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ASSET PREPAYMENT ASSUMPTIONS FOR REGULATORY CASH-FLOW TESTING

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Panelists: JOHN V. MALVEY*
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Recorder: RANDALL L. BOUSHEK

- Corporate bonds and private placements
  - How can call features be modeled?
  - What factors other than interest rates are important?
  - How do sinking-fund provisions operate?
- Mortgage-backed securities
  - What prepayment models are available?
  - Are historical data valid? What data are available?
  - What factors other than interest rates are important?
  - What are the most crucial pitfalls to avoid?

MR. RANDALL L. BOUSHEK: With us as panelists for this session are two distinguished gentlemen from the investment community here in New York, both of whom have recently been honored in a very significant way for their work in their respective areas of expertise. As a bit of background and by way of introduction, a couple of years ago, *Institutional Investor* magazine began polling portfolio managers and analysts at some 700 leading money management organizations -- insurance companies, banks, mutual funds, and pension funds -- for an investors' (buy side) ranking of Wall Street's (sell side) fixed-income analysts and strategists. The top-scoring analysts or strategists in each of several categories are then recognized as members of the All-American Fixed-Income Research Team. The two individuals with us -- Mr. John Malvey, senior vice president and corporate credit strategist with Lehman Brothers, and Mr. Dale Westhoff, a managing director for mortgage research at Bear Stearns, responsible for prepayment forecasting and analysis -- have both recently been named First Team All-Americans for 1993. This is an honor that reflects the respect that they are accorded in the investment community, and we're very grateful to them for taking the time to be with us.

We'd like to begin this session by focusing on the prepayment characteristics of corporate bonds with imbedded options. Leading off for us in this area will be Jack Malvey. As I mentioned, Jack is a senior vice president with Lehman Brothers in New York. Prior to joining Lehman Brothers, he spent ten years with Kidder Peabody, heading up its credit research group for a good share of that time. Before that, he served a stint as a credit analyst with Moody's Investor Service. Jack has an AB in economics from Georgetown University and has done graduate work in economics at the New School for Social Research in New York. He has lectured at Georgetown,

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Wharton, and Columbia graduate business schools, and is a Chartered Financial Analyst (CFA) and a past officer and board member of the Fixed-Income Analysts' Society.

MR. JOHN V. MALVEY: My plan is to (1) quickly go through an overview of the corporate bond market, (2) look at some dimension of how much prepayment and redemption activity has taken place within that market, (3) investigate some of the techniques that corporate bond issuers have used to retire debt prior to maturity, and (4) make some suggestions as to the investment implications for you.

OVERVIEW

During the last 20 years, the corporate bond market has, on average, provided the best total return among all fixed-income sectors. This is true for each of the last three years as well. Granted, some portion of relative outperformance may be a function of differences in effective duration, a point often argued by my mortgage colleagues. However, we have only a limited database of duration-adjusted returns available to bring to this argument, because we can't retrospectively run option valuation models to determine effective durations for previous years.

Good performance notwithstanding, I'd like to take a look at a potentially big problem for corporate bond portfolio managers. I thought it would be interesting to give you a snapshot of the amount of callable corporate debt outstanding. In Table 1, you can see that as of September 1993, almost 1,400 of the approximately 4,000 corporate bonds in the Lehman Brothers corporate index are callable.

In addition, a total of 335 have some kind of sinking-fund provision. Because of the way that we prepare this study, there's actually some overlap between those two categories. I should point out that these data measure only public corporate debt with more than one year to maturity and at least $50 million outstanding -- a market-value sample of about $760 billion. Conspicuously missing from this sample are private placements, most medium-term notes, and Eurobonds.

Table 2 contains information on the historical total returns of callable debt relative to that of other corporate securities. The returns for each type of security are not directly comparable because of differences in coupon, maturity, and credit quality distributions, but it is still instructive to note the differences in both absolute and duration-adjusted performance.

Table 2 is an interesting exhibit for other reasons. First, it maps out how callable structures have declined as a percentage of the corporate market. In 1990, 72% of public corporate bonds outstanding were callable, and 32% (remember the overlap) had sinking-fund provisions. By September 1993, the percentage of callable bonds had been halved to 36%, with only 9% of all bonds having a sinking-fund provision. Why this reduction? Well, besides anticipating your problems in modeling these bonds and trying to retire them for you, corporate America has been taking advantage of the very steep yield curve. It has been targeting the intermediate area, which is typically bullet structured, to minimize interest expense, maximize fixed-charge coverage, and maintain or enhance credit ratings.

TABLE 1

Corporate Bond Analysis by Structure Type for September 1993

	Lehman Brothers Corporate Index Identified By Structure Type						
	Corporate Index	Callable	Sinking Fund	Putable	Bullet	Zero Coupon	OID
Number of Issues	3,908	1,395	335	133	2,391	149	18
Percent of Corp. Index		35.70%	8.57%	3.40%	61.18%	3.81%	0.46%
Par Amount	686,252	207,939	44,337	22,964	453,014	10,992	4,359
Percent of Corp. Index		30.30%	6.46%	3.35%	66.01%	1.60%	0.64%
Market Value	760,555	226,800	49,556	27,239	507,253	3,851	4,351
Percent of Corp. Index		29.82%	6.52%	3.58%	66.70%	0.51%	0.57%
Yield to Worst	6.09	6.35	6.92	6.16	5.97	6.32	5.96
Modified Adjusted Duration	5.70	5.08	4.70	6.30	5.98	11.64	3.58
September 1993 Total Return	**0.24%**	**0.03%**	**-0.18%**	**0.48%**	**0.34%**	**1.14%**	**0.52%**
Total Return as Percent of Corp. Index		12.50%	-75.00%	200.00%	141.67%	474.17%	216.67%
Last Three Months Total Return	**3.48%**	**3.35%**	**2.54%**	**4.15%**	**3.61%**	**7.54%**	**4.85%**
Total Return as Percent of Corp. Index		96.48%	73.10%	119.36%	103.79%	216.99%	139.62%
Year to Date Total Return	**12.33%**	**10.71%**	**9.46%**	**13.71%**	**13.43%**	**22.99%**	**16.72%**
Total Return as Percent of Corp. Index		86.80%	76.67%	111.15%	108.86%	186.39%	135.52%
Duration Adjusted Returns							
September 1993 Total Return	**0.04%**	**0.01%**	**-0.04%**	**0.08%**	**0.06%**	**0.10%**	**0.15%**
Total Return as Percent of Corp. Index		14.03%	-90.96%	180.95%	135.03%	232.20%	344.97%
Last Three Months Total Return	**0.62%**	**0.68%**	**0.57%**	**0.67%**	**0.61%**	**0.64%**	**1.23%**
Total Return as Percent of Corp. Index		110.46%	92.17%	109.35%	98.18%	104.46%	198.89%
Year to Date Total Return	**2.20%**	**2.18%**	**2.06%**	**2.46%**	**2.24%**	**1.90%**	**3.01%**
Total Return as Percent of Corp. Index		99.31%	93.77%	111.82%	101.95%	86.65%	136.88%

