0.31	0.31	7.21
BB	239	0	0	0.42	7.11	73.22	6.28	1.67	1.26	10.04
B	295	0	0	0	0.34	4.07	66.78	10.51	8.14	10.17
CCC	20	0	0	0	0	0	0	70	20	10

1987 Static Pool		Rating at year end (%)								
Initial Rating	Issuers	AAA	AA	A	BBB	BB	B	CCC	D	NR
AAA	114	88.6	6.14	0	0.88	0	0	0	0	4.39
AA	360	1.39	86.39	5.56	0.56	0	0	0	0	6.11
A	518	0	1.54	83.59	5.21	0.39	1.16	0	0	8.11
BBB	340	0	0.59	5	78.24	5.88	2.65	0	0	7.65
BB	275	0.36	0	0	6.91	69.45	8	0	0	15.27
B	368	0	0	0.82	0	5.16	73.91	2.45	3.26	14.4
CCC	65	0	0	0	1.54	1.54	7.69	60	7.69	21.54

1988 Static Pool		Rating at year end (%)								
Initial Rating	Issuers	AAA	AA	A	BBB	BB	B	CCC	D	NR
AAA	125	88	4	2.4	0	1.6	0	0	0	4
AA	360	1.67	82.78	10.28	1.94	0.56	0.28	0	0	2.5
A	513	0	1.36	87.72	4.87	0.97	0.58	0	0	4.48
BBB	351	0	0.57	9.12	74.36	4.56	2.28	0.57	0	8.55
BB	296	0	0	1.01	7.09	71.28	7.43	2.03	1.01	10.14
B	426	0	0.23	0	0.47	4.46	72.54	3.05	3.76	15.49
CCC	58	0	0	0	3.45	3.45	8.62	48.28	22.41	13.79

1989 Static Pool		Rating at year end (%)								
Initial Rating	Issuers	AAA	AA	A	BBB	BB	B	CCC	D	NR
AAA	133	88.72	8.27	0.75	0	0	0	0	0	2.26
AA	351	0.85	88.6	7.41	0	0	0	0	0	3.13
A	575	0	1.39	85.57	6.09	2.43	0.35	0	0.17	4
BBB	358	0	0	7.54	77.09	5.03	1.12	0.84	0.56	7.82
BB	290	0	0	1.03	11.72	66.21	6.55	0.69	1.03	12.76
B	425	0	0.24	0	0	7.06	68.94	4.47	3.29	16
CCC	55	0	0	1.82	0	1.82	0	43.64	25.45	27.27

1990 Static Pool		Rating at year end (%)								
Initial Rating	Issuers	AAA	AA	A	BBB	BB	B	CCC	D	NR
AAA	126	96.03	3.17	0	0	0	0	0	0	0.79
AA	369	0.54	85.64	12.47	0	0	0	0	0	1.36
A	589	0	2.04	84.89	7.3	1.7	0.17	0	0	3.9
BBB	365	0	0	3.84	84.66	4.93	1.1	0	0.27	5.21
BB	291	0	0	0.69	5.5	65.64	9.28	3.44	3.09	12.37
B	378	0	0.53	0	0.53	2.91	65.87	5.56	8.2	16.4
CCC	51	1.96	0	0	0	1.96	3.92	56.86	29.41	5.88

1991 Static Pool		Rating at year end (%)									
Initial Rating	Issuers	AAA	AA	A	BBB	BB	B	CCC	D	NR	
AAA	137	90.51	8.76	0.73	0	0	0	0	0	0	
AA	368	0	90.22	7.34	0	0	0	0	0	2.45	
A	606	0.17	0.83	90.43	6.44	0.17	0	0	0	1.98	
BBB	388	0	1.03	4.38	83.51	6.19	0.77	0	0.26	3.87	
BB	248	0	0	0	8.06	72.58	8.47	1.61	2.42	6.85	
B	293	0	0	0	0	5.12	68.26	3.75	12.97	9.9	
CCC	68	0	0	0	1.47	4.41	5.88	45.59	30.88	11.76	

1992 Static Pool		Rating at year end (%)									
Initial Rating	Issuers	AAA	AA	A	BBB	BB	B	CCC	D	NR	
AAA	136	88.24	8.82	0	0	0	0	0	0	2.94	
AA	397	0.5	89.42	7.3	0.76	0	0	0	0	2.02	
A	661	0	0.91	91.83	3.18	0.91	0	0	0	3.18	
BBB	411	0	0	5.11	85.4	3.89	0.73	0.24	0	4.62	
BB	250	0	0.4	0.4	10.8	73.6	4	2.4	0	8.4	
B	236	0	0	0.42	1.27	10.59	63.98	5.08	7.63	11.02	
CCC	55	0	0	0	0	3.64	12.73	47.27	29.09	7.27	

