Median thrift sensitivity rose to 190 basis points in the fourth quarter, up from 177 basis points in September. This increase reflects the rise in medium- and long-term interest rates between the third and fourth quarters.

Both the median pre- and post-shock Net Portfolio Value (NPV) ratios rose between the third and fourth quarters. In addition, the fourth quarter saw the number of thrifts with high interest rate risk rise to 21, up from 15 thrifts in the previous quarter.

**Spot and Forward Rates in the NPV Model**

Thrifts hold a wide variety of assets and liabilities in their portfolios. Despite obvious differences, all of these financial instruments have one important feature in common: their fair market values are equal to the present discounted values of the cash flows that occur over the lifetime of the instruments.

An important question arises as to what is the appropriate interest rate to use in discounting the cash flows. In deciding which discount rate to use for an asset, say a bond, it is important to take into account the characteristics of that bond. For example, is the bond a zero-coupon or a coupon bond?

Because Treasury securities have no credit risk, the rates on these instruments serve as benchmark rates with which to compare the rates of other financial instruments that contain credit risk. Thus, while the following discussion focuses on Treasury rates, it can easily be generalized through the incorporation of credit spreads.

The NPV Model uses Treasury spot and implied forward rates to produce present value estimates of Treasury securities. Securities other than Treasuries are valued using spot and forward rates where spreads are added to account for different levels of credit risk.

In order to understand spot and forward interest rates, we need to define two other relevant interest rates: yield to maturity (YTM) and constant maturity Treasury (CMT) rates.

**Yield to maturity** is also known as effective rate of return, is the annualized percentage return of a non-callable bond held until its stated maturity. In using this yield measure, one assumes that the security is held until maturity and that all cash flows can be reinvested at the same constant YTM. With this rate measure, it is important to note that all cash flows associated with the bond are discounted at the same rate.
Spot and Forward Rates in the NPV Model (continued)

(Continued from page 1)
rate.

Several drawbacks are associated with the use of yield to maturity: Investors typically do not hold fixed-income investments until maturity; interim cash flows cannot usually be reinvested at the assumed constant yield; and it is not possible to compare returns on investments with different maturities, different coupons, and more complex return/risk profiles.

Constant maturity Treasury rates are yields to maturity produced by the U.S. Treasury from the daily Treasury yield curve. The constant maturity Treasury yields are calculated based on the closing market bids on actively traded Treasury securities in the over-the-counter market. As the name implies, these rates are for a given set of fixed, or constant, maturities. That is, as rate schedules are published over time, the underlying securities must be changed such that their time remaining to maturity most precisely concords with the time frames for which the rates are being quoted.

Because constant maturity Treasury rates are yields to maturity, the drawbacks discussed above apply to their use. When discussing the Treasury yield curve, it should be noted that the rates depicted in the curve are yields that are constant maturity Treasury yields.

By definition, the spot rate for a particular maturity is the yield on a zero-coupon bond with that maturity. For example, the two-year spot Treasury rate is the yield on a zero-coupon Treasury with a two-year maturity.

The spot rate curve is the graphical representation of the spot rates corresponding to various maturities. The Treasury spot rate will only be identical to the actual yield for discount Treasury securities, such as the 3 and 6 month Treasury bills. The complete theoretical spot rate curve, however, must be derived from the yields on Treasury bills, as well as coupon-paying Treasury bonds.

Bootstrapping is the standard technique used to construct the theoretical Treasury spot-rate curve from observed yields on both Treasury bills and bonds. The basic principle underlying this approach is that the cash flows on a coupon-bond can be viewed as a series of zero-coupon or discount bonds for each coupon payment and maturity date. Thus, the value of a Treasury coupon security for a given maturity is equal to the value of the series of zero-coupon Treasury securities that reproduces the coupon bond’s cash flows.

