Volume 8, Issue 3

Third Quarter, 2003

The Quarterly Review Of Interest Rate Risk

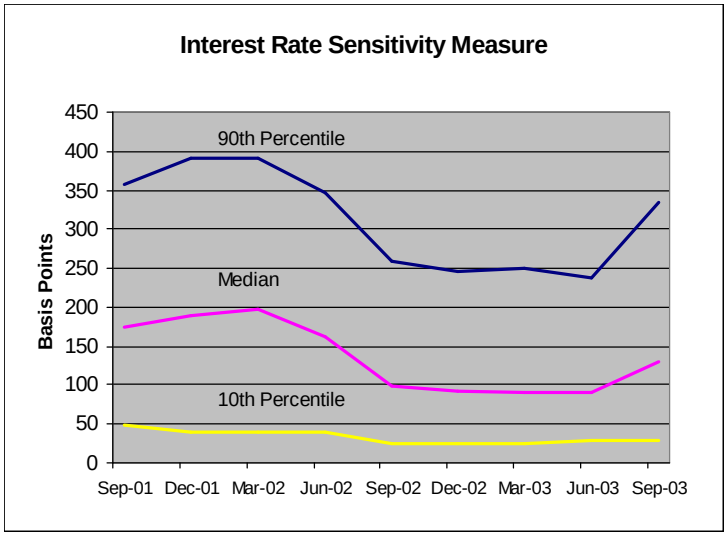
Office of Supervision,
Economic Analysis Division

Third Quarter Interest Rate Sensitivity Rises

Median interest rate sensitivity increased from 91 basis points in the second quarter to 130 basis points in the third quarter. This sharp rise in sensitivity for the thrift industry was due to the increase in interest rates in the third quarter.

The median pre–shock Net Portfolio Value (NPV) ratio rose in the third quarter, while the median post-shock NPV ratio fell slightly.

The number of thrifts with high interest rate risk rose to seven institutions, up from three in the previous quarter. (*Continued on page 4*)



Special points of interest:

- 30-yr mortgage rate rises
- Yield curve rises in the third quarter
- Third quarter median interest rate sensitivity increases
- Asset duration rises while liability duration falls
- Comparative Regional Analysis
- Feature Article on Interest Rate Risk and Alternative Methods for Its Measurement

Charts in this issue:

Interest Rate Risk and Alternative Methods for Its Measurement

The increased volatility and unprecedented high levels of interest rates in the late 1970s and early 1980s forced financial institutions to recognize the importance of asset-liability management in controlling their interest rate risk exposure, while still achieving acceptable profitability and capital levels.

Several different approaches, or models, can be used to measure a financial institution's exposure to interest rate risk. Among the simplest of these approaches are: the repricing gap model, the maturity gap model, and the duration gap model. And, while more complex approaches are available, such as Value at Risk models, these three methods still play a role in measuring an institution's interest rate risk.

For most financial institutions, there exists either a positive or negative gap between the interest-rate-sensitive assets and interest-rate-sensitive liabilities held in their portfolios. Each of the approaches discussed below is based on a different definition of the asset-liability gap.

For example, in the duration gap model (where duration is a measure of the sensitivity of the value of a financial instrument to interest rate changes), the typical thrift's portfolio is characterized by a positive asset-liability gap.

This positive gap is the direct result of funding long-term assets, such as mortgages, with short-term borrowings, such as certificates of deposit.

As a result, a rise in interest rates produces a decline in both the net interest income and equity of these institutions because the duration of assets is higher than the duration of liabilities.

We will discuss each of the three basic models for measuring interest risk exposure, along with several variations of the duration gap model, including those based on Macaulay duration and effective duration. (Our discussion draws

(Continued on page 2)

Interest Rate Risk and Alternative Methods for Its Measurement (continued)

(Continued from page 1)
heavily from A. Saunders and M. Cornett, *Financial Institutions Management*, Fourth Edition, chapters 8 and 9.)

The Repricing Gap Model

The repricing, or funding, gap model focuses on the gap between the interest income earned on a financial institution's assets and the interest paid on its liabilities over a given repricing time period. Unlike the maturity gap and duration gap models where the market value changes for assets and liabilities brought about by interest rate changes, repricing gap analysis is based only on book value accounting cash flows.

Book value accounting involves reporting, for example, the historic values of securities purchased, loans made, and liabilities on the balance sheets of financial institutions. No adjustment is made to account for the effects of interest rate changes on the market values of fixed-income securities.

Typically, the repricing time periods, or buckets, used in the repricing model include one day, one day to three months, three months to six months, six months to 12 months, one year to five years, and over five years.

By definition, the repricing gap for a particular repricing bucket, say, the one-day period, is the dollar size of the imbalance between the book value of rate-sensitive assets and the book value of rate-sensitive liabilities with a repricing period of one day.

In order to calculate the financial institution's net interest income exposure to changes in interest rates for the one-day bucket, one would multiply the imbalance for this maturity bucket times the annualized change in interest rates.

In the repricing gap model, rate sensitivity is measured by the period of time that the financial institution must wait to change the posted rates on its assets and liabilities.

There are both advantages and disadvantages associated with using the repricing gap model's measure of an institution's asset-liability gap. The advantages include simplicity of calculation and information value regarding the net interest income exposure of an institution in different maturity buckets to changes in interest rates.

The disadvantages of the repricing gap model fall into four areas. First, it ignores the market value effects of interest rate changes on the present values of assets and liabilities. As a result, this approach can only provide a partial measure of a financial institution's interest rate risk exposure in each maturity bucket.

Second, this approach is overly aggregative in that it assumes that all assets and liabilities in a particular maturity bucket actually reprice at the same time.

Third, cash flow runoffs for both assets and liabilities that are sensitive to interest rate changes, such as securities with embedded options, are ignored in the repricing gap model. As a result, the imbalances for some or all maturity buckets will be measured with error, producing an incorrect asset-liability gap measure.

Finally, the repricing gap model is incapable of producing an aggregate repricing gap or imbalance measure of overall net interest income exposure. This is because the aggregate book value of assets is equal to the aggregate book value of liabilities, which means that the cumulative repricing gap is always zero.

The Maturity Gap Model

In contrast to the repricing gap model, the maturity gap model explicitly accounts for the effects of changes in interest rates on the market values of assets and liabilities.

More specifically, the maturity gap model takes into account the following: (1) a rise (fall) in interest rates generally produces a fall (rise) in the market value of an asset or liability; (2) the longer the maturity of a fixed-income asset or liability, the larger the fall (rise) in market value for any given interest rate increase (decrease); and (3) the fall in the market value of longer-term securities rises at a diminishing rate for any given increase in interest rates.

