

THE CORPORATE BOND HIGH QUALITY CENTERED YIELD CURVE FOR PENSION DISCOUNTING

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This paper updates the Treasury White Paper on constructing corporate bond yield curves for the purpose of calculating pension liabilities and lump sum distributions.¹ The update extends the White Paper methodology for the AA corporate bond yield curve to the high quality centered yield curve, which is derived from bonds in the three high quality classes AAA, AA, and A combined. Features of the high quality centered curve are summarized, followed by results for the curve through the end of last year.

The High Quality Centered Yield Curve

The White Paper methodology focused on corporate bonds rated AA, which provides yield curves corresponding to AA quality. The high quality centered (HQC) yield curve methodology includes bonds rated AAA or A in addition to AA, and generates a yield curve which reflects the center of quality in the combined high quality market for AAA, AA, and A bonds.

The methodology for computing the HQC curve from the sample of high quality bonds builds on the White Paper methodology:

- ▶ The price of each bond is expressed as the discounted sum of the bond's cash flows, where the discount factors are given by a discount function. The discount function is expressed in terms of the forward rate which is modeled as a cubic spline.²
- ▶ Call options embedded in the bonds are accounted for by a regression variable which measures the length of time of call exposure.
- ▶ Coefficients are estimated by nonlinear least squares. As in the White Paper, the forward rate is kept constant beyond 30 years maturity at its value at 30 years, and together with the constraints on the forward rate in estimation, this assumption provides a seamless projection of yield curves beyond 30 years.

¹ The White Paper "Creating a Corporate Bond Spot Yield Curve for Pension Discounting" (February 7, 2005) can be found on the Treasury website at http://www.treas.gov/offices/economic-policy/reports/pension_yieldcurve_020705.pdf.

² As in the White Paper, the knots of the spline are placed at maturities 0, 1.5, 3, 7, 15, and 30 years, and the same endpoint constraints and forward rate constraints are imposed. Although the specific characteristics of the White Paper methodology carry over well to the HQC curves for the data used in this paper, movements in financial markets may at some point require adjustments to aspects of this methodology.

Adding AAA and A bonds to the AA bonds introduces heterogeneity into the sample, and necessitates extending the White Paper methodology as follows:

- ▶ In the White Paper, bonds were weighted by the square root of par value divided by the square root of duration. This scheme gives more weight to larger bonds, and also takes into account the greater volatility of bonds with longer duration. This scheme is kept for the HQC curve, but before weighting, all par values are rescaled to equalize the sums of the par values for the three quality classes. The rescaling makes each of the three classes equally important regardless of their relative sizes in the sample.
- ▶ Differences among classes are captured by two regression variables, one for AAA bonds and one for A bonds, formulated in terms of years to maturity. Therefore, the variables correspond to the hypothesis that there should be a greater quality differential in a bond price when the bond is of greater maturity.