1993 Static Pool		Rating at year end (%)									
Initial Rating	Issuers	AAA	AA	A	BBB	BB	B	CCC	D	NR	
AAA	131	90.84	3.82	1.53	0	0	0	0	0	3.82	
AA	406	0	90.39	6.16	0.25	0	0	0	0	3.2	
A	718	0.28	0.84	90.53	3.48	0	0	0	0	4.87	
BBB	460	0	0	3.48	82.83	5.43	0	0	0	8.26	
BB	300	0	0.67	0.33	7.67	71.67	6.33	0.33	0.33	12.67	
B	238	0	0	0	1.26	13.87	65.13	1.68	2.1	15.97	
CCC	50	0	0	0	0	2	32	30	12	24	

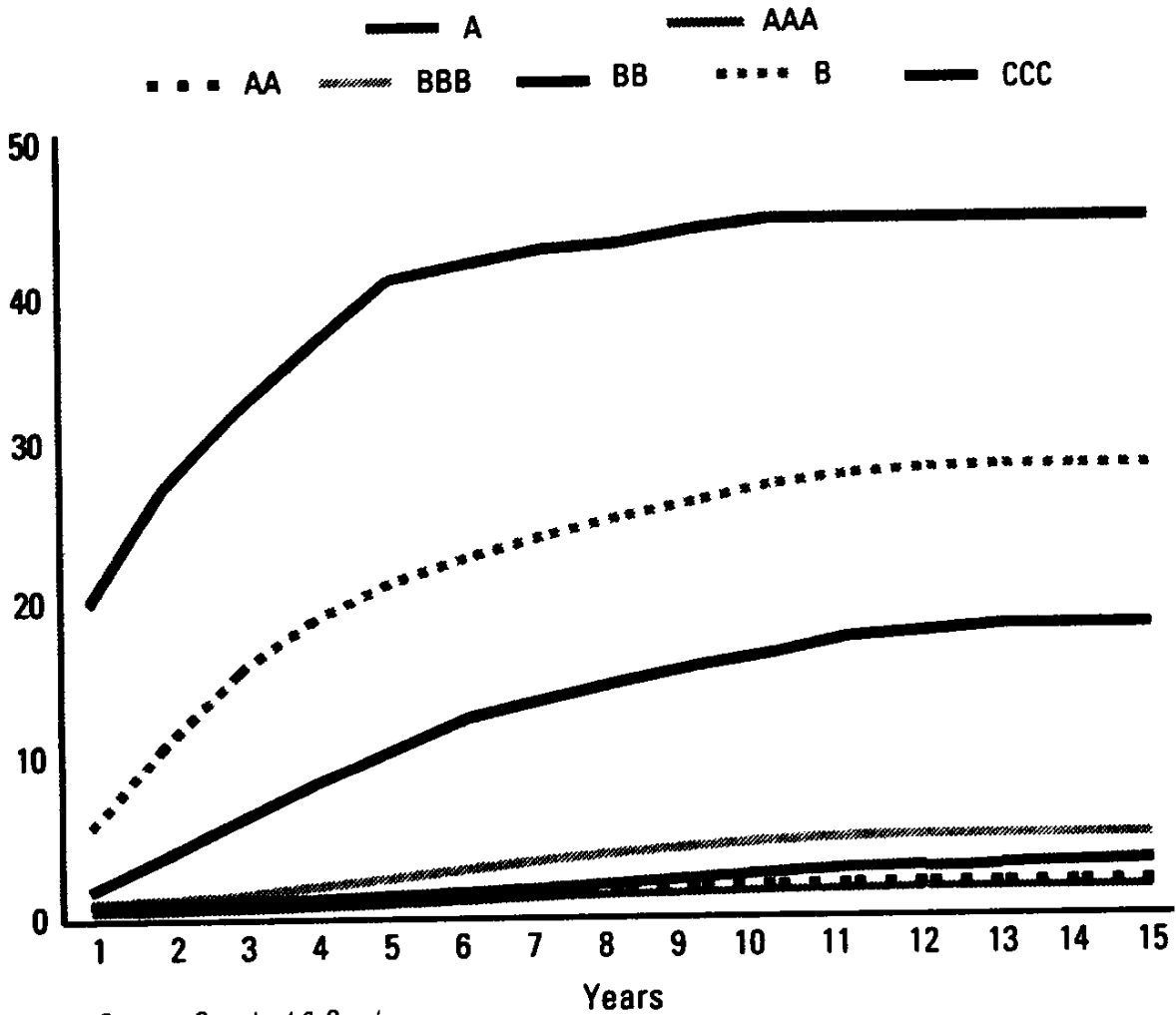
1994 Static Pool		Rating at year end (%)									
Initial Rating	Issuers	AAA	AA	A	BBB	BB	B	CCC	D	NR	
AAA	128	89.06	7.03	0.78	0	0	0	0	0	3.13	
AA	416	0.24	89.9	7.93	0	0	0	0	0	1.92	
A	798	0	0.88	91.73	4.01	0.13	0	0.13	0.13	3.01	
BBB	539	0	0.19	3.53	88.5	2.04	0.19	0	0	5.57	
BB	399	0	0	0.25	7.52	82.46	3.01	0	0.25	6.52	
B	345	0	0	0.29	0.29	6.09	81.45	2.9	2.32	6.67	
CCC	24	0	0	4.17	0	0	4.17	45.83	16.67	29.17	