By definition, the maturity gap for a financial institution is the difference between the weighted-average maturity of its assets and the weighted-average maturity of its liabilities. The portfolio asset and liability weights used in the calculation are measured by the market value of the asset (liability) position divided by the market value of all assets (liabilities).

As such, the maturity gap measures the size and direction of the mismatch between the maturities of a financial institution's assets and liabilities. The net effect of changes in interest rates on a financial institution's balance sheet will depend on whether the maturity gap is positive, negative, or zero.

The maturity gap model specifically incorporates the following general rules for a financial institution's portfolios of fixed-income assets and liabilities: (1) a rise in interest rates typically reduces the market values of asset and liability portfolios; (2) the longer the maturity of the asset or liability portfolio, the greater the fall in the market value for any given interest rate increase; and (3) the fall in the market value of the asset or liability portfolio increases with its maturity at a diminishing rate.

For the case of the typical thrift, the maturity of assets is longer than the maturity of liabilities, since it funds longer-term assets with shorter-term liabilities. As a result, the maturity gap is positive.

This means that a rise in interest rates reduces

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Interest Rate Risk and Alternative Methods for Its Measurement (continued)

(Continued from page 2)
the market value of assets by more than the market value of liabilities, resulting in a fall in the thrift's market value of net worth.

There are both advantages and disadvantages associated with using the maturity gap model's measure of an institution's asset-liability gap. The advantages are explicitly accounting for the market value effects of interest rate changes and that it produces an aggregate measure of a financial institution's asset-liability gap that can be used in risk management.

Its disadvantages are that it ignores the duration or average waiting time for cash flows associated with assets and liabilities, and that it fails to account for the degree of leverage (the proportion of assets funded by liabilities) in an institution's balance sheet.

The Duration Gap Model

Like the maturity gap model, the duration gap model explicitly accounts for the market value effects of changes in interest rates. In addition, it produces an aggregate measure of a financial institution's asset-liability gap that accounts for the duration of assets and liabilities and the degree of leverage in the balance sheet.

In the most basic sense, duration measures the sensitivity of an asset or liability's market value to changes in interest rates. There are two measures of duration that we will focus on in our discussion of the duration gap model: Macaulay duration and effective duration.

In a previous issue of this publication, we provided a detailed examination of various duration measures in the context of falling interest rates and negative duration gaps, so the following discussion will be brief.

Macaulay duration is the weighted average time to arrival of cash flows on a bond and is measured in years. Such a measure is an improvement over maturity because it provides a more precise linkage between changes in interest rates and changes in the market value of a bond.

Macaulay duration can also be viewed as the elasticity of the market value of a fixed-income security with respect to small changes in interest rates. While it represents an improvement over maturity, Macaulay duration has serious shortcomings when applied to instruments with embedded options.

A second measure of duration that can be applied to instruments with embedded options is effective duration. By definition, effective duration is a measure of the average price change between two points along the price/yield curve.

It is customary to measure effective duration between up and down 100 basis points from the current required yield. However, there is no reason it could not be measured between +/- one basis point.

The duration gap for a financial institution is the difference between the weighted-average duration of its assets and the weighted-average duration of its liabilities, adjusted for leverage. The portfolio asset and liability weights used in the calculation are measured by the market value of the asset (liability) position divided by the market value of all assets (liabilities).

The duration gap measures the size and direction of the mismatch between the durations of a financial institution's assets and liabilities. The net effect of changes in interest rates on the market value of a financial institution's equity or net worth will depend on whether the duration gap is positive, negative, or zero.

Basically, the net effect of an interest rate shock captures three effects: (1) the leverage-adjusted duration gap (this is calculated as the duration of assets less the duration of leverage adjusted liabilities); (2) the size of the financial institution (total assets); and (3) the size of the interest rate shock.

For the case of the typical thrift, the duration of assets is longer than the duration of liabilities, since it funds longer-term assets with shorter-term liabilities. As a result, the typical duration gap is positive.

This means that a rise in interest rates reduces the market value of assets by more than the market value of liabilities, causing a fall in the thrift's market value of net worth.

When rates fall for an extended period of time, as was the case for the past several years, financial institutions can find themselves confronting a negative duration gap. For a negative duration gap, interest rate increases cause the market value of equity to rise.

There are several advantages of the duration gap approach. First, it explicitly accounts for the market value effects of interest rate changes. Second, it produces an aggregate measure of a financial institution's asset-liability gap that can be used effectively in risk management, especially in hedging interest rate risk by immunizing the balance sheet to interest rate shocks. And third, it uses duration as the time dimension associated with an institution's assets and liabilities.

Critics of the duration gap model argue that this model is difficult to use in the real world. Weaknesses identified by critics of this approach generally fall into three categories.

First, it is argued that the duration matching of assets and liabilities is costly due to the balance sheet restructuring that is involved. At one time this was probably true; however, the dramatic growth of purchased funds, asset securitization, and loans sales markets has substantially reduced the transaction costs associated with balance sheet restructurings.

(Continued on page 4)

Interest Rate Risk and Alternative Methods for Its Measurement (continued)

(Continued from page 3)

Second, immunization is a dynamic problem that is not well understood within the context of the duration gap model. It is true that instantaneous immunization or continuous rebalancing is not feasible, given the difficulties inherent in monitoring changes in duration as interest rates change and the exorbitant transaction costs of dynamically restructuring the balance sheet.

However, most financial institutions can achieve an approximate dynamically immunized balance sheet by rebalancing at discrete intervals, such as quarterly.

Third, the duration gap model cannot be used for large changes in interest rates. This criticism follows from the fact that duration is defined for small changes in interest rates and ignores the curvature of the price-yield curve. The duration gap model can be modified, however, to incorporate the convexity effect associated with interest rate changes.

That is, we could use effective duration as our operating definition of duration in the leverage-adjusted duration gap model. Thus, the effective duration gap, is more appropriate for large changes in interest rates, because it incorporates the curvature of the price-yield curve or convexity.

Conclusion

The OTS Net Portfolio Value (NPV) Model is essentially an effective duration gap model. Among its outputs is an institution's leverage-adjusted effective duration gap, a measure that can be used to assess the interest rate risk exposure of a thrift.

We hope the foregoing discussion provides you with an understanding of the advantages and disadvantages of the different approaches, or models, that can be used to measure a financial institution's exposure to interest rate risk. Each approach offers an alternative measure of the asset-liability gap that characterizes a financial institution's interest rate risk. exposure.

For more details on the OTS NPV Model, see the *Net Portfolio Value Model Manual.*

Third Quarter Earnings Remain Strong (continued)

(Continued from page 1)

Treasury rates rose for all maturities, but the increase for short-term and medium-term maturities was greater than long-term maturities. In comparing the yield curve to the prior quarter, it was more steeply sloped up to the ten-year maturity point, but flatter for maturities greater than ten years.