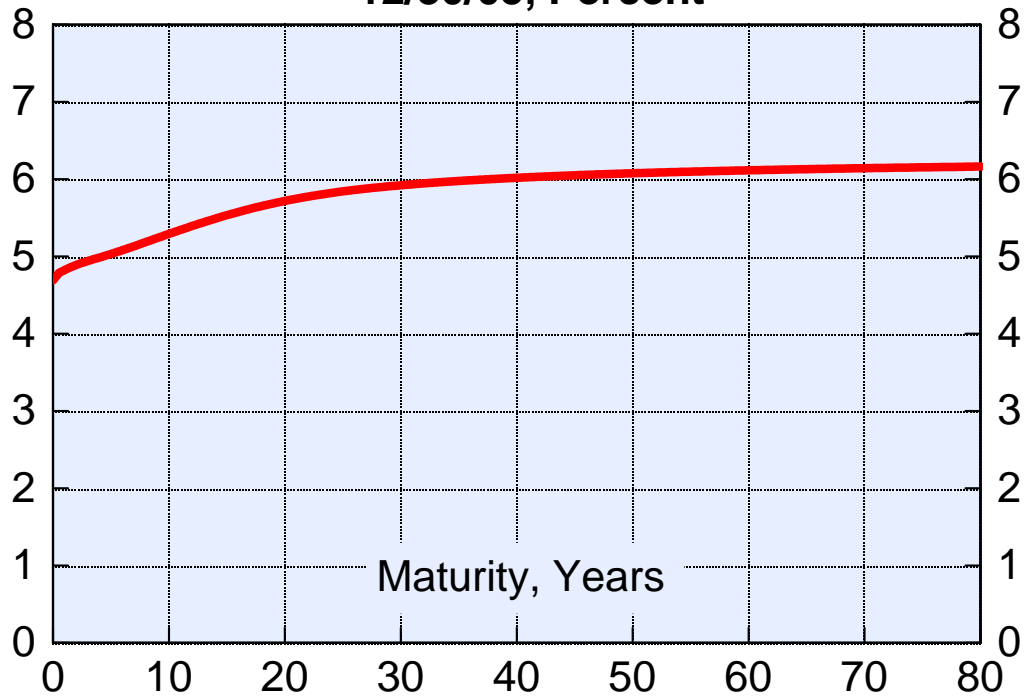
Results

As in the White Paper, bond data for prices and other daily attributes were obtained from an investment house, and the data are augmented by data on bond characteristics. Moreover, as before, for maturities of less than one year, these data are supplemented by AA commercial paper data from the Federal Reserve.

The sample of bonds for all three quality classes is much larger than the AA sample alone. Recently, for example, the samples being used for the HQC curves contain about 1,090 A bonds, about 420 AA bonds, and about 90 AAA bonds.

The following charts show results for the HQC yield curve for recent periods. The Appendix contains spot rates for December 2005.

Chart 1 on the next page shows the HQC spot yield curve for the last business day of 2005, which was Friday, December 30.

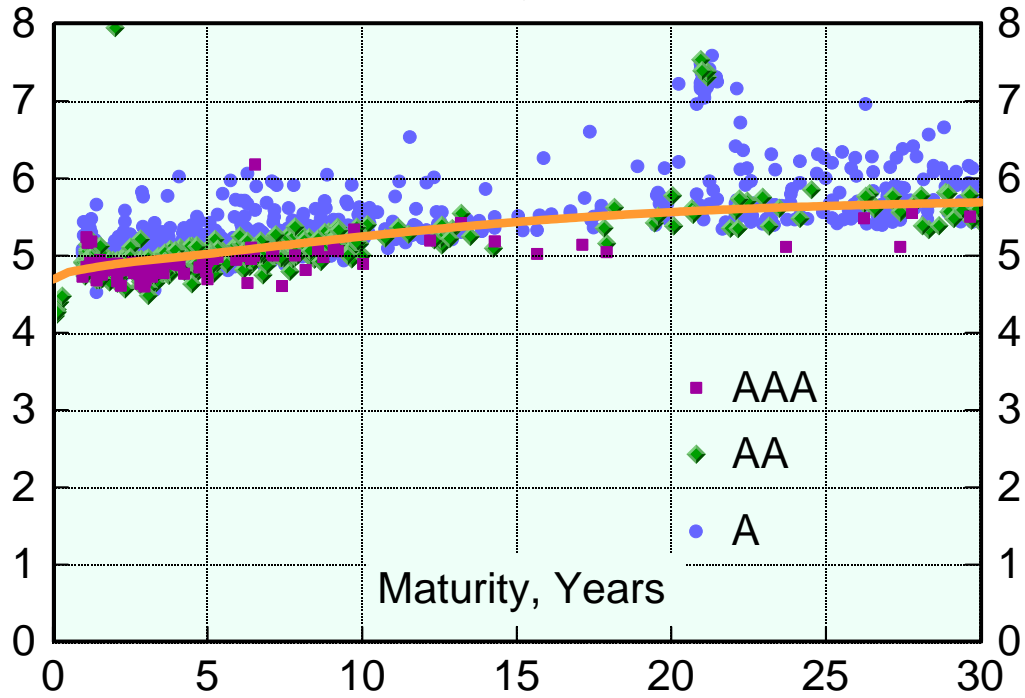
CHART 1**CORPORATE SPOT YIELD CURVE
HIGH QUALITY CENTERED****12/30/05, Percent**

The chart shows the recent flatness of the yield curve. At the short end, the spot rates start around 4.70 percent, and rise gradually to a bit over 6.15 percent in the projection period beyond 30 years.