Source: Lehman Brothers Fixed Income Research

TABLE 2

Corporate Bond Return Analysis by Structure Type

January 1, 1990 through September 30, 1993

	Corporate Index			Callable			Sinkers			Putables			Bullets			Zeros		
	Total Return	Dur Adj Return	% of Index	Total Return	Dur Adj Return	% of Index	Total Return	Dur Adj Return	% of Index	Total Return	Dur Adj Return	% of Index	Total Return	Dur Adj Return	% of Index	Total Return	Dur Adj Return	% of Index
1990	7.05	1.11	100%	7.56	1.51	72%	7.66	1.41	32%	6.53	1.79	5%	6.68	1.44	24%	6.93	0.87	4%
1991	18.51	3.30	100%	18.55	3.75	60%	18.94	3.64	21%	15.98	3.84	4%	18.79	3.54	37%	19.94	2.02	6%
1992	8.69	1.51	100%	9.11	1.94	46%	9.57	2.01	15%	8.71	1.97	4%	8.60	1.53	50%	10.64	1.00	4%
*1993	12.32	2.20	100%	10.72	2.18	36%	9.46	2.06	9%	13.72	2.46	3%	13.43	2.24	61%	23.00	1.90	4%
1990 - 1993	54.86	8.36		54.04	9.70		53.58	9.42		52.74	10.43		56.10	9.03		74.53	5.92	
Average	11.64	2.03		11.48	2.35		11.41	2.28		11.23	2.51		11.87	2.19		15.13	1.45	
Std Dev	5.05	0.96		4.86	0.98		5.10	0.95		4.37	0.93		5.41	0.97		7.58	0.60	
Coeff Variation	44%	47%		43%	42%		45%	42%		39%	37%		46%	44%		50%	41%	

* Through September 30, 1993

Source: Lehman Brothers Corporate Bond Index

Table 2 also shows that on a duration-adjusted, total-return basis, callable structures outperformed bullet structures in each of 1990, 1991, and 1992. It's only in 1993, with the sharp rally thus far this year, that callables have lagged.

REDEMPTION ACTIVITY

Now let's take a look at Table 3. Here we've mapped both gross and net origination for 1993 by major subsectors within the corporate bond market for investment-grade product. You can see that year-to-date through September we've had gross originations of $173.4 billion, with net originations of just under $64 billion. This means that we've already had total redemptions of $110 billion in the corporate bond market this year alone. In particular, if you look at the utility area, there have been more redemptions than gross originations, generating a negative net supply for 1993. Table 4 contains similar information for high-yield bonds.

Table 5 provides another snapshot of the composition of supply. Note that in 1993, 81% of all new supply has been structured with no imbedded-option features. This continues a trend first evidenced in 1991. Note also that there has been a swing toward longer maturities. This year, about 35% of all new supply has been long-dated (longer than 13 years within the corporate market), compared with only about 25% in 1992.

As I mentioned earlier, even though some issuers are taking advantage of the steep yield curve to issue intermediate-term debt, there nonetheless has been a swing in some quarters to longer-dated maturities by issuers who believe that the absolute level of interest rates is irresistible for long-term financing. This has triggered the origination of such notable issues as the Coca-Cola and Disney 100-year maturities, which came in July 1993, the first so-called "century bonds" in about 40 years.

The composition of new supply is a little different for the high-yield bond market. You can see on Table 6 that only about 30% of high-yield supply consists of bullet structures. What's happening here, of course, is that high-yield issuers always seem to hope that they will become investment-grade before maturity, enabling them to refinance their debt early at a much tighter spread. Unfortunately, this is usually a triumph of hope over reality.

Chart 1 highlights how the coupon distribution within the corporate market has changed during the last 21 months. During this time, there has been a significant shift from coupons in the 9-10% range to coupons in the 8-9% range. This change in coupon distribution, coupled with the increasing reliance of issuers on bullet structures, leads us to believe that we have passed the peak of the refunding blitz in corporate America, even if we see a 5% long bond in 1994. Still, it is worthwhile to note that a number of bond issues that are vulnerable to call remain outstanding.

TABLE 3
Investment-Grade Corporate Bond Net Supply
January 1 through September 30, 1993 (Millions of U.S.$)