The NPV Model uses the bootstrapping approach to construct Treasury spot rates. These spot rates are reported for selected maturities at the end of each quarter by OTS in the Asset/Liability Price Tables published on its website. Forward rates are the market’s expectation as to what the spot rate will be at a particular point in the future. Because forward rates are derived from the spot rate curve under the assumption of no arbitrage (i.e., riskless profits can not be earned), they are usually referred to as implied forward rates. For example, the expected yield on a three-month Treasury bill three months from now is called an implied forward rate. That is, it is the expected rate for this particular future time frame implied by the current spot yield curve. At the end of each quarter, the Asset/Liability Price Tables report implied one-month forward rates for a selected set of maturities.

Based on the rate definitions above, we can now discuss how the NPV Model calculates theoretical spot and implied forward rates, and how these rates are used in asset and liability valuations. This discussion draws on material from “Term Structures and Projected Interest Rates,” Chapter 8, The OTS Net Portfolio Model.

To begin the process, data on constant maturity Treasury rates are obtained from Federal Reserve Statistical Release, H.15 (previously obtained from G.13). The maturities for which these yields are available are 1, 3, and 6 months, and 1, 2, 3, 5, 7, 10, 20, and 30 years. Because the NPV Model requires monthly market yields going out 360 months, an estimation method known as “splining” is used to produce estimates of yields for maturities with no available market quotes.

Once a full set of 360 CMTs is obtained, the NPV Model uses the bootstrapping technique to generate the theoretical spot-rate curve for the base case scenario, whose estimation is based on having different spot rates for each and every month, going out 360 months.

Questions arise each quarter as to why the spot-rate curve produced by the NPV Model and the spot-rate curve obtained from Bloomberg differ, even though both curves are bootstrapped. The spot-rate estimates differ because the splining or smoothing techniques are not identical.

Given the spot-rate curve bootstrapped from the constant maturity Treasuries, the NPV Model calculates implied one-month forward rates. For example, the implied one-month forward rate in month 24 is calculated based on the 24- and 25-month theoretical spot rates. These one-month implied forward rates are rates that the market expects to prevail in the future for one-month time horizons.

At the end of each quarter, the NPV Model also generates term structure estimates and projected future rates for LIBOR, FHLLB, and retail and secondary market CD rates using the same methods described above. The foregoing discussion focuses on Treasury spot and forward rates, since these are the areas most closely watched by users of the NPV Model results.

It is hoped that this discussion will help to promote a better understanding of the rates used by the NPV Model, how they are defined, and how they are calculated.
(Continued from page 1)

Medium- and long-term Treasury rates rose, while rates on Treasuries with maturities less than two years fell, between the third and fourth quarters. In addition, the 30-year mortgage rate rose to 7.16 percent at the end of the fourth quarter.

The changes in interest rates between the third and fourth quarters created a favorable lending environment for the typical thrift. As a result of a more steeply sloped yield curve, thrifts saw their net interest margins rise. For example, the industry’s average net interest margin improved to 312 basis points in the third quarter, up from 294 basis points in the prior quarter.

The ARM share of total thrift mortgage originations fell to 26 percent, down from 36 percent in the prior quarter. Along with the relative fall in ARM originations, the share of ARM mortgages held in portfolio fell to 54.9 percent in the fourth quarter.

The fourth quarter saw a rebound in mortgage originations due to delays in loan settlement for a short period of time following the September 11 terrorist attacks. Fourth-quarter 1-4 family mortgage originations by thrifts stood at $110.4 billion, up six percent from $103.8 billion in the third quarter. Total mortgage originations in the fourth quarter were at a level of $124.2 billion, up from $118.7 billion in the third quarter.

Thrifts’ share of all 1-4 family originations was 17 percent in the fourth quarter, down from 23.4 percent in the third quarter.

(Continued on page 4)
fourth quarter witnessed a slight decrease in U.S. home ownership, falling to 68 percent from 68.1 percent by quarter-end.

Refinancing activity of all mortgages accounted for 41 percent of thrift originations in the fourth quarter, up sharply from 28.8 percent in the third quarter. This increase is consistent with the mortgage refinancing activity of all lenders, with the rate rising dramatically to 70 percent in the fourth quarter, up from 45 percent in the prior quarter.

Fourth-quarter earnings rose to a new record of $2.93 billion, up from $2.61 billion in the third quarter.