Chart 2 depicts the par yield curve for this same date, also showing yields to maturity for all the bonds in the sample in all three quality classes.

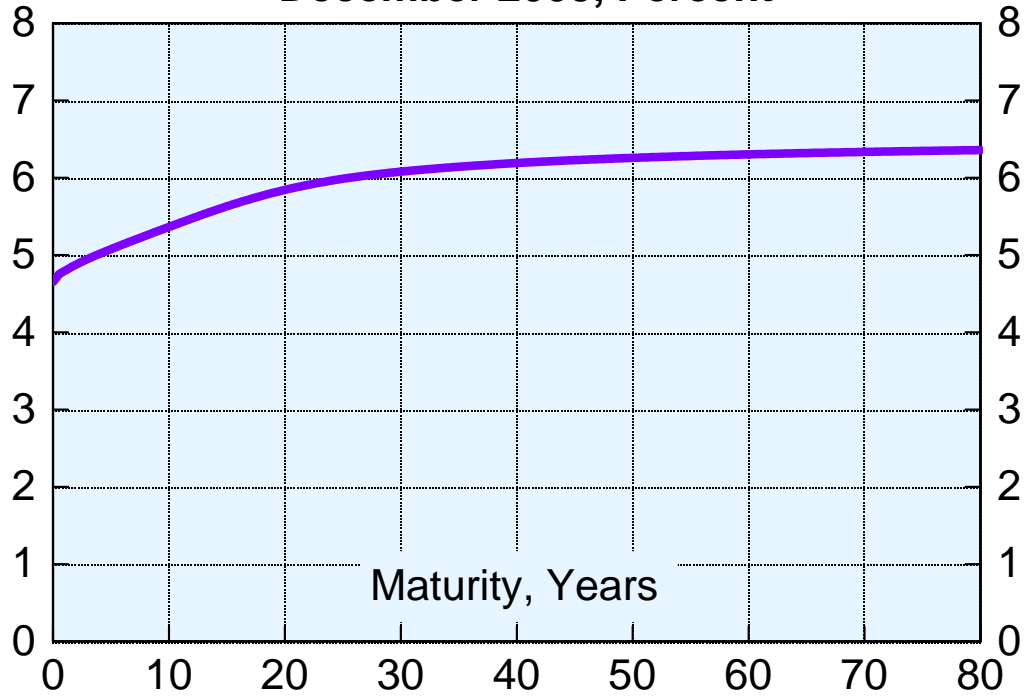
CHART 2**CORPORATE PAR YIELD CURVE
HIGH QUALITY CENTERED**

12/30/05, Percent

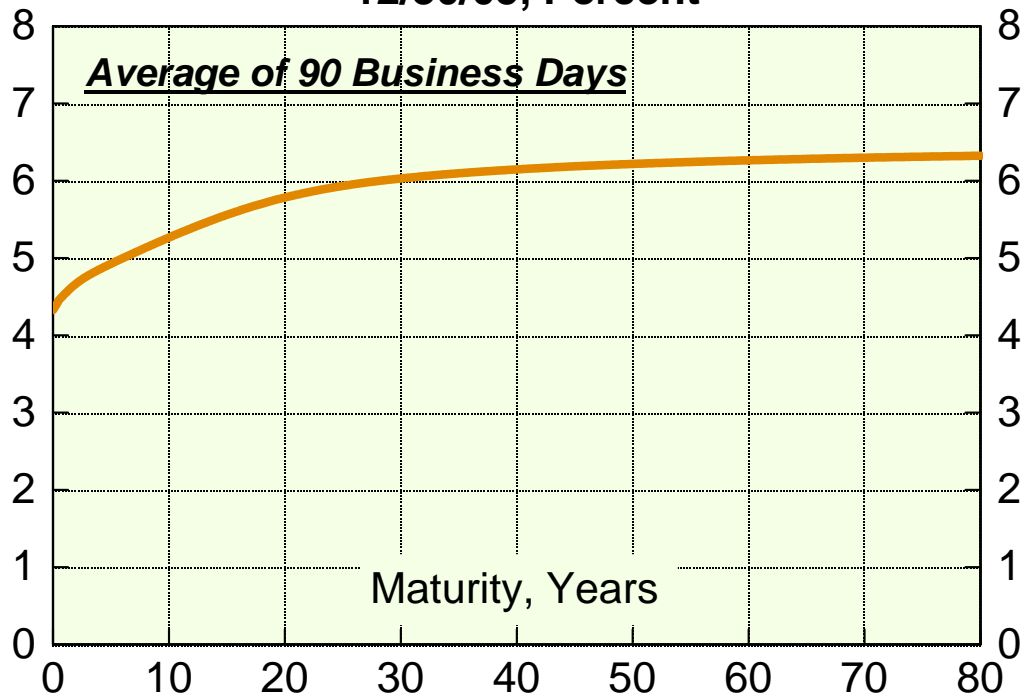


This chart shows that the HQC yield curve methodology produces a curve that falls in the center of the combined AAA, AA, and A market.

Chart 3 shows the average HQC spot yield curve for last December.