The Freddie Mac contract interest rate on commitments for fixed-rate 30-year mortgages increased to 5.77 percent at the end of the third quarter from 5.24 percent at the end of the previous quarter.

Despite the increase in interest rates, thrift profitability was lower. The average return on assets for the industry fell to 1.28 percent in the third quarter from a record 1.34 percent in the prior quarter.

This fall was attributed to downward pressure on net interest margins and lower non-interest income in the third quarter.

In conjunction with the fall in profitability, the third quarter average net interest margin fell to 284 basis points, down from 294 basis points in the second quarter. This reduction was caused by the relatively greater rise in shorter-term interest rates that caused the yields on new and repriced assets to rise less than the costs of liabilities.

Thrift industry earnings fell three percent to $3.44 billion in the third quarter, from $3.53 billion in the prior quarter.

In the third quarter, total fee income, which includes mortgage loan servicing fee income and other fee income, rose to 1.01 percent of average assets, up from 0.55 percent in the second quarter. Other fee income rose to 0.96 percent of average assets from 0.94 percent in the prior quarter. Other non-interest income fell to 0.77 percent of average assets from 1.30 percent between the second and third quarters.

The ARM share of total thrift mortgage originations rose to 26 percent, up from 21 percent in the prior quarter. Along with the relative rise in ARM originations, the ARM share of total 1-4 family mortgages held in portfolio rose to 55.4 percent from 54 percent in the second quarter.

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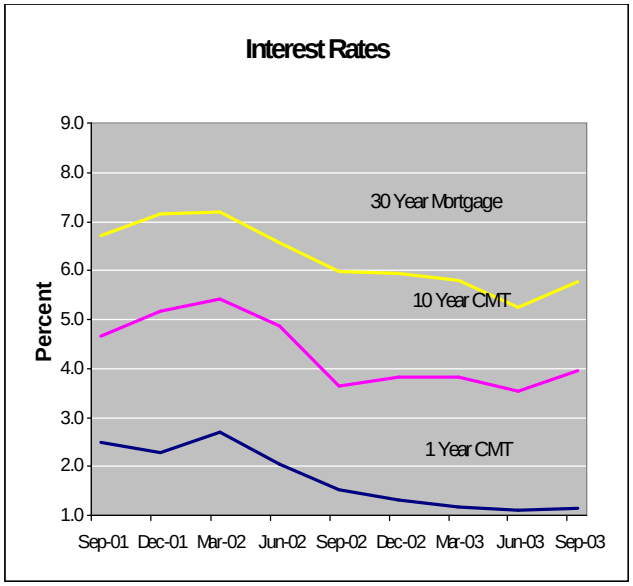
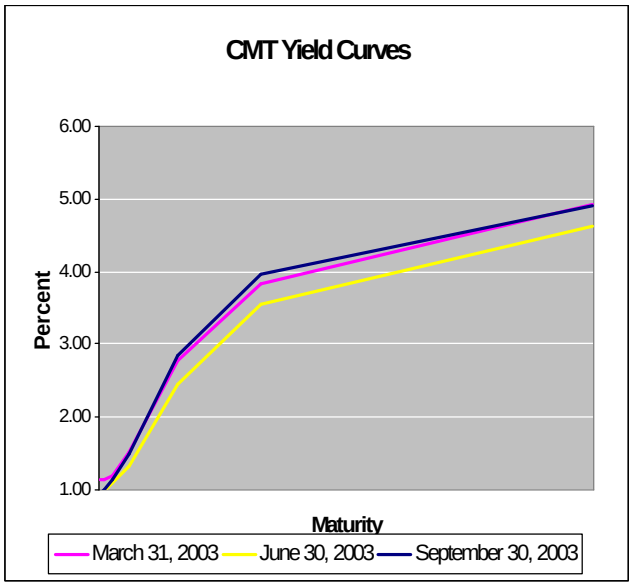
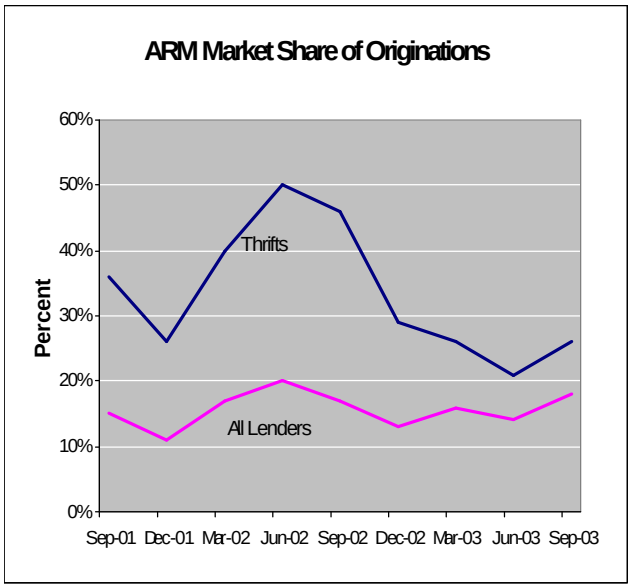
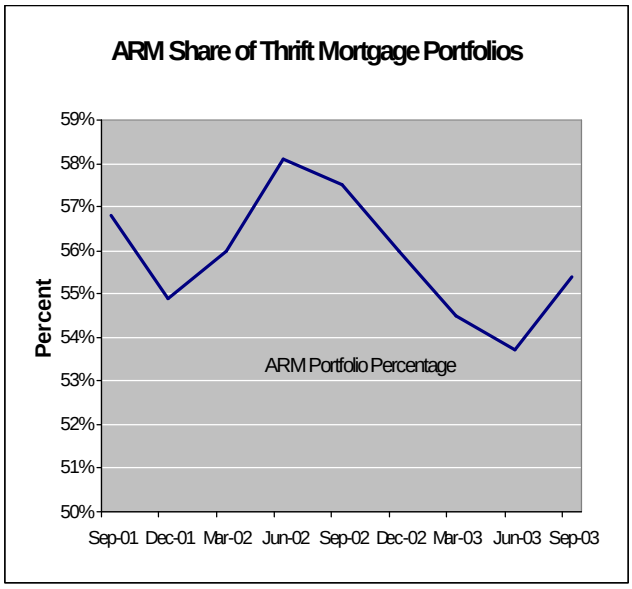
Interest Rates and ARM Market Share









Third Quarter Earnings Remain Strong (continued)

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Third-quarter 1-4 family mortgage originations by thrifts reached a new record, $229.9 billion, up from $195.8 billion in the second quarter. This represents the first time that single-family mortgage originations by thrifts exceeded the $200 billion mark.

Total mortgage originations in the third quarter were $250.4 billion, up sharply from $215.1 billion in the second quarter.