	Industrial			Utility			Finance			Yankee			Total		
	New Issue	Redemption	Net	New Issue	Redemption	Net	New Issue	Redemption	Net	New Issue	Redemption	Net	New Issue	Redemption	Net
January	10500	2153	8347	4867	2040	2827	7735	1659	6076	7875	275	7600	30,977	6,127	24,850
February	6430	2582	3848	6070	3579	2492	9475	2213	7262	3050	896	2154	25,025	9,269	15,756
March	6279	3711	2568	8163	6577	1586	4075	4084	-9	2575	1240	1335	21,092	15,612	5,480
April	3075	3703	-628	5948	8681	-2733	3700	2573	1127	1600	574	1026	14,323	15,531	-1,208
May	3600	3074	526	3071	7353	-4282	2805	4492	-1687	1025	2072	-1047	10,501	16,991	-6,490
June	6779	3262	3517	5695	7021	-1326	7500	3048	4452	5185	438	4747	25,159	13,769	11,390
July	4000	2678	1322	5595	8204	-2609	3685	3172	513	2160	384	1776	15,440	14,438	1,002
August	5125	1856	3269	2645	4476	-1831	4320	2614	1706	1300	478	822	13,390	9,424	3,966
September	1335	783	552	5765	5239	526	2875	2755	120	7600	86	7514	17,575	8,862	8,713
Total	47,123	23,802	23,321	47,819	53,169	-5,350	46,170	26,609	19,561	32,370	6,442	25,928	173,482	110,023	63,459
October*	3000	0	3000	5300	0	5300	4000	0	4000	3000	0	3000	15,300	0	15,300
November*	3000	0	3000	5300	0	5300	4000	0	4000	3000	0	3000	15,300	0	15,300
December*	3000	0	3000	5300	0	5300	4000	0	4000	3000	0	3000	15,300	0	15,300
1993 Forecast	56,123	23,802	32,321	63,719	53,169	10,550	58,170	26,609	31,561	41,370	6,442	34,928	219,382	110,023	109,359
Change vs 1992	0%	-9%	8%	59%	45%	203%	17%	4%	30%	81%	-15%	129%	30%	14%	50%
1993**	62,831	31,736	31,095	63,759	70,892	-7,134	61,560	35,479	26,081	43,160	8,589	34,571	231,309	146,697	84,612
1992	56,069	26,247	29,822	40,201	36,717	3,484	49,845	25,619	24,226	22,800	7,565	15,235	168,915	96,147	72,768
Change	12%	21%	4%	59%	93%	-305%	24%	38%	8%	89%	14%	127%	37%	53%	16%

*Forecast
Redemptions = Called bonds + matured debt.
** Annualized Year-to-date

Source: Lehman Brothers Fixed Income Research

ASSET PREPAYMENT ASSUMPTIONS FOR REGULATORY CASH-FLOW TEST

TABLE 4
High-Yield Corporate Bond Net Supply
January 1 through September 30, 1993 (Millions of U.S.$)

	Industrial			Utility			Finance			Yankee			Total		
	New Issue	Redemption	Net	New Issue	Redemption	Net	New Issue	Redemption	Net	New Issue	Redemption	Net	New Issue	Redemption	Net
January	5685	1930	3755	0	15	-15	255	236	19	75	0	75	6,015	2,181	3,834
February	3798	770	3028	0	0	0	215	100	115	125	0	125	4,138	870	3,268
March	7935	1927	6008	0	0	0	100	271	-171	350	0	350	8,385	2,198	6,187
April	4800	2240	2560	0	57	-57	432	300	132	375	0	375	5,607	2,597	3,010
May	4327	782	3545	0	195	-195	100	200	-100	200	0	200	4,627	1,177	3,450
June	4866	2138	2728	112	49	63	425	179	247	200	0	200	5,603	2,365	3,238
July	5712	2819	2893	0	22	-22	168	0	168	0	10	-10	5,880	2,851	3,029
August	8322	2251	6071	0	70	-70	510	0	510	0	0	0	8,832	2,321	6,511
September	2067	894	1173	240	75	165	0	840	-840	0	100	-100	2,307	1,909	398
Total	47,512	15,751	31,761	352	483	-131	2,205	2,126	80	1,325	110	1,215	51,394	18,469	32,925
October*	4000	0	4000	0	0	0	0	0	0	0	0	0	4,000	0	4,000
November*	5000	0	5000	0	0	0	0	0	0	0	0	0	5,000	0	5,000
December*	2000	0	2000	0	0	0	0	0	0	0	0	0	2,000	0	2,000
1993 Forecast	58,512	15,751	42,761	352	483	-131	2,205	2,126	80	1,325	110	1,215	62,394	18,469	43,925
1993**	78,016	21,001	57,015	469	644	-174	2,940	2,834	106	1,767	147	1,620	63,192	24,626	58,566
1992	32,032	12,021	20,011	2,635	299	2,336	1,912	1,349	563	1,000	0	1,000	37,578	13,669	23,909
Change	144%	75%	185%	-82%	115%	-107%	54%	110%	-81%	77%	0%	62%	121%	80%	145%

*Forecast
Redemptions = Called bonds + matured debt.
** Annualized Year-to-date

Source: Lehman Brothers Fixed Income Research

TABLE 5
Composition of Investment-Grade Corporate Bond New Issuance
January 1, 1993 through September 30, 1993

No. of Issues	1 YR	3 YR	4 YR	5 YR	7 YR	10 YR	12 YR	15 YR	20 YR	30 YR	Preferred	Total	Percent %
Industrials	0	11	1	17	20	68	6	6	26	71	7	226	25.71%
Utilities	0	6	4	36	46	80	25	13	13	131	54	354	40.27%
Financials	28	25	4	27	30	80	12	6	6	8	15	226	25.71%
Yankees	1	5	0	7	6	29	2	3	10	10	15	73	8.30%
Total	29	47	9	87	102	257	45	28	55	220	91	879	100%
	3%	5%	1%	10%	12%	29%	5%	3%	6%	25%			100%

($ Millions)

Amount of Issues	1 YR	3 YR	4 YR	5 YR	7 YR	10 YR	12 YR	15 YR	20 YR	30 YR	Preferred	Total	Percent %
Industrials	0	2200	100	4075	5365	12436	1400	854	5893	14800	3250	47123	27%
	0.0%	4.7%	0.2%	8.6%	11.4%	26.4%	3.0%	1.8%	12.5%	31.4%			
Utilities	0	790	425	3745	4773	9729	3175	1148	1845	22189	3954	47,819	28%
	0.0%	1.7%	0.9%	7.8%	10.0%	20.3%	6.6%	2.4%	3.9%	46.4%			
Financials	6585	5050	550	6125	6050	15685	2775	1150	975	1225	2490	46,170	27%
	14.3%	10.9%	1.2%	13.3%	13.1%	34.0%	6.0%	2.5%	2.1%	2.7%			
Yankees	200	910	0	2590	3025	13660	800	650	4000	6535	3370	32,370	19%
	0.6%	2.8%	0.0%	8.0%	9.3%	42.2%	2.5%	2.0%	12.4%	20.2%			
Total	6,785	8,950	1,075	16,535	19,213	51,511	8,150	3,802	12,713	44,750	13,064	173,486	100%
	4%	5%	1%	10%	11%	30%	5%	2%	7%	26%			100%