CHART 3**CORPORATE SPOT YIELD CURVE
HIGH QUALITY CENTERED****December 2005, Percent**

And Chart 4 shows the average HQC curve over the final 90 business days of last year.

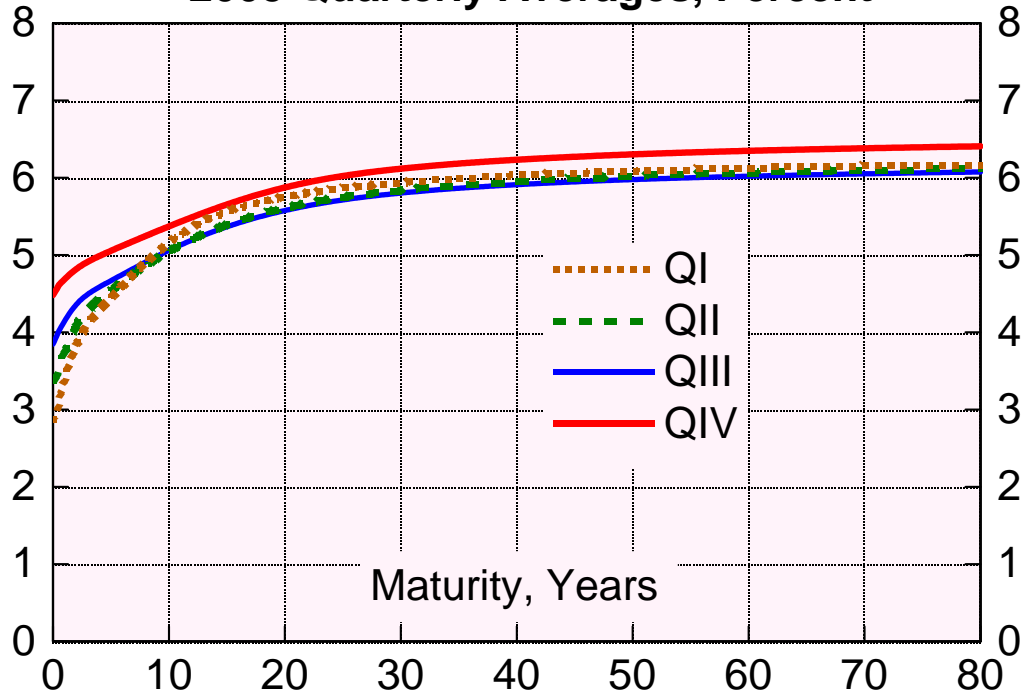
CHART 4**CORPORATE SPOT YIELD CURVE
HIGH QUALITY CENTERED****12/30/05, Percent**

The last two charts are similar to each other and to Chart 1, indicating stability in the yield curve recently.

Chart 5 plots quarterly averages of the HQC spot yield curve for each of the four quarters of last year.