Thrifts' share of all 1-4 family originations was 21.6 percent in the third quarter, up from 20.1 percent in the second quarter. The rate of U.S. home ownership increased slightly to 68.4 percent, up from 68 percent in the second quarter.

Refinancing accounted for 42 percent of thrift originations of single-family mortgages in the third quarter, down from 54.2 percent in the second quarter. This decrease contrasts markedly with the refinancing activity of all lenders, where the rate remained unchanged at 68 percent between the second and third quarters.

The industry's average effective duration of assets rose substantially from 1.55 to 1.81 between the second and third quarters.

Consistent with this result, the Lehman Brothers MBS Index, which tracks single-family agency MBS, saw its duration jump from 1.02 at the end

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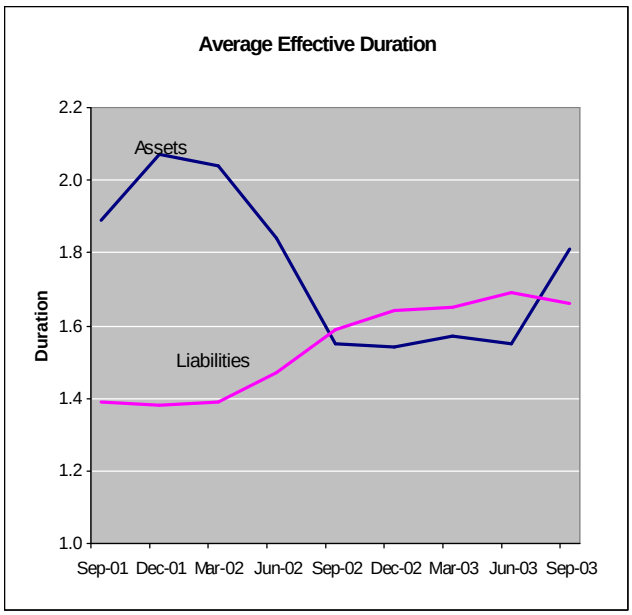
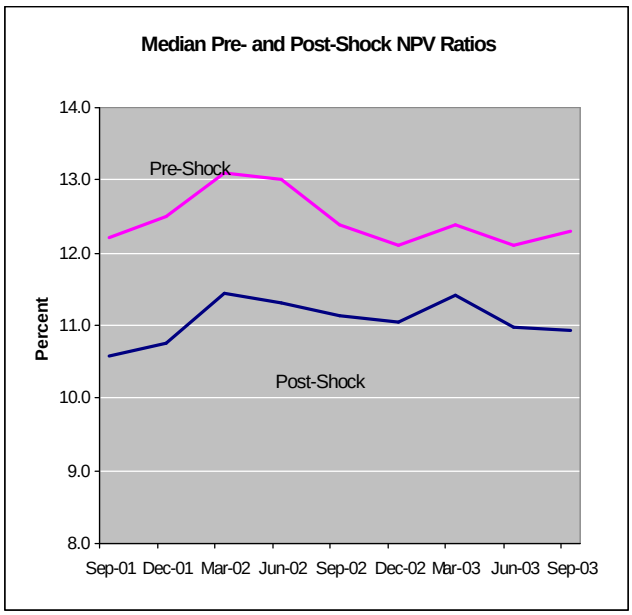
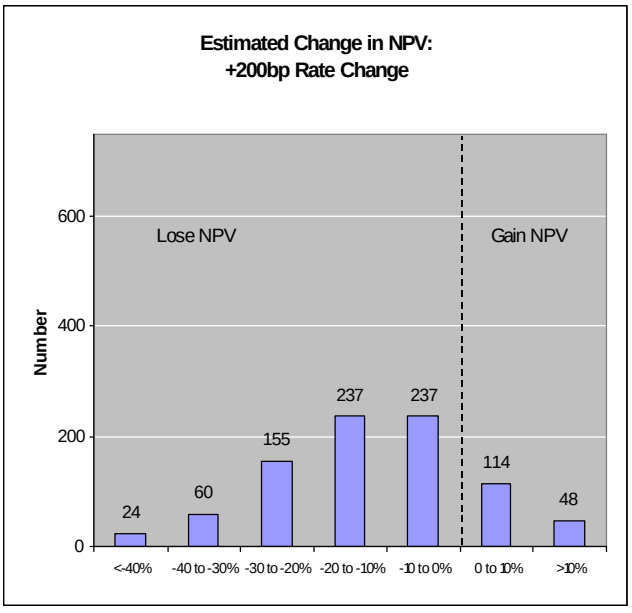
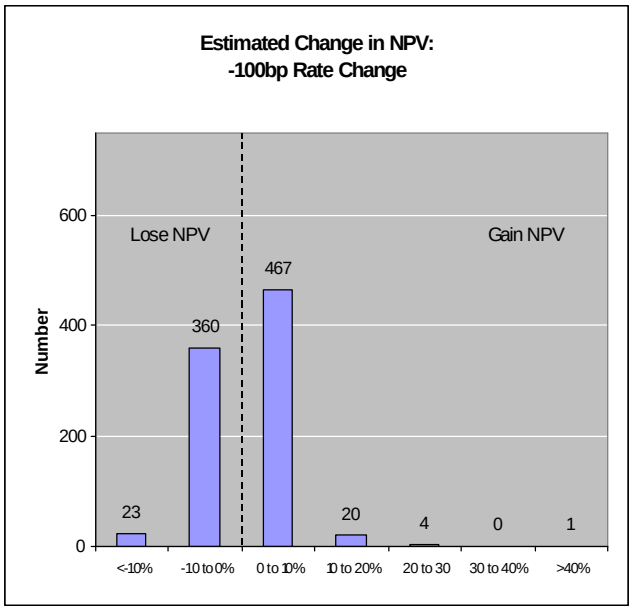
Duration and NPV Sensitivity Measures









Third Quarter Earnings Remain Strong (continued)

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of the second quarter to 2.49 at the end of the third quarter.

With the increase in interest rates in the third quarter, the NPV model predicted a decrease in prepayments of mortgages held in portfolio. This raised the average duration of mortgages and, therefore, total assets duration.

The industry's average effective duration of liabilities fell slightly from 1.69 to 1.66 in the third quarter.

The changes in asset and liability durations in the third quarter resulted in a large positive duration gap for the thrift industry as a whole. This represents the first time in a year that asset duration has exceeded liability duration.

While asset duration rose substantially in the third quarter, it is likely that asset duration will continue its upward trend for another quarter. This will happen because of the sharp rise in rates that occurred in the third quarter combined with the effect of lower-coupon mortgages replacing higher-coupon mortgages held in portfolio by thrifts.