Noncall	140,181	80.80%
Callable	33,301	19.20%
Putable	0	0.00%

Euros	61,674
FRNs	6,150
High Yield	48,378

AAA	5,375	3.10%
AA	36,357	20.96%
A	82,039	47.29%
BBB	49,711	28.65%

Short Paper	1-4 YRS	9.69%
Intermediate	5-12 YRS	55.00%
Long Paper	13-30 YRS	35.31%

Figures compiled for fixed rate nonconvertible investment grades.
Source: Lehman Brothers Fixed Income Research

ASSET PREPAYMENT ASSUMPTIONS FOR REGULATORY CASH-FLOW TEST

TABLE 6
Composition of High-Yield Corporate Bond New Issuance
January 1, 1993 through September 30, 1993

No. of Issues	1 YR	3 YR	4 YR	5 YR	7 YR	10 YR	12 YR	15 YR	20 YR	30+ YR	Total	Percent %
Industrials	0	1	0	11	64	125	20	9	10	5	245	86.88%
Utilities	0	0	0	0	7	2	0	0	0	0	9	3.19%
Financials	0	0	0	2	5	10	1	0	0	0	18	6.38%
Yankees	0	0	0	5	3	2	0	0	0	0	10	3.55%
Total	0	1	0	18	79	139	21	9	10	5	282	100%
	0%	0%	0%	6%	28%	49%	7%	3%	4%	2%		100%

($ Millions)

Amount of Issues	1 YR	3 YR	4 YR	5 YR	7 YR	10 YR	12 YR	15 YR	20 YR	30+ YR	Total	Percent %
Industrials	0	250	0	2714	9923	22256	3767	2013	3189	3396	47,508	92%
	0.0%	0.5%	0.0%	5.7%	20.9%	46.8%	7.9%	4.2%	6.7%	7.1%		
Utilities	0	0	0	0	100	252	0	0	0	0	352	1%
	0.0%	0.0%	0.0%	0.0%	28.4%	71.6%	0.0%	0.0%	0.0%	0.0%		
Financials	0	0	0	470	570	1065	100	0	0	0	2,205	4%
	0.0%	0.0%	0.0%	21.3%	25.9%	48.3%	4.5%	0.0%	0.0%	0.0%		
Yankees	0	0	0	325	725	275	0	0	0	0	1,325	3%
	0.0%	0.0%	0.0%	24.5%	54.7%	20.8%	0.0%	0.0%	0.0%	0.0%		
Total	0	250	0	3,510	11,319	23,850	3,867	2,013	3,189	3,396	51,394	100%
	0%	0%	0%	7%	22%	46%	8%	4%	6%	7%		100%

Noncall	16,258	31.63%
Callable	35,136	68.37%
Putable		0.00%

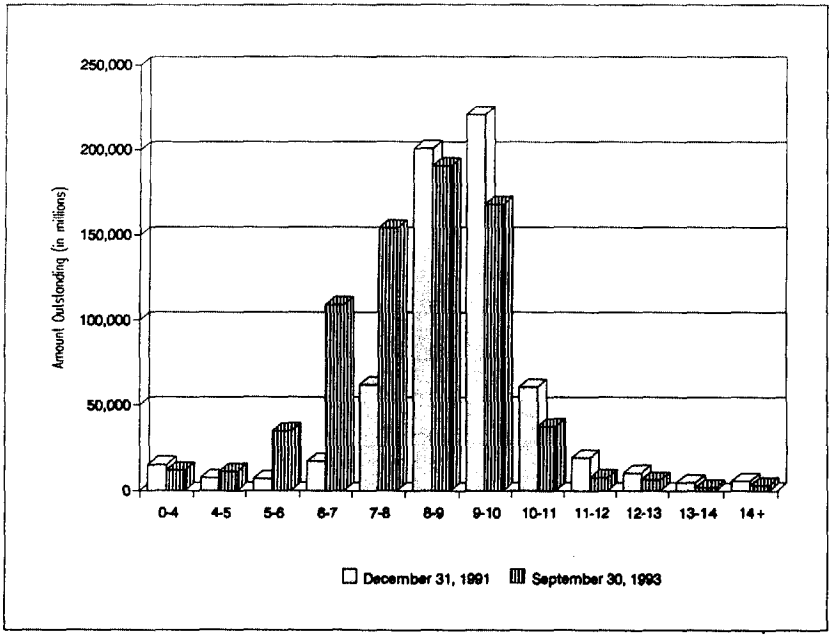
BB	18,168	35.35%
B	28,471	55.40%
CCC	1,967	3.83%
NR	2,788	5.42%

SHORT PAPER	1-4YRS	0.49%
INTERMEDIATES	5-12YRS	82.78%
LONG-TERM	13-30YRS	16.73%

Figures compiled for fixed-rate nonconvertible investment grades.
Source: Lehman Brothers Fixed Income Research

CHART 1
Coupon Distribution for Investment-Grade Corporates
December 31, 1991 Versus September 30, 1993

	December 31, 1991			September 30, 1993		
Coupon	Amount Outstanding	Percent	Cummulative Percent	Amount Outstanding	Percent	Cummulative Percent
0 - 4	15,369	2.43%	100.00%	12,227	1.66%	100.00%
4 - 5	7,714	1.22%	97.57%	11,378	1.54%	98.34%
5 - 6	7,158	1.13%	96.35%	35,009	4.75%	96.80%
6 - 7	17,376	2.75%	95.22%	109,226	14.81%	92.05%
7 - 8	62,122	9.82%	92.47%	154,110	20.89%	77.25%
8 - 9	200,619	31.71%	82.65%	190,649	25.84%	56.36%
9 - 10	220,769	34.90%	50.94%	168,186	22.80%	30.51%
10 - 11	60,717	9.60%	16.05%	37,514	5.09%	7.71%
11 - 12	19,398	3.07%	6.45%	7,836	1.06%	2.63%
12 - 13	10,643	1.68%	3.38%	6,298	0.85%	1.57%
13 - 14	4,884	0.77%	1.70%	1,995	0.27%	0.71%
14 +	5,875	0.93%	0.93%	3,253	0.44%	0.44%