CHART 5

CORPORATE SPOT YIELD CURVES HIGH QUALITY CENTERED 2005 Quarterly Averages, Percent

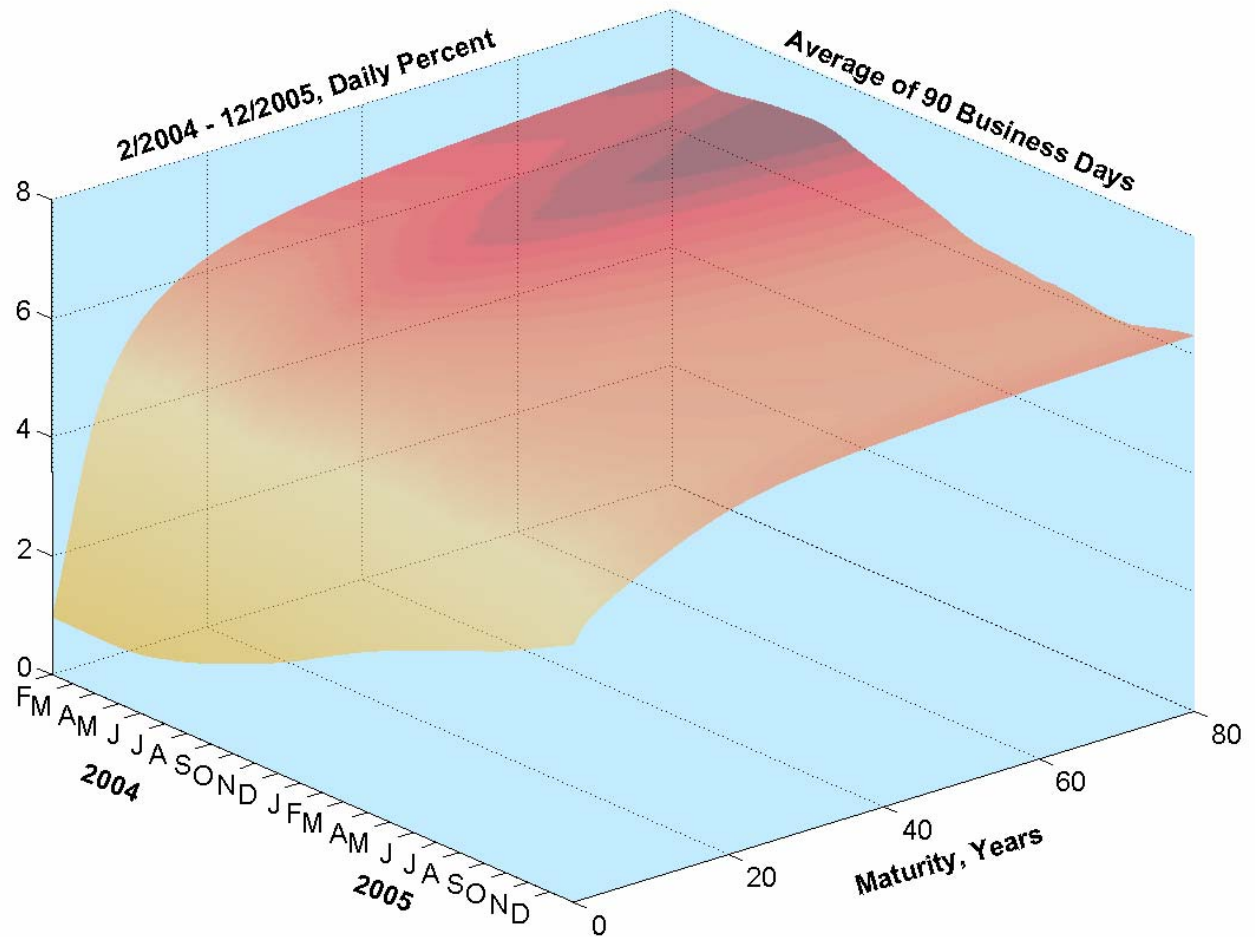


The chart shows that the curve rose a bit and flattened over the year, with the short end moving up more than the long end.

Finally, Chart 6 on the next page is a surface chart that depicts the movement of the 90-business-day averages of the HQC spot yield curves from February 2004 through December of last year.