Given the sharp rise in rates in the third quarter, newly-refinanced mortgages will have a much lower likelihood of prepaying, resulting in an increase in asset duration.

As a result, thrifts can probably expect to see their interest rate risk ex-

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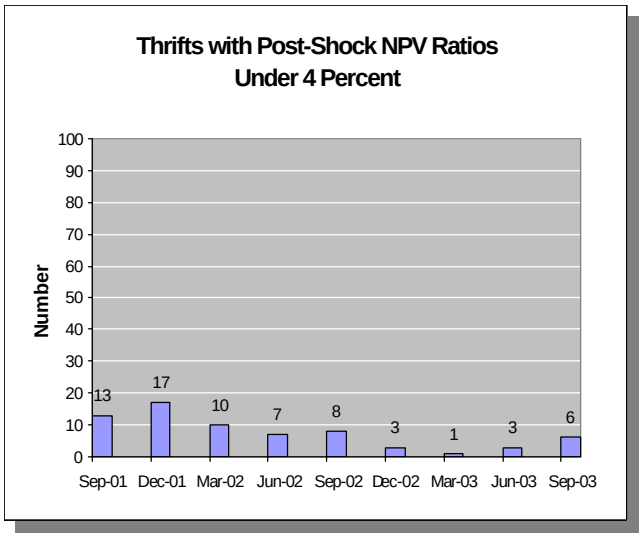
Interest Rate Risk Measures



Interest Rate Risk Measures
Industry Aggregates
Last Two Quarters

	NPV as % of PV of Assets		% Change in NPV	% Change in NPV
	Jun-03	Sep-03	Jun-03	Sep-03
+300	8.57%	8.06%	-19%	-24%
+200	9.26%	8.88%	-11%	-14%
+100	9.79%	9.56%	-4%	-6%
Base	10.11%	10.09%	0%	0%
-100	10.09%	10.30%	1%	3%
-200	N/A	N/A	N/A	N/A
-300	N/A	N/A	N/A	N/A

Post-Shock NPV Ratio and
Sensitivity Measure Matrix
June 2003

	Under 100bp	101-200bp	201-400bp	Over 400bp	Total
Over 10%	304	131	93	6	534
6% to 10%	166	105	36	5	312
4% to 6%	10	12	7	1	30
Below 4%	0	1	2	0	3
Total	480	249	138	12	879

Minimal | Moderate | Significant | High

Post-Shock NPV Ratio and
Sensitivity Measure Matrix
September 2003

	Under 100bp	101-200bp	201-400bp	Over 400bp	Total
Over 10%	259	116	136	19	530
6% to 10%	112	87	88	12	299
4% to 6%	6	10	21	3	40
Below 4%	1	1	4	0	6
Total	378	214	249	34	875

Minimal | Moderate | Significant | High

Third Quarter Earnings Remain Strong (continued)

(Continued from page 6)
posure increase again next quarter.

The median pre-shock NPV ratio for the industry rose during the third quarter from 12.1 percent to 12.3 percent. Along with this rise in the median pre-shock NPV ratio, the median post-shock NPV ratio fell slightly, moving from 11 percent at the end of the second quarter to 10.9 percent at the end of the third quarter.

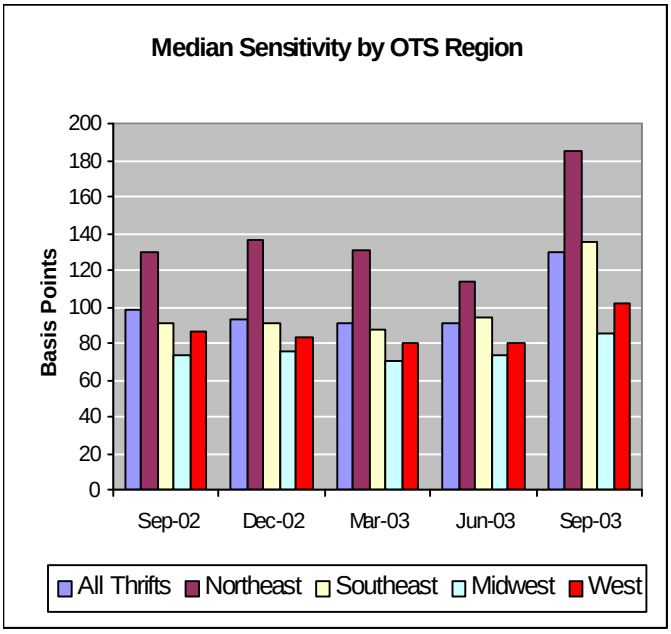
The number of thrifts with a post-shock NPV ratio below 4 percent rose to six from three in the previous quarter. The percentage of thrifts with a post-shock NPV ratio over 6 percent decreased between the second and third quarters. In the third quarter, such thrifts comprised 94.7 percent of the industry, compared to 96.2 percent in the prior quarter.

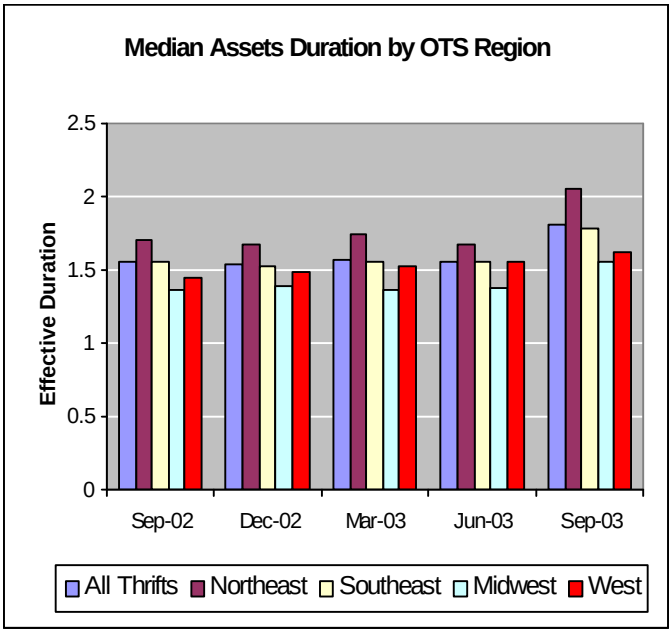
The number of thrifts with a post-shock NPV ratio below 6 percent rose to 46 in the third quarter, up from 33 in the first quarter.