Source: Lehman Brothers Fixed Income Research

REDEMPTION TECHNIQUES

I would like to briefly review the techniques that can be used to retire debt in the corporate bond market. First and most obvious there is maturity, which is generally the most preferable alternative for investors. Second, there are a number of contractual early-redemption options:

1. Exercise of a standard call provision, which typically provides the issuer the right to call the bonds after a stated time interval for a stated call price, which generally declines ratably to par at maturity.

2. Exercise of a nonrefund call provision, which is similar to a standard call provision, except that an issuer must have cash on hand to retire the bonds and cannot use the proceeds of a new (presumably lower-cost) debt issue.

3. Mandatory sinking-fund payments, which are similar to a series of mandatory annual calls on some percentage of the original amount outstanding.

4. Optional sinking-fund payments, which are often allowed as part of a sinking fund provision and enable an issuer to retire as much as twice the mandatory amount.

5. Open-market sinking-fund redemptions, common to electric utility issues, which require an issuer to retire a certain percentage of total debt outstanding each year, but leave the choice of which bonds to retire at any given time up to the issuer.

6. Maintenance replacement-fund compliance redemptions, found in older electric utility issues, which I'll describe more fully in a moment.

Nonrefund calls are difficult to anticipate within the corporate market because of the difficulty of predicting two things – an issuer's future cash availability and the attitude of management toward utilizing this option. There are some issuers who feel very strongly that it does not behoove them to exercise this privilege, because it may adversely affect their standing within the corporate bond market. Unfortunately, there are other issuers who believe that the corporate bond market is so broad and deep that it doesn't matter. In truth, the market is quite broad and quite deep and does tend to have a very short memory. As an illustration, in the mid-1980s, a whole host of investors who were adversely affected by early redemptions formed committees for bondholder rights and threatened to penalize issuers who undertook these types of activities. In retrospect, however, those threats proved idle, and investment activity continued on.

Sinking funds with open-market redemptions ("funnel" or "channel" sinking funds) are also very difficult to model, because repayments are a function of an issuer's entire mix of outstanding debt at any given point in time. Maintenance replacement funds, which were originally conceived of as an investor safeguard, further complicate the modeling of early redemptions on certain electric utility bonds. Under a maintenance replacement covenant, a utility company is supposed to spend a certain amount each year to keep its property in good repair in the event that bondholders ever have to take title to the property. Unfortunately, for roughly one-third of the outstanding

electric utility debt issues with this covenant, there are annual maintenance deficiencies; i.e., the utilities are not spending as much as they need to meet this annual test. As a result, they must either certify new property that has not yet been subject to the lien of the first-mortgage indenture or deposit cash with the trustee to be used for retiring outstanding first-mortgage debt. This effectively provides them with an open-market-sinking-fund redemption option. Florida Power and Light pioneered this technique in 1977. Since then, there have been quite a number of electric utilities that have followed its lead.

An issuer may also be able to effect an early redemption through the use of a tender. In a standard tender, there is typically hard, noncall protection for investors. However, to retire debt prior to maturity, the issuer will voluntarily offer to pay a market premium to investors to repurchase their bonds. This may actually benefit both the issuer and the investors. In a shotgun tender, by contrast, an issuer will also offer to buy back outstanding debt, but will couple it with a threat to hit nonparticipating holders with a maintenance fund par call. This carrot-and-stick approach obviously affects investors adversely.

REDEMPTION MODELS

Let's turn our attention now to redemption models. I would submit to you that the modeling tools currently available represent about the 1.5 phase of the second generation of development. By *second generation*, I mean that we are now taking into account the issuer's cost of capital. However, we really have not yet taken into account how an issuer's credit sensitivity may change through time.

Let's look at a specific example (Table 7). On the far right, you can see an evaluation of the acceleration, delivery, designation, and call options imbedded in this particular bond. By way of definition, the acceleration option is the right of the issuer to increase the annual sinking-fund payment. In this particular case, the issuer may accelerate by 100% or double up the annual payment. The delivery option is the right of the issuer to make open-market sinking-fund redemptions, and the designation option has to do with prepurchase designations of sinking-fund eligibility. The model behind these numbers does a good job of incorporating interest rate volatility and is fairly state-of-the-art, but it's still incomplete. It does not, for example, incorporate corporate yield spread volatility, nor does it have any sensitivity to tender or recapitalization.

Table 8 provides an analysis of tender efficiency for our sample bond. What is tender efficiency? It is basically the ratio of the imbedded option value to the present value (PV) savings of retiring an issue at whatever tender price one nominates. Within corporate finance circles, a tender efficiency of about 90% has developed as somewhat of a minimum standard for consideration by issuers. However, not every issuer subscribes to that thesis. In this particular example, we've shown you a summary of the calculated tender price for this security at various levels of tender efficiency, with additional information on how this price changes with changing interest rates. The results are actually interesting. The analysis shows that it makes sense for the issuer to retire these bonds, yet no action has been taken. Why? The answer lies in tax and accounting considerations. This is a $400 million bond issue. A tender price of $120 would result in an $80 million pretax charge to earnings for the issuer, which it is not currently prepared to swallow.

TABLE 7
Costal Corp 11 3/4's due 6/16/2006
Option-Adjusted Bond Valuation

Pretax Analysis		Option Valuation	
Given Flat Price:	116.330	Put:	0.000
Accrued Interest:	4.015	Acceleration:	0.255
		Delivery:	0.086
Computed OAS:	97.5 bp	Designation:	0.000
Computed YTM:	9.50%	Call:	8.491
		Total:	8.832% of par
Duration:	2.59 yrs		
Convexity:	-0.46		

Bond Indicator Data

Issue Date:	6/24/1986	Maturity Date:	6/15/2006
Coupon:	11.75%	Interest Frequency:	Semiannual
Face Amount:	$400,000,000	Outstanding:	$400,000,000

Proceeds to Issuer: 97.375%

Callable at 103.917 on 6/15/1996, declining to 103.133 on 6/15/1997.