CHART 6

CORPORATE HIGH QUALITY CENTERED SPOT YIELD CURVES



The chart shows that the 90-business-day averages of the HQC spot yield curves have evolved smoothly over the last two years, and at the same time have picked up market movements. At the longest maturity in the projection range of 80 years, the spot rates started around 7 percent, varied a bit, and now are around 6.3 percent. At 30 years maturity, the rates were a bit over 6-1/2 percent in February 2004, and now are about 6 percent. At the short end, the rates reflect the Federal Reserve tightening which began in mid-2004. The shortest maturity rates started at about 1 percent in February 2004 and now are about 4.3 percent.

Conclusion

The HQC yield curve as described in this update to the White Paper accurately measures the center of the combined market for corporate AAA, AA, and A bonds. The curve moves smoothly over time while remaining sensitive to market conditions. Therefore, it can be used as a high quality yield curve for pension discounting.

APPENDIX

SPOT YIELD CURVE, CORPORATE HIGH QUALITY CENTERED

December 2005 Average, Percent

Maturity, Years	Spot Rate	Maturity, Years	Spot Rate	Maturity, Years	Spot Rate	Maturity, Years	Spot Rate
0.5	4.75	20.5	5.86	40.5	6.20	60.5	6.30
1.0	4.80	21.0	5.88	41.0	6.20	61.0	6.31
1.5	4.84	21.5	5.89	41.5	6.20	61.5	6.31
2.0	4.88	22.0	5.91	42.0	6.21	62.0	6.31
2.5	4.92	22.5	5.92	42.5	6.21	62.5	6.31
3.0	4.95	23.0	5.94	43.0	6.21	63.0	6.31
3.5	4.98	23.5	5.95	43.5	6.22	63.5	6.32
4.0	5.02	24.0	5.96	44.0	6.22	64.0	6.32
4.5	5.05	24.5	5.98	44.5	6.23	64.5	6.32
5.0	5.08	25.0	5.99	45.0	6.23	65.0	6.32
5.5	5.11	25.5	6.00	45.5	6.23	65.5	6.32
6.0	5.14	26.0	6.01	46.0	6.24	66.0	6.32
6.5	5.17	26.5	6.02	46.5	6.24	66.5	6.32
7.0	5.19	27.0	6.03	47.0	6.24	67.0	6.33
7.5	5.22	27.5	6.04	47.5	6.24	67.5	6.33
8.0	5.25	28.0	6.05	48.0	6.25	68.0	6.33
8.5	5.28	28.5	6.06	48.5	6.25	68.5	6.33
9.0	5.31	29.0	6.06	49.0	6.25	69.0	6.33
9.5	5.34	29.5	6.07	49.5	6.26	69.5	6.33
10.0	5.37	30.0	6.08	50.0	6.26	70.0	6.34
10.5	5.39	30.5	6.09	50.5	6.26	70.5	6.34
11.0	5.42	31.0	6.09	51.0	6.26	71.0	6.34
11.5	5.45	31.5	6.10	51.5	6.27	71.5	6.34
12.0	5.48	32.0	6.11	52.0	6.27	72.0	6.34
12.5	5.50	32.5	6.11	52.5	6.27	72.5	6.34
13.0	5.53	33.0	6.12	53.0	6.27	73.0	6.34
13.5	5.56	33.5	6.13	53.5	6.28	73.5	6.34
14.0	5.58	34.0	6.13	54.0	6.28	74.0	6.35
14.5	5.61	34.5	6.14	54.5	6.28	74.5	6.35
15.0	5.63	35.0	6.14	55.0	6.28	75.0	6.35
15.5	5.66	35.5	6.15	55.5	6.28	75.5	6.35
16.0	5.68	36.0	6.15	56.0	6.29	76.0	6.35
16.5	5.70	36.5	6.16	56.5	6.29	76.5	6.35
17.0	5.72	37.0	6.16	57.0	6.29	77.0	6.35
17.5	5.75	37.5	6.17	57.5	6.29	77.5	6.35
18.0	5.77	38.0	6.17	58.0	6.30	78.0	6.35
18.5	5.79	38.5	6.18	58.5	6.30	78.5	6.36
19.0	5.81	39.0	6.18	59.0	6.30	79.0	6.36
19.5	5.83	39.5	6.19	59.5	6.30	79.5	6.36
20.0	5.84	40.0	6.19	60.0	6.30	80.0	6.36