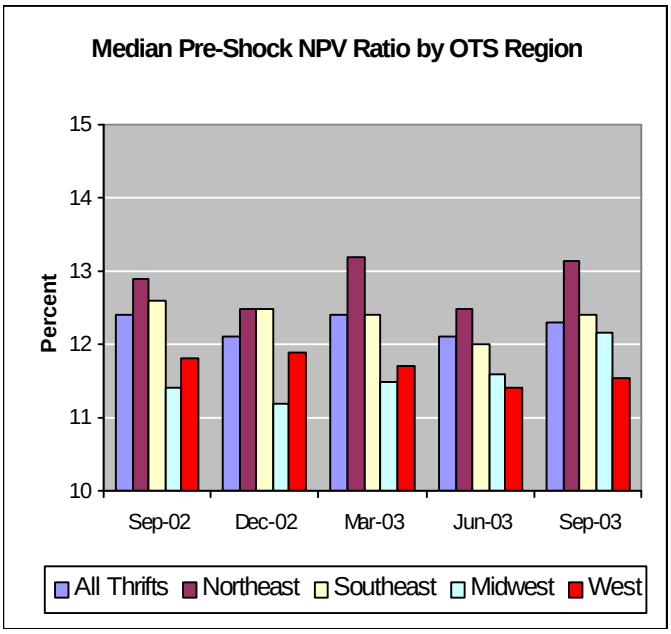
The percentage of thrifts with a sensitivity of 200 basis points or less decreased substantially in the third quarter, falling to 68 percent from 83 percent in the prior quarter.

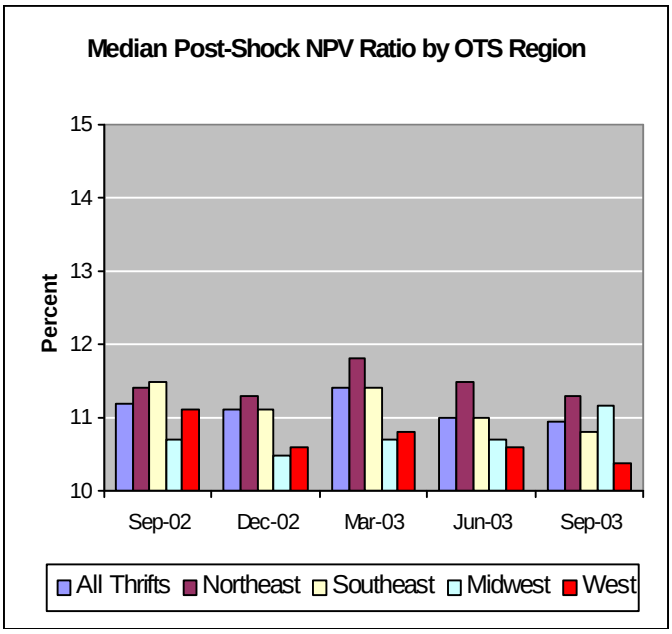
In addition, the percentage of thrifts with over 400 basis points in sensitivity rose to four percent from one percent in the prior quarter. This result is consistent with the rise in median sensitivity for the industry.¦

Comparative Trends in the Four OTS Regions









Regional Comparisons

The Northeast Region had the highest median sensitivity, at 185 basis points at the end of the third quarter, while the Midwest Region had the lowest median sensitivity, at 85 basis points.

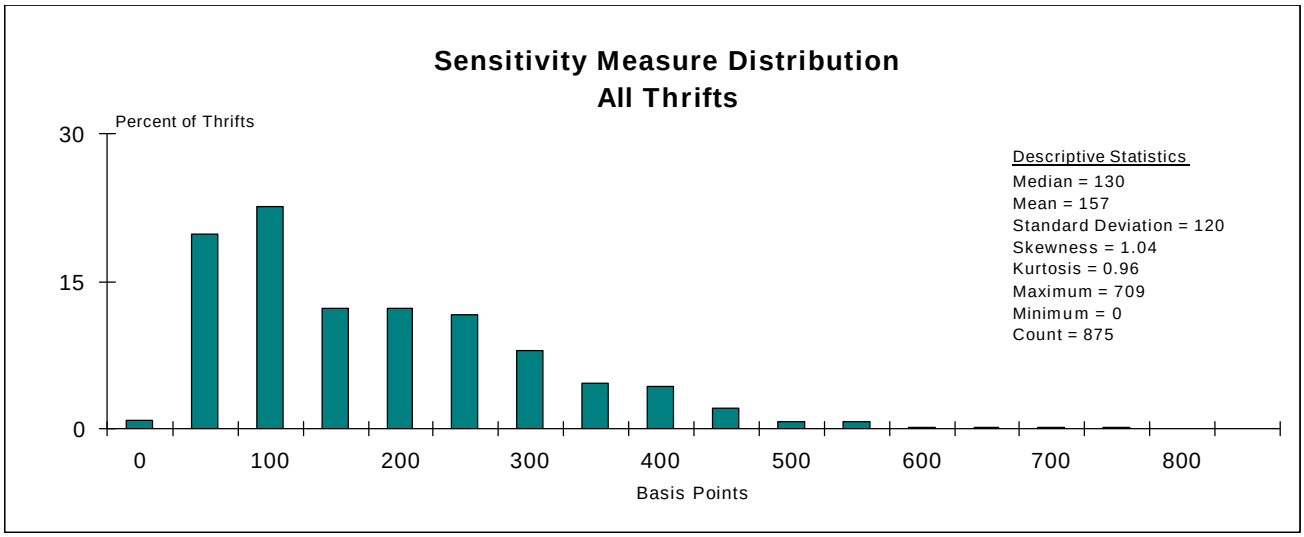
All OTS regions experienced substantial increases in their interest rate sensitivity in the third quarter. The Northeast Region saw its median sensitivity rise by 62.2 percent, the largest relative increase of the four regions. The Southeast, Midwest, and West Regions saw their median sensitivities rise by 43.6 percent, 43.8 percent, and 27.5 percent, respectively.

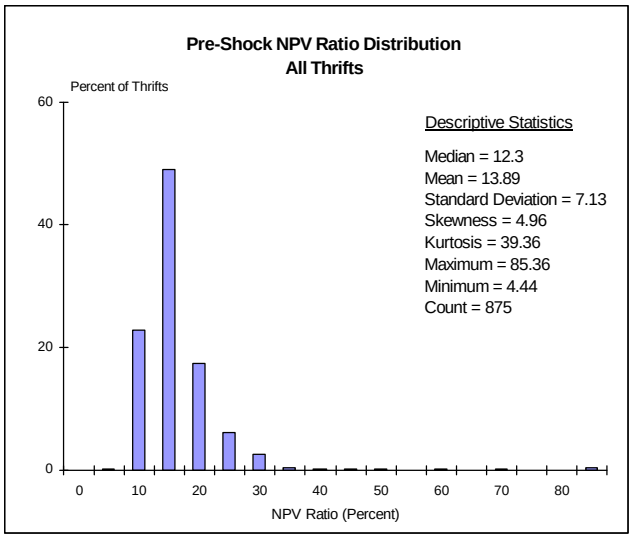
Consistent with the greater sensitivity results, all four OTS regions experienced a rise in their median asset durations. The Northeast Region had the highest median asset duration, at 2.06 at the end of the third quarter, while the Midwest Region had the lowest median asset duration, at 1.55.