Acceleration: 100%
Market purchase is allowed, and prepurchases remain undesignated.
The next sinking fund payment of $30,000,000 will be made on 6/15/1996,
and a final principal payment of $100,000,000 will be made on 6/15/2006.
Accumulation: $0

Interest Rate Assumptions

Present Value Date: 10/18/1993

Treasury Yield Curve

6 mo:	3.11*	1 yr:	3.24*	2 yr:	3.82	3 yr:	4.06	4 yr:	4.34
5 yr:	4.62	7 yr:	4.78	10 yr:	5.22	20 yr:	5.80	30 yr:	6.00

BBB-Credit Non-call Life Spreads

6 mo:	90.0	1 yr:	100.0	2 yr:	110.0	3 yr:	120.0	4 yr:	125.0
5 yr:	140.0	7 yr:	150.0	10 yr:	165.0	20 yr:	175.0	30 yr:	180.0

Short-rate volatility: 8% Long-rate volatility: 8%

*Discount Rate

TABLE 8
Tender Study for Costal Corp 11 3/4's due 6/15/2006
First callable at 103.917 on 6/15/1996
Refunded with Cash-matched 6.653% Bonds due 6/15/2006

	Yield Curve Shift (1)	Adjusted Option Value (2)	85% Efficient Prices (3)	90% Efficient Prices (4)	95% Efficient Prices (5)	100% Efficient Prices (6)
	-100	13.509	125.373	124.350	123.328	122.305
	-75	12.579	124.466	123.514	122.562	121.609
	-50	11.666	123.570	122.687	121.804	120.921
	-25	10.782	122.668	121.851	121.035	120.219
*	**0 bp**	**9.919%**	**121.768%**	**121.017%**	**120.266%**	**119.515%**
	25	9.074	120.875	120.188	119.500	118.813
	50	8.281	119.944	119.317	118.690	118.063
	75	7.517	119.005	118.436	117.866	117.297
	100	6.779	118.062	117.549	117.035	116.521

Columns (2) through (6) are expressed as percentages of par.

(1) Parallel shift of current yield curve.
(2) Refunded issue's embedded option value, adjusted for issuance expenses of 0.65%, forfeited by tendering.
(3) Flat tender price to investors at an efficiency of 85%.
(4) Flat tender price to investors at an efficiency of 90%.
(5) Flat tender price to investors at an efficiency of 95%.
(6) Flat tender price to investors at an efficiency of 100%.

Interest Rate Assumptions

Present Value Date: 10/18/1993

Treasury Yield Curve

6 mo: 3.11* 1 yr: 3.24* 2 yr: 3.82 3 yr: 4.06 4 yr: 4.34
5 yr: 4.62 7 yr: 4.78 10 yr: 5.22 20 yr: 5.80 30 yr: 6.00

BBB-Credit Non-call Life Spreads

6 mo: 90.0 1 yr: 100.0 2 yr: 110.0 3 yr: 120.0 4 yr: 125.0
5 yr: 140.0 7 yr: 150.0 10 yr: 165.0 20 yr: 175.0 30 yr: 180.0

Short-rate volatility: 8% Long-rate volatility: 8%

*Discount Rate
Marginal tax rate: 34%

Tender management fees: 0.25%

I think that we are beginning to see the emergence of third-and fourth-generation corporate bond redemption models that will allow us to take into account spread and curve sensitivity to a greater degree than we currently have been able to. There is even a chance that they may begin to account for the fact that certain issuers, particularly in the utilities sector, have, over time, demonstrated a greater propensity to employ aggressive redemption tactics.

INVESTMENT IMPLICATIONS

What strategies should investors follow in managing corporate-bond call risk? Well, you could first you could decide to invest only in bullet securities. Unfortunately, I don't think that makes sense, because you are giving up yield and total return opportunities. Second, you could avoid the nonrefunding structures, which I think may make sense for some of you. Third, you should look to identify and avoid issuers that have been more aggressive in employing certain early-redemption techniques. Finally, and most importantly, I think that every portfolio manager and every insurance company should begin to establish call and tender efficiency models for their own portfolios. I think that this would be a big stride over conventional call modeling as it is probably employed in many organizations currently.

In summary, we think that the call "problem" within the corporate bond market has probably peaked, even if interest rates continue to decline somewhat. At the same time, we are also very optimistic that during the next several years, new technologies will enable us to better model the sensitivity of these possible early calls in the corporate bond market.

MR. BOUSHEK: I think most of us are quite unaware of just how much optionality exists in the corporate bond market and how issuer-specific it may be.

We'd like to move now to a discussion of the prepayment characteristics of mortgage-backed securities (MBSs). Unlike corporate bonds, I'm afraid, there is no trend in the MBS market toward issuance of bullet structures. Optionality appears to be a permanent feature of this particular market.

At this time, I'd like introduce our second speaker, Dale Westhoff. As I mentioned earlier, Dale is a managing director in mortgage research at Bear Stearns, where he is responsible specifically for the analysis and modeling of MBS prepayments. Dale has been with Bear Stearns since 1990. Prior to that time, he was an engineer at Hughes Aircraft Company in the satellite communications division. He has dual degrees in civil engineering and computer science and also holds an MBA from New York University.

MR. DALE P. WESTHOFF: The timing of this conference is good. The major refinancing cycles that we've gone through in the last 1.5 years have really focused a lot of attention on MBS prepayments, and the proliferation in the number and types of highly-prepayment-sensitive securities available in the market has only intensified the scrutiny and focus on prepayment modeling. As an investor, you're generally short bad options in an MBS. The homeowner has the option to call his mortgage at any time, and evaluating that option for a pool of individual borrowers is a complex task that requires a lot of resources. At Bear Stearns, we have a team of seven people working full-time in the prepayment area to address that problem.

I'd like to touch briefly on the impact that prepayments have on MBS price and return performance and then spend the bulk of the time discussing the challenges of prepayment modeling.

When you look at the homeowner's option to prepay, you can really break that option down into four components, of which the first two are the most important. First, the option to resell your home provides a relatively constant base to the annual prepayment rate, something in the neighborhood of 5-7% per year regardless of the current level of interest rates. Second, the option to refinance can cause prepayment rates to jump as high as 60% per year and more. This component is tied very closely not only to the level of current interest rates, but also to the availability of refinancing alternatives and to a homeowner's ability to qualify for refinancing. Other components include loan default, which results eventually in full prepayment on most securities, and curtailment, which is nothing more than extra payments made monthly by some homeowners to shorten the effective term of their mortgage. These both tend to be fairly static components, generally accounting for less than 5% of the dollar value of prepayments for a given security.

Why are MBS yields so high relative to other fixed-income instruments on a duration-adjusted basis? Primarily because the imbedded prepayment option makes the timing of principal returns uncertain, and investors must be compensated for that risk. What impact does this uncertain timing have on price performance? Well, for a typical noncallable security, price moves inversely to interest rates; as interest rates increase, the market price decreases and vice versa. In addition, as interest rates rise/fall, the price becomes less/more sensitive to further changes in interest rates; this is referred to as positive convexity. From an investor's standpoint, this is a desirable characteristic. Most MBSs, by contrast, have negative convexity. As interest rates fall, market prices tend to rise to a premium above par. However, as interest rates continue to fall, prepayments accelerate, with principal returned at par. The result is an effective capping of price increases, which leads to total return underperformance. Conversely, as interest rates rise, market prices will tend to fall to a discount below par. At the same time, however, slowing prepayments extend the average life of most MBSs. This leads to a compounding decrease in market price and, once again, underperformance.

Just a quick note on prepayment terminology. In the MBS market, people will most often talk in terms of either constant prepayment percentage (CPP) or percentage of the Public Securities Association (PSA) prepayment model. These are both expressed in terms of effective annual rates. Sometimes you may hear the term *standard monthly mortality* (SMM) – this is simply the percentage of principal that pays down each month. The PSA model has come under a lot of pressure recently.

Under this model, prepayments are assumed to increase uniformly from 0% CPP to 6% CPP during the first 30 months from origination, remaining level thereafter. When it was first constructed back in the 1980s, this model fit historical interest-rate-neutral prepayment patterns well. However, borrower habits and lender practices have changed considerably in the face of the refinancing waves of the past two years. Multiple refinancings of a single loan have become commonplace. As an example, I recently looked up and tracked a Countrywide loan through three refinancings in a four-month span. With that kind of turnover, the PSA model goes out the window.

We've seen prepayment rates on some MBSs of over 2,000 PSA in the early months, which is really meaningless. At that point, you really have to return to CPPs. My stance on the PSA model is that for premium securities in today's environment, it really doesn't work anymore. However, it may still be reasonable for discount securities.

What I really want to focus on is modeling the prepayment option, in particular discussing the approach that we take at Bear Stearns. We've had some measure of success. No model can fully capture or anticipate all of the elements that will influence MBS prepayments. However, I do think it is possible to develop models that can produce reasonable assumptions. Our model begins with a good database. The various agencies (Ginnie Mae, Fannie Mae, and Freddie Mac) provide us with factors on every mortgage pool every month so that we can calculate historic prepayment rates. We have over 600,000 agency pools in our database, which we can aggregate in any number of ways. In particular, we can tie pools to a regional economic database that gives us some macro variables to use in trying to explain prepayments.

The traditional approach to modeling prepayments is to develop an econometric model by using regressions on historical data to forecast the future. There are some limitations to this approach, which I'll discuss more fully a little later.

At any rate, we define a series of independent variables to try to explain the monthly changes that we see in actual prepayment observations. Typically, there are four variables that are included in this framework. The first is the refinancing incentive. The most important and most functional forms of this variable deal with the gross weighted-average coupon on a mortgage pool relative to the prevailing mortgage rate in the market, with some kind of lag. There is a very nice historical relationship between interest rate differentials and prepayments. However, this relationship has not been static over time. In 1986-87, the rule of thumb was that a mortgage pool needed to be "in-the-money" by about 200 basis points to trigger a surge in prepayments. We've seen that same spread reduced to about 75 basis points. In 1986-87, our expected prepayment rate on pools that were 100 basis points "in-the-money" was right around 500 PSA. That expected rate is now 900 PSA.

The lowering of the refinancing threshold has come about because of fundamental changes in lender practices and borrower habits. Lenders now offer no-cost and low-cost refinancing to homeowners, leading to multiple refinancings by borrowers. In our office, some people have refinanced three to four times this year. In addition, the menu of refinancing alternatives available to borrowers has increased dramatically. There are not only 30-year loans, but 15-year loans, balloon loans, and adjustable-rate mortgages (ARMs). In today's environment, the 15-year rate tends to be about 50 basis points lower than the 30-year rate. In 1992, 42% of the refinancing of 30-year loans went into 15-year mortgages.

The second most important variable in prepayment modeling is probably premium burnout, the phenomenon of a pool of mortgages tending through time to get less and less sensitive to changes in interest rates. Why is that? Think of the borrowers behind a pool of mortgages having a continuum of transaction costs. Some have higher transaction costs; some have lower transaction costs. The homeowners with

the lowest transaction costs are the ones most likely to prepay very quickly if there is a refinancing incentive. As they leave the pool, you're increasingly left with people who are less able to refinance or are less sensitive to interest rates for whatever reason. Many of the borrowers left in higher-rate pools live in areas of the country that have seen significant declines in home values, especially the Northeast and California. Why haven't they refinanced? Basically, they can't qualify for new loans because their loan-to-value ratios now exceed the underwriting guidelines for Fannie Mae and Freddie Mac.

Some people try to point to borrower ignorance as a primary factor in prepayment burnout. I have trouble buying that argument. Borrowers have become much more sophisticated in their understanding of mortgage financing. I use my mom as a benchmark here. She's from rural Colorado and calls me up to chat about things like points and seven-year balloon mortgages. There just aren't that many people out there who are unaware of the benefits and terms of mortgage refinancing. I really think that burnout is much more a function of homeowner equity and individual intentions than borrower ignorance. The one thing that could really change future assumptions on prepayment burnout is a structural change in lender practices on low-equity/no-equity loans, which just may be in the works. Countrywide Mortgage, one of the biggest mortgage bankers in the country, has recently announced a refinance program for no-equity homeowners. In addition, the state of Connecticut has initiated a program that is targeted to homeowners in that state. If these programs are successful, the effect on prepayment burnout could be significant.

The third variable in most prepayment models is seasonality; that is, the tendency of prepayments to peak in the summer months and slow during the winter. This phenomenon is tied very much to the school year and is most evident for lower-coupon pools in which the refinancing option is "out-of-the-money."

The final variable is demographics, embodied in the aging of a pool of mortgages. This is the variable that is dealt with most directly in the PSA model. All things being equal, prepayments tend to peak between years five and seven, as people trade up to new homes.

The problem with the econometric approach to modeling is that you're using historic observations to forecast future prepayment rates. If there's any kind of change in the relationship between interest rates and prepayments or loan age and prepayments, your model is not going to capture that effect. The first time I saw this take place was right after the Gulf War. We saw a shift in consumer confidence and a spurt in housing market sales during February, but our model was showing declining prepayments because of the typical seasonality of home sales. More recently, the advent of no-cost/low-cost refinancing programs has had a significant impact on prepayment rates.

At Bear Stearns we make several external adjustments to our models. The first is for regional bias. Based on data that we get from Fannie Mae and Freddie Mac, we construct a prepayment index for each state relative to the national prepayment averages. Then, by tracking the regional composition of the pools in our database, we make adjustments to our prepayment assumptions for individual collateralized mortgage obligations (CMOs). California prepayment speeds, for example, have

traditionally been much faster than the rest of the U.S., and states in the Northeast have tended to show slower speeds. Interestingly, both of these trends are slowly reversing.

We also make an external adjustment for short-term estimates. It is difficult to capture fundamental changes in borrower and lender practices until we have enough data points to regress into our model. In the meantime, we try to take advantage of information in the mortgage "pipeline" about transactions that have already taken place. One key indicator that we use to calibrate our short-term forecast is the Mortgage Bankers of America (MBA) refinancing index. This index provides a weekly measure of mortgage refinancing applications by borrowers with all types of mortgages. Applications tend to precede prepayments reported by the various agencies by about three months, and despite its all-inclusive nature, the MBA index has shown a strong statistical correlation with subsequent prepayment reports from each of the agencies.

Some of you may be familiar with the prepayment forecasts available on Telerate from various Wall Street firms. Typically, these are lifetime yield-equivalent prepayment assumptions, not short-term forecasts. Let me explain what I mean by "lifetime yield-equivalent." When we produce a prepayment estimate for a given security, we are really producing a vector of up to 360 individual monthly speeds. These month-by-month projections incorporate seasonality, loan seasoning, long-term econometric regressions, and external adjustments. Unfortunately, it is difficult to convey 360-element vectors as a prepayment assumption.

To simplify things, we use our prepayment vector first to project cash flows for a given security and to determine its yield based on the current market price. Given this yield, we then solve for the single equivalent level prepayment speed that produces the same yield. This level speed is the lifetime yield-equivalent assumption.

I should probably spend just a moment discussing the differences in modeling Ginnie Mae pools versus Fannie Mae or Freddie Mac pools. Ginnie Mae pools comprise Federal Housing Administration (FHA) and Veterans Administration (VA) loans, Freddie Mac and Fannie Mae pools comprise conventional conforming loans. In addition to prepayment variances attributable to differences in the profile of the borrowers, FHA loans are simply much more difficult to refinance than other loans. Each new FHA loan requires a 3.8% up-front premium and a 50-basis-point annual insurance premium. As a result, Ginnie Mae prepayments tend to track prepayments for the other agencies with at least a 50-basis-point offset. Burnout also affects Ginnie Mae pools differently, and the assumability provision of VA and FHA loans tends to lower the base prepayment rate in times of high or rising interest rates.

MR. BOUSHEK: I think you'd all agree that our speakers have done an excellent job of discussing the prepayment characteristics of corporate bonds and mortgage-backed securities, respectively, and have also provided some excellent material for you to digest in this area.

MR. CRAIG W. REYNOLDS: Dale, on one of your graphs you showed prepayment speeds over time relative to the yield on 30-year treasuries. I was just curious why

you picked the 30-year rate and wondered if you really think that that's the best indicator.

MR. WESTHOFF: No, it isn't the best indicator. That's very perceptive. Actually, the best correlation for mortgage rates tends to be with the ten-year treasury.

MR. REYNOLDS: On one of your tables you had forecasts of prepayments for October, November, and December, and they were shown as zero. That kind of surprises me.

MR. MALVEY: I don't think that we can be that precise within the corporate market in terms of forecasting on a monthly basis. Within the corporate sector there is no instantaneous roll into a new product. There's leakage into commercial paper and into bank lines. The debt issue may either be used to effectively clean up short-term paper that was used to refinance long-term debt six months ago or be used to refinance a long-term-debt issue maturing in February 1994.

MR. MICHAEL J. KINZER: Your presentation focused on agency MBSs. How would you adjust for whole-loan paper?

MR. WESTHOFF: The whole-loan share of the MBS market has increased dramatically. Unfortunately, we simply do not have the nice data on whole loans that we have on conforming products. In truth, it is very issuer specific. Right now our approach is to look at how the nonconforming product is prepaying in aggregate relative to conforming products.

However, different issuers have different origination standards. Some may be very innovative and very aggressive about urging customers to refinance. This can lead to significant differences in prepayment experience. As we get more data on whole loans, we hope to be able to build more sophisticated models.