The industry’s average effective duration of assets rose from 1.89 to 2.07 between the third and fourth quarters, due to the rise in interest rates. As rates rise, the NPV Model yields a decrease in the predicted rate of mortgage prepayments. This decrease in the predicted rate of mortgage prepayments causes, in turn, increases in the durations of mortgage assets.

The industry’s average effective duration of liabilities fell slightly to 1.38 in the fourth quarter, down from 1.39 in the prior quarter.

The median pre-shock NPV ratio for the industry rose from 12.2 percent to 12.5 percent between the third and fourth quarters.

The median post-shock NPV ratio rose to 10.8 percent in the fourth quarter, up from 10.6 percent in the prior quarter.

(Continued on page 5)
At the end of the fourth quarter, a 200 basis point increase in rates would result in a loss in net portfolio value for 848 thrifts, while 88 thrifts would see their net portfolio values rise. In the event that rates fell by 100 basis points, 760 thrifts would see their net portfolio values rise, while 176 thrifts would see a decrease in their net portfolio values.

The number of thrifts with a post-shock NPV ratio below 4 percent rose to 17. This represents the second consecutive quarterly increase in this number.

With a 200 basis point increase in interest rates, the thrift industry would lose 15 percent of its net portfolio value. This net portfolio loss is up only slightly from 14 percent in the previous quarter, and is consistent with the rise in median sensitivity.

The percentage of thrifts with a post-shock NPV ratio over 6 percent decreased to 491 in the fourth quarter, down from 552 in the third quarter.

(Continued from page 4)
(Continued from page 5)

The number of thrifts with over 400 basis points in sensitivity rose to 82 in the fourth quarter, up sharply from 51 in the third quarter. The rise in medium- and long-term interest rates led to the aforementioned increase in the number of thrifts with high interest rate risk from 15 to 21 between the third and fourth quarters.

Due to the abnormally low short term interest rates prevailing at the end of the fourth quarter of 2001, the rate shocks for producing sensitivities and post-shock NPVs were modified from +/-200 bps to +200/-100 bps. For this reason, the reader should exercise caution in making comparisons in the interest rate risk measures between the third and fourth quarters.

CMR Reporting of Mortgage Derivatives

Beginning with the March 2002 reporting cycle, thrifts must provide market value estimates for all their mortgage derivatives on Schedule CMR. This reporting change means that market values need to be supplied for both high and low risk mortgage derivatives.

Using contract code 123 from Appendix D, Thrift Financial Report Instruction Manual, the market values of all mortgage derivatives are now reported on the “Supplemental Reporting of Market Value Estimates” page of CMR. This change will produce more accurate NPV estimates.
Appendix A — All Thrifts

**Sensitivity Measure Distribution**

**All Thrifts**

![Graph](image)

**Descriptive Statistics**
- Median = 190
- Mean = 203
- Standard Deviation = 137
- Skewness = 0.2
- Kurtosis = 36.2
- Maximum = 85.65
- Minimum = 0
- Count = 936

**Pre-Shock NPV Ratio Distribution**

All Thrifts

![Graph](image)

**Descriptive Statistics**
- Median = 12.49
- Mean = 14.29
- Standard Deviation = 7.66
- Skewness = 4.85
- Kurtosis = 34.14
- Maximum = 85.84
- Minimum = 3.12
- Count = 936

**Post-Shock NPV Distribution**

All Thrifts

![Graph](image)

**Descriptive Statistics**
- Median = 10.16
- Mean = 12.26
- Standard Deviation = 7.7
- Skewness = 5
- Kurtosis = 36.2
- Maximum = 85.65
- Minimum = 0.08
- Count = 936

**Asset Duration Distribution**

All Thrifts

![Graph](image)

**Descriptive Statistics**
- Median = 2.07
- Mean = 2.06
- Standard Deviation = 0.76
- Skewness = -0.1
- Kurtosis = 2.18
- Maximum = 6.09
- Minimum = -2.22
- Count = 936

**Liabilities Duration Distribution**

All Thrifts

![Graph](image)