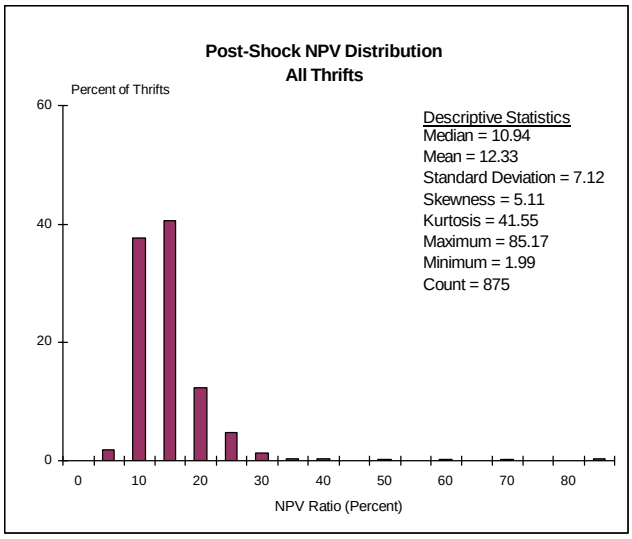
All OTS regions saw their median pre-shock NPV ratios rise in the third quarter. The Northeast Region had the highest pre-shock NPV ratio at 13.1 percent, while the West Region had the lowest pre-shock NPV ratio at 11.5 percent.

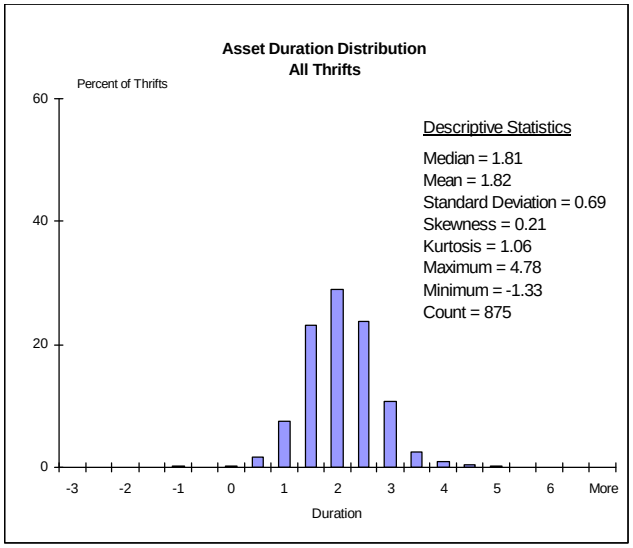
Despite the increase in median pre-shock NPV ratios for all regions, the median post-shock NPV ratio fell in each region due to the rise in sensitivity.

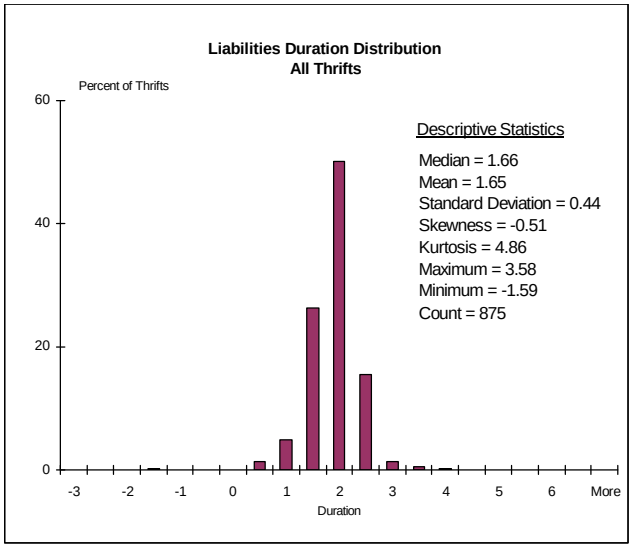
Appendix A – All Thrifts



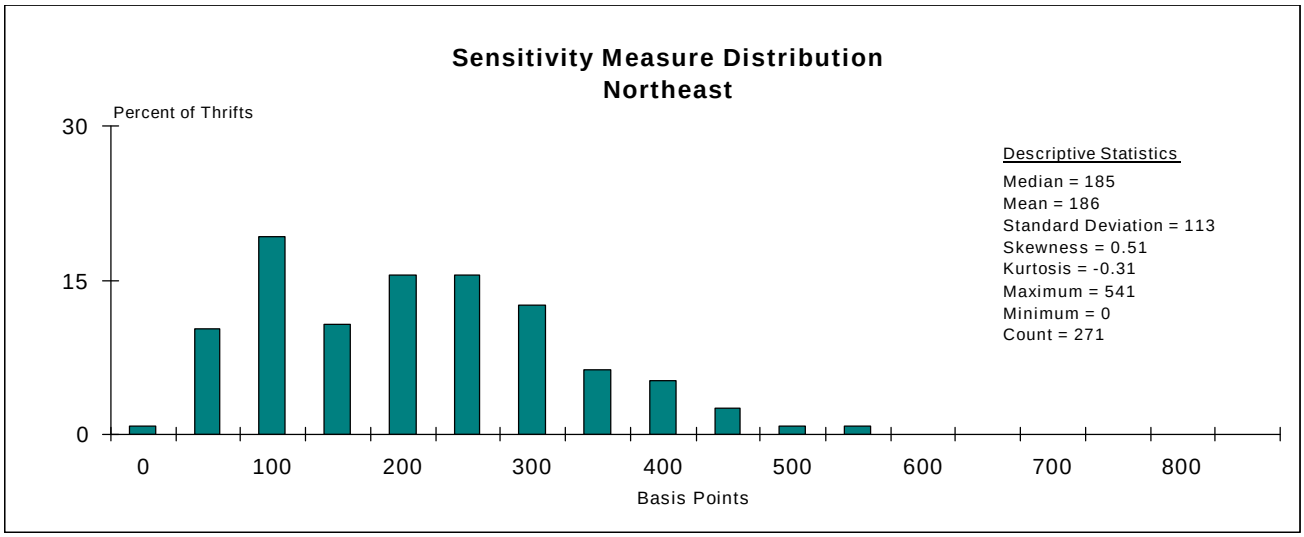


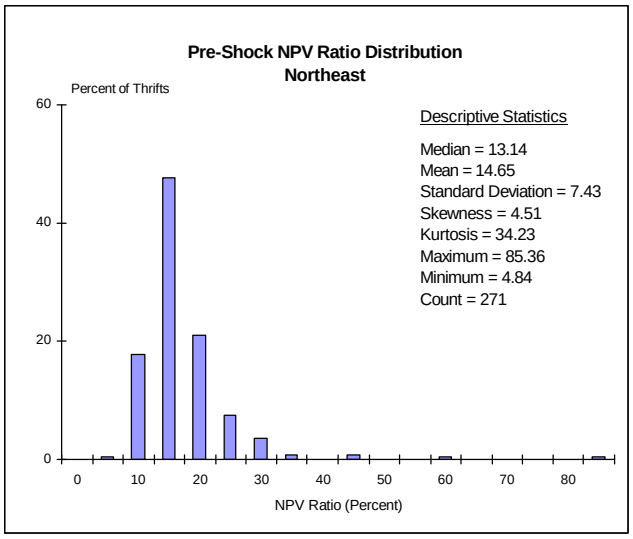


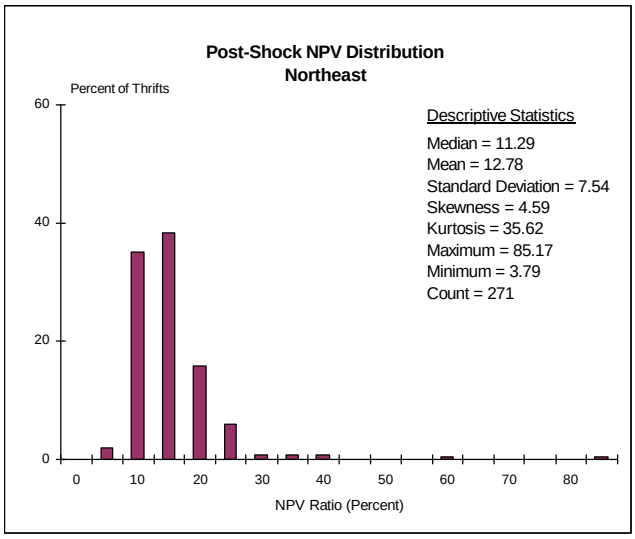


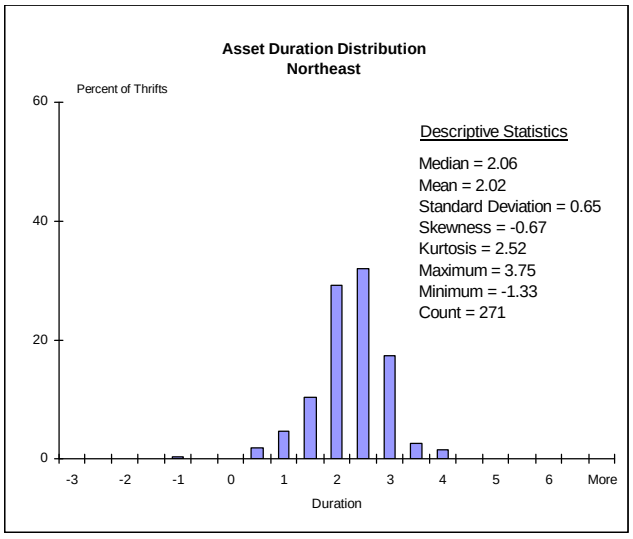


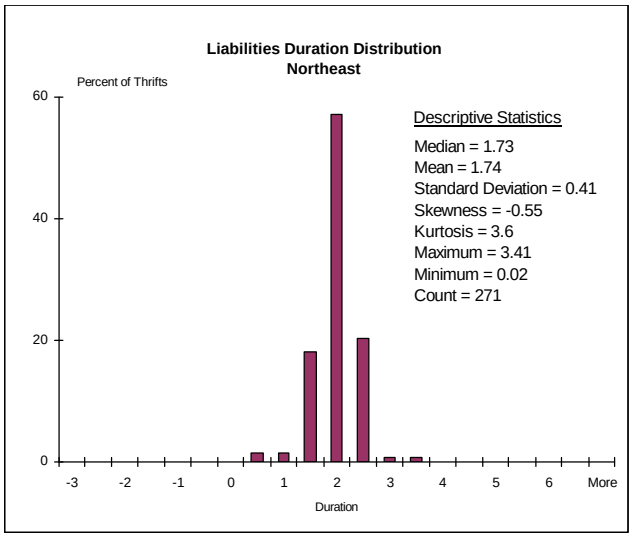
Appendix B – Northeast Region



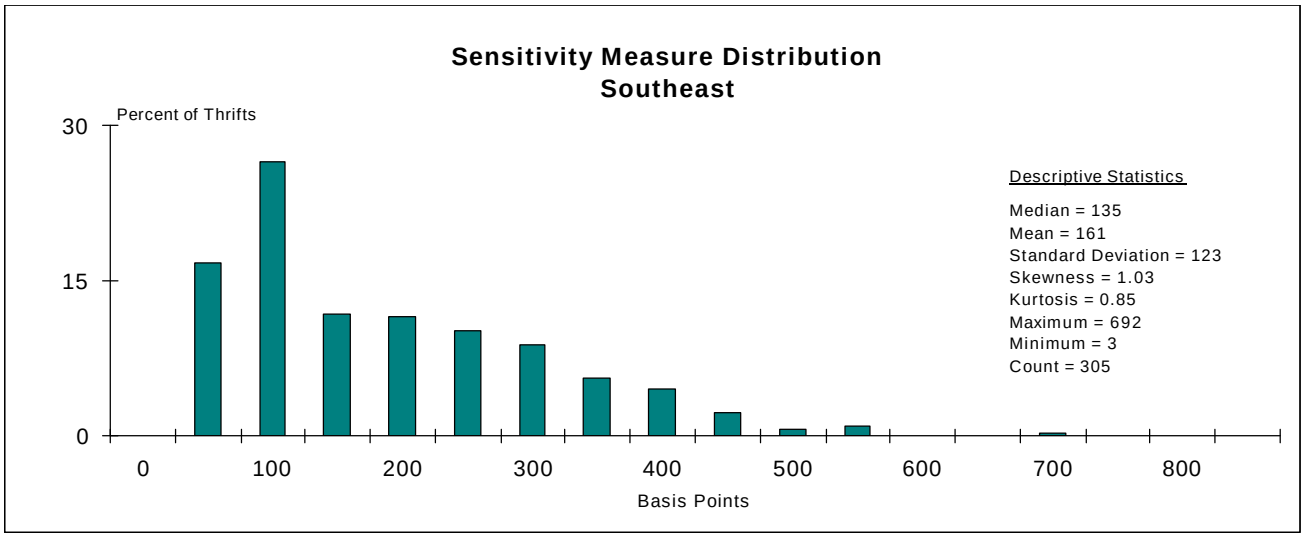