1995 Static Pool		Rating at year end (%)									
Initial Rating	Issuers	AAA	AA	A	BBB	BB	B	CCC	D	NR	
AAA	126	92.86	6.35	0	0	0	0	0	0	0.79	
AA	434	0	87.1	9.68	0.46	0	0	0	0	2.76	
A	955	0	2.09	90.16	3.35	0.1	0	0	0	4.29	
BBB	625	0	0.48	5.76	85.44	2.72	0	0	0.32	5.28	
BB	447	0	0	0.67	6.49	81.66	4.7	0	0.67	5.82	
B	409	0	0	0	0.24	7.33	76.04	2.44	4.4	9.54	
CCC	27	0	0	0	3.7	0	3.7	55.56	25.93	11.11	

1996 Static Pool		Rating at year end (%)									
Initial Rating	Issuers	AAA	AA	A	BBB	BB	B	CCC	D	NR	
AAA	125	84.8	6.4	0.8	0	0	0	0	0	8	
AA	436	0.23	88.3	5.28	0	0	0	0	0	6.19	
A	1013	0	3.46	87.76	2.37	0.1	0	0	0	6.32	
BBB	678	0.15	0	5.31	88.2	1.77	0.15	0	0	4.42	
BB	494	0	0	0.61	6.88	79.76	3.85	0.61	0.4	7.89	
B	444	0	0	0.23	0.23	8.11	72.75	1.35	2.48	14.86	
CCC	29	0	0	0	0	6.9	13.79	62.07	3.45	13.79	

Initial Rating	Issuers	Rating at year end (%), 15-year average, 1981-1996								
		AAA	AA	A	BBB	BB	B	CCC	D	NR
AAA	1665	88.1	8.4	0.7	0.1	0.1	0.0	0.0	0.0	2.7
AA	5146	0.7	88.3	7.4	0.6	0.1	0.1	0.0	0.0	2.7
A	9305	0.1	2.5	87.1	5.2	0.8	0.3	0.0	0.1	4.0
BBB	5910	0.0	0.3	5.8	81.5	5.0	1.2	0.1	0.2	5.8
BB	4230	0.0	0.1	0.6	6.7	73.1	8.4	0.9	1.0	9.1
B	4359	0.0	0.1	0.3	0.5	5.8	74.1	3.3	4.4	11.6
CCC	523	0.1	0.0	0.4	1.0	1.4	10.0	58.8	15.6	12.6

Average Cumulative Default Rates (%)



TIME TO DEFAULT BY RATING CATEGORY

Original rating	Defaults (units)	Average years from original rating	Last rating prior to D	Default (units)	Average years from last rating
AAA	3	8	AAA	0	N.A.
AA	9	7.4	AA	0	N.A.
A	22	7.7	A	0	N.A.
BBB	33	6.3	BBB	6	1.5
BB	143	5	BB	21	3.1
B	220	3.7	B	185	2
CCC	36	3	CCC	254	0.7
Totals	466	4.5	Totals	466	1.3

Source: S&P “Ratings Performance 1996—Stability and Transition”