**Descriptive Statistics**
- Median = 1.38
- Mean = 1.39
- Standard Deviation = 0.38
- Skewness = 0.44
- Kurtosis = 3.94
- Maximum = 4.06
- Minimum = -0.39
- Count = 936
Appendix B — Northeast Region

Sensitivity Measure Distribution
Northeast

Pre-Shock NPV Ratio Distribution
Northeast

Post-Shock NPV Distribution
Northeast

Asset Duration Distribution
Northeast

Liabilities Duration Distribution
Northeast

Descriptive Statistics
Median = 265
Mean = 256
Standard Deviation = 120
Skewness = -0.05
Kurtosis = -0.55
Maximum = 532
Minimum = 20
Count = 196

Descriptive Statistics
Median = 13.21
Mean = 15.31
Standard Deviation = 8.85
Skewness = 4.64
Kurtosis = 28.43
Maximum = 80.54
Minimum = 4.56
Count = 196

Descriptive Statistics
Median = 11.01
Mean = 12.75
Standard Deviation = 9.11
Skewness = 4.66
Kurtosis = 28.73
Maximum = 80.25
Minimum = 2.84
Count = 196

Descriptive Statistics
Median = 2.37
Mean = 2.37
Standard Deviation = 0.67
Skewness = -0.89
Kurtosis = 3.44
Maximum = 4.08
Minimum = -1.09
Count = 196

Descriptive Statistics
Median = 1.49
Mean = 1.51
Standard Deviation = 0.33
Skewness = 0.25
Kurtosis = 0.04
Maximum = 2.43
Minimum = 0.68
Count = 196
Appendix C — Southeast Region

Sensitivity Measure Distribution
Southeast

Descriptive Statistics
Median = 164
Mean = 200
Standard Deviation = 152
Skewness = 0.82
Kurtosis = -0.11
Maximum = 668
Minimum = 7
Count = 182

Pre-Shock NPV Ratio Distribution
Southeast

Descriptive Statistics
Median = 12.26
Mean = 13.51
Standard Deviation = 4.66
Skewness = 1.03
Kurtosis = 0.9
Maximum = 29.95
Minimum = 4.48
Count = 182

Post-Shock NPV Distribution
Southeast

Descriptive Statistics
Median = 10.35
Mean = 11.5
Standard Deviation = 4.65
Skewness = 0.78
Kurtosis = 0.68
Maximum = 26.16
Minimum = 1.59
Count = 182

Asset Duration Distribution
Southeast

Descriptive Statistics
Median = 1.86
Mean = 2.02
Standard Deviation = 0.79
Skewness = 0.35
Kurtosis = -0.28
Maximum = 4.4
Minimum = 0.29
Count = 182

Liabilities Duration Distribution
Southeast

Descriptive Statistics
Median = 1.32
Mean = 1.33
Standard Deviation = 0.38
Skewness = -0.27
Kurtosis = 1.88
Maximum = 2.41
Minimum = -0.39
Count = 182
Appendix D — Central Region

### Sensitivity Measure Distribution

#### Central

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<th>Basis Points</th>
<th>Percent of Thrifts</th>
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<td>700</td>
<td>8</td>
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<td>800</td>
<td>7</td>
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#### Descriptive Statistics
- Median = 213
- Mean = 214
- Standard Deviation = 131
- Skewness = 0.49
- Kurtosis = -0.01
- Maximum = 652
- Minimum = 12
- Count = 279

---

### Pre-Shock NPV Ratio Distribution

#### Central

<table>
<thead>
<tr>
<th>NPV Ratio (Percent)</th>
<th>Percent of Thrifts</th>
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</thead>
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<td>70</td>
<td>8</td>
</tr>
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<td>80</td>
<td>7</td>
</tr>
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#### Descriptive Statistics
- Median = 13.25
- Mean = 14.46
- Standard Deviation = 6.55
- Skewness = 3.44
- Kurtosis = 19.07
- Maximum = 62
- Minimum = 4.37
- Count = 279