DEFAULT RATES BY INDUSTRY

	Period 1981-1996			1996	
	No. obligors	No. of defaults	Default rate(%)	No. of defaults	Default rate(%)
Aerospace/Automotive/Capital goods/Metal	739	67	9.07	1	0.14
Hightech/Computers/Office	326	24	7.36	1	0.31
Consumer/Servicesector	946	115	12.16	8	0.85
Leisure-time/Media	525	67	12.76	4	0.76
Healthcare/Chemicals	362	18	4.97	1	0.28
Forest/Buildingproducts/Home	275	28	10.18	0	0
Energy/NaturalResources	363	48	13.22	1	0.28
Utilities	420	12	2.86	0	0
Telecommunications	169	4	2.37	0	0
Transportation	280	29	10.36	1	0.36
Financial Institutions	1100	37	3.36	0	0
Insurance/Realestate	399	17	4.26	0	0
Totals	5904	466	7.89	17	0.29

Source: S&P, op. cit.

WEIGHTED-AVERAGE RECOVERY RATES PER \$100 FACE VALUE ON DEFAULTED DEBT BY SENIORITY, 1978-95

Source: Altman & Kishore, "Almost Everything You Wanted to Know about Recoveries on Defaulted Bonds"

Financial Analysts Journal, November/December 1996, pp. 57- 64

Default Year	Senior Secured		Senior Unsecured		Senior Subordinated		Subordinated		Discount and Zero Coupon	
	Number	Recovery	Number	Recovery	Number	Recovery	Number	Recovery	Number	Recovery
		Rate		Rate		Rate		Rate		Rate
1995	5	44.64	9	50.50	17	39.01	1	20.00	1	17.50
1994	5	48.66	8	51.14	5	19.81	3	37.04	1	5.00
1993	2	55.75	7	33.38	10	51.50	9	28.38	4	31.75
1992	15	59.85	8	35.61	17	58.20	22	49.13	5	19.82
1991	4	44.12	69	55.84	37	31.91	38	24.30	9	27.89
1990	12	32.18	31	29.02	38	25.01	24	18.83	11	15.63
1989	9	82.69	16	53.70	21	19.60	30	23.95	0	-
1988	13	67.96	19	41.99	10	30.70	20	35.27	0	-
1987	4	90.68	17	72.02	6	56.25	4	35.25	0	-
1986	8	48.32	11	37.72	7	35.20	30	33.39	0	-
1985	2	74.25	3	34.81	7	36.18	15	41.45	0	-
1984	4	53.42	1	50.50	2	65.88	7	44.68	0	-
1983	1	71.00	3	67.72	0	-	4	41.79	0	-
1982	0	-	16	39.31	0	-	4	32.91	0	-
1981	1	72.00	0	-	0	-	0	-	0	-
1980	0	-	2	26.71	0	-	2	16.63	0	-
1979	0	-	0	-	0	-	1	31.00	0	-
1978	0	-	1	60.00	0	-	0	-	0	-
Total/average	85	57.89	221	47.65	177	34.38	214	31.34	31	21.66
Median		51.04		40.65		27.86		31.96		18.66
Standard deviation		22.99		26.71		25.08		22.42		18.35

Table 2. Recovery Rates by industry: Defaulted Bonds, 1971-95
Source: Altman & Kishore, "Almost Everything You Wanted to Know about Recoveries on Defaulted Bonds"
Financial Analysts Journal, November/December 1996, pp. 57- 64

SIC Code	Industry	Observations	Recovery Rate	
			Average	Weighted
492	Gas utilities	25	81.75	90.42
150	Construction contracting	1	71.00	71.00
616	Mortgage banks	4	67.60	49.80
290	Petroleum and energy products	23	67.29	84.18
730	Personal business service--cornpu	3	64.87	70.90
491	Electric utilities	29	62.57	51.43
560	Apparel and accessory stores	1	61.00	61.00
790	Recreation services	10	59.00	60.70
280	Chemicals and arned products	6	58.00	61.63
470	Transportation services	5	52.73	43.16
350	Machinery (except electric)	20	50.54	49.95
300	Rubber and plastic products	6	49.96	56.55
500	Wholesale and retail trade	7	49.34	52.00
610	Finance comparees	3	49.50	53.91
380	Instruments and related products	2	49.38	49.30
770	Casino hotels	11	48.91	44.22
609	Noncredit institutions	12	48.75	54.76
520	Retail trade	2	48.50	47.56
390	Manufacturing, miscellaneous	6	47.40	51.18
260	Paper and allied products	6	46.83	44.37
270	Printing and publishing	8	46.77	47.76
330	Steel and metal products	32	46.07	42.92
360	Electrical and electronic equipment	14	46.06	35.90
200	Food and related--manufacturing	18	45.28	37.40
208	Beverage bottlers	1	44.50	44.50
496	Steam and air conditioning supply	2	44.00	43.99
420	Trucking	4	43.63	40.39
620	Financial services	7	42.07	36.46
100	Mining	10	40.69	33.34
410	Bus transit	1	40.30	40.50
998	Diversified manufacturing	14	40.11	23.64
450	Air transportation	39	39.50	41.25
483	Radio and TV Broadcasting	32	38.97	39.81
720	Laundry service	2	38.30	39.31
220	Textile and mill products	18	37.22	38.52
590	Retail miscellaneous	20	36.95	38.37
780	Movie production	15	35.00	35.41
540	Food stores	21	34.47	26.68
650	Real estate	34	34.21	27.93
320	Building materials	26	32.31	25.25
340	Fabricated metal products	10	32.15	24.62
130	Oil and gas drilling	33	31.54	31.91
580	Eating and dining places	3	31.50	38.74
630	Insurance	10	31.48	35.17
530	Department stores	37	30.69	27.99
533	Variety stores	5	30.33	18.28
370	Transportation equiprment	8	30.28	40.77
602	Commercial banks	22	29.33	21.60
510	Wholesale trade--nondurable good	3	28.08	34.15
800	Hospitals and nursing facilities	11	26.89	18.47
482	Telegraph and related communicat	10	26.43	34.85
701	Lodging places	11	26.09	22.12
230	Apparel and related products	13	23.96	26.13
570	Furniture, furnlshings and equipme	2	23.00	23.30
632	Hospitals and medical services	3	22.30	31.41
670	Investment funds and trusts	2	20.82	28.21
138	Oil and gas field services	2	19.07	19.08
310	Leather products	1	13.00	13.00
250	Furniture	3	9.50	11.39
603	Savings institutions	6	9.25	19.68
240	Wood and related products	1	5.00	5.00

Table 3. Recovery Rates by Industry: Defaulted Bonds by Three-Digit SIC Code, 1971-95
 Source: Altman & Kishore, "Almost Everything You Wanted to Know about Recoveries on Defaulted Bonds"
Financial Analysts Journal, November/December 1996, pp. 57- 64

Industry	SIC Code	Number of Observations	Recovery Rate			
			Average	Weighted observation:	Median Average	Standard Deviation Weighted
Public utilities	490	56	70.47	65.48	79.07	19.46
Chemicals, petroleum, rubber and plastic products	280,290,300	35	62.73	80.39	71.88	27.10
Machinery, instruments, and related products	350,360,380	36	48.74	44.75	47.50	20.13
Services--business and personal	470,632,720,730	14	46.23	50.01	41.50	25.03
Food and kindred products	200	18	45.28	37.40	41.50	21.67
Wholesale and retail trade	500,510,520	12	44.00	48.90	37.32	22.14
Diversified manufacturing	390,998	20	42.29	29.49	33.88	24.98
Casino, hotel, and recreation	770,790	21	40.15	39.74	28.00	25.66
Building materials, metals, and fabricated products	320,330,340	68	38.76	29.64	37.75	22.86
Transportation and transportation equipment	370,410,420,450	52	38.42	41.12	37.13	27.98
Communication, broadcasting, movies, printing, publishing	270,480,780	65	37.08	39.34	34.50	20.79
Financial institutions	600,610,620,630,670	66	35.69	35.44	32.15	25.72
Construction and real estate	150,650	35	35.27	28.58	24.00	28.69
General merchandise stores	530,540,560,570,580,000	89	33.16	29.35	30.00	20.47
Mining and petroleum drilling	100,103	45	33.02	31.83	32.00	18.01
Textile and apparel products	220,230	31	31.66	33.72	31.13	15.24
Wood, paper, and leather products	240,250,260,310	11	29.77	24.30	18.25	24.38
Lodging, hospitals, and nursing facilities	700 through 890	22	26.49	19.61	16.00	22.65
Total		696	41.00	39.11	36.25	25.56

From Tom Wolfe, Bonfire of the Vanities, 1987.

(On the origins of the bond markets of the 70s and 80s)

... They had Lyndon Johnson to thank. Ever so quietly, the U.S. had started printing money by the billions to finance the war in Vietnam. Before anyone, even Johnson, knew what was happening, a worldwide inflation had begun. Everyone woke up to it when the Arabs suddenly jacked up oil prices in the early 1970s. In no time, markets of all sorts became heaving crap-shoots: gold, silver, copper, currencies, bank certificates, corporate notes--even bonds. For decades the bond business had been the bedridden giant of Wall Street. At firms such as Salomon Brothers, Morgan Stanley, Goldman Sachs and Pierce & Pierce, twice as much money had always changed hands on the bond market as on the stock market. But prices had budged by only pennies at a time, and mostly they went down. As Lopwitz put it, "The bond market has been going down every since the Battle of Midway." The Battle of Midway (Sherman had to look it up) was in the Second World War. The Pierce & Pierce bond department had consisted of only twenty souls, twenty rather dull souls known as the Bond Bores. The less promising members of the firm were steered into bonds, where they could do no harm.

Sherman resisted the thought that it had been even thus when he entered the bond department. Well, there was no more talk about Bond Bores these days . . . Oh no! Not at all! The bond market had caught fire, and experienced salesmen such as himself were all at once much in demand. All of a sudden, in investment houses all over Wall Street, the erstwhile Bond Bores were making so much money they took to congregating after work in a bar on Hanover square called Harry's to tell war stories . . . and assure one another this wasn't dumb luck but, rather, a surge of collective talent. Bonds now represented four-fifths of Pierce & Pierce's business, and the young hotshots, the Yalies, Harvards, and Stanfords, were desperate to get to the bond trading room of Pierce & Pierce.

"But what do you *do*?" asked Campbell.

"Well, Sherman, how about it?" said his father with a big grin. I want to hear the answer to this myself. I've often asked myself what it is you fellows do exactly. Campbell, that's an *excellent* question."

"Well, I deal in *bonds*, sweetheart. I buy them, I sell them, I ..."

"What are bonds? What is a deal?"

"Explain it to me, too, Sherman," said his father. "I must have done five thousand leveraged purchase contracts, and I always fell asleep before I could figure out why anyone wanted the bonds."

"Your grandfather's only joking, honey." He shot his father a sharp look.

"A bond is a way of loaning people money. Let's say you want to build a road, and it's not a little road but a big highway, like the highway we took up to Maine last summer. Or you want to build a big hospital. Well, that requires a lot of money, more money than you could ever get by just going to a bank. So what you do is, you issue what are called bonds."

"You build roads and hospitals, Daddy? That's what you do?"

"No, I don't actually build them, sweetheart. I handle the bonds, and the bonds are what make it possible--"

"You *help* build them?"

"Well, in a way."

"Which ones?"

"Which *ones*?"

"Well, not any one specifically."

"The road to Maine?"

Judy broke in. "Let me try. . . . Darling, Daddy doesn't build roads or hospitals, and he doesn't help build them, but he does handle the *bonds* for the people who raise the money."

"Bonds?"

"Yes. Just imagine that a bond is a slice of cake, and you didn't bake the cake, but every time you hand somebody a slice of the cake a tiny bit comes off, like a little crumb, and you can keep that."

Judy was smiling, and so was Campbell, who seemed to realize that this was a joke, a kind of fairy tale based on what her daddy did.

"Little crumbs?" She said encouragingly.

"Yes," said Judy. "or you have to imagine little crumbs, but a *lot* of little crumbs. If you pass around enough slices of cake, then pretty soon you have enough crumbs to make a *gigantic* cake."

"For real life?" asked Campbell.

"No, not for real life. You just have to imagine that." Judy looked to Sherman's father and mother for approval of this witty description of the bond business. They smiled, but uncertainly.

"I'm not sure you're making it any clearer for Campbell," said Sherman.

"My goodness . . . *crumbs*." He smile to show he knew this was only lunch-table banter. In fact . . . he was used to Judy's supercilious attitude toward Wall Street, but he was not happy about . . . *crumbs*.

"You can call them crumbs if you want," said Sherman, trying not to sound testy, and failing.

"Well, that's the best I can do," Judy said brightly. Then to his father and mother: "Investment banking is an unusual field. I don't know if there *is* any way you can explain it to anyone under twenty. Or perhaps under *thirty*."

WEB SITES

- Bonds On-Line: <http://www.bonds-online.com>

- Standard and Poors:
<http://www.ratings.standardpoor.com>

This is an excellent site with tons of information (even though some of the Adobe Acrobat files are screwed up!)

- Moody's <http://www.moody.com>

Not nearly as good as S&P!

- Arthur Warga, www.uwm.edu:80/People/warga,

Professor at U. of Wisconsin, Milwaukee who is building a data base on fixed income with Lehman Brothers