---

### Post-Shock NPV Distribution

#### Central

<table>
<thead>
<tr>
<th>NPV Ratio (Percent)</th>
<th>Percent of Thrifts</th>
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<td>70</td>
<td>8</td>
</tr>
<tr>
<td>80</td>
<td>7</td>
</tr>
</tbody>
</table>

#### Descriptive Statistics
- Median = 11.16
- Mean = 12.32
- Standard Deviation = 6.51
- Skewness = 3.56
- Kurtosis = 20.58
- Maximum = 59.97
- Minimum = 0.08
- Count = 279

---

### Asset Duration Distribution

#### Central

<table>
<thead>
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<th>Duration</th>
<th>Percent of Thrifts</th>
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#### Descriptive Statistics
- Median = 2.15
- Mean = 2.13
- Standard Deviation = 0.74
- Skewness = 0.03
- Kurtosis = 4.99
- Maximum = 6.09
- Minimum = -1.77
- Count = 279

---

### Liabilities Duration Distribution

#### Central

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<th>Duration</th>
<th>Percent of Thrifts</th>
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<tr>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>More</td>
<td>5</td>
</tr>
</tbody>
</table>

#### Descriptive Statistics
- Median = 1.36
- Mean = 1.4
- Standard Deviation = 0.35
- Skewness = 0.49
- Kurtosis = 3.42
- Maximum = 2.84
- Minimum = 0.03
- Count = 279

---
Appendix E — Midwest Region

Sensitivity Measure Distribution

Descriptive Statistics
Median = 110
Mean = 151
Standard Deviation = 122
Skewness = 1.05
Kurtosis = 0.32
Maximum = 533
Minimum = 0
Count = 204

Pre-Shock NPV Ratio Distribution

Descriptive Statistics
Median = 11.88
Mean = 13.89
Standard Deviation = 9.17
Skewness = 5.53
Kurtosis = 36.92
Maximum = 85.84
Minimum = 3.12
Count = 204

Post-Shock NPV Distribution

Descriptive Statistics
Median = 12.38
Mean = 12.38
Standard Deviation = 9.17
Skewness = 5.66
Kurtosis = 38.68
Maximum = 85.65
Minimum = 1.05
Count = 204

Asset Duration Distribution

Descriptive Statistics
Median = 1.7
Mean = 1.8
Standard Deviation = 0.71
Skewness = -0.41
Kurtosis = 4.07
Maximum = 3.52
Minimum = -2.22
Count = 204

Liabilities Duration Distribution

Descriptive Statistics
Median = 1.36
Mean = 1.39
Standard Deviation = 0.44
Skewness = 1.31
Kurtosis = 7.26
Maximum = 4.06
Minimum = 0.08
Count = 204
Appendix F — West Region

Sensitivity Measure Distribution  
West  

Descriptive Statistics  
Median = 133  
Mean = 172  
Standard Deviation = 143  
Skewness = 1.38  
Kurtosis = 2.32  
Maximum = 707  
Minimum = 5  
Count = 75

Pre-Shock NPV Ratio Distribution  
West

Descriptive Statistics  
Median = 12.32  
Mean = 14.03  
Standard Deviation = 9.2  
Skewness = 4.51  
Kurtosis = 25.56  
Maximum = 73.94  
Minimum = 6.9  
Count = 75

Post-Shock NPV Distribution  
West

Descriptive Statistics  
Median = 12.6  
Mean = 12.31  
Standard Deviation = 9.22  
Skewness = 4.65  
Kurtosis = 26.56  
Maximum = 72.75  
Minimum = 4.05  
Count = 75

Asset Duration Distribution  
West

Descriptive Statistics  
Median = 1.73  
Mean = 1.85  
Standard Deviation = 0.79  
Skewness = 0.54  
Kurtosis = 0.52  
Maximum = 4.02  
Minimum = 0.11  
Count = 75

Liabilities Duration Distribution  
West

Descriptive Statistics  
Median = 1.27  
Mean = 1.24  
Standard Deviation = 0.39  
Skewness = -0.2  
Kurtosis = 1.5  
Maximum = 2.24  
Minimum = 0.04  
Count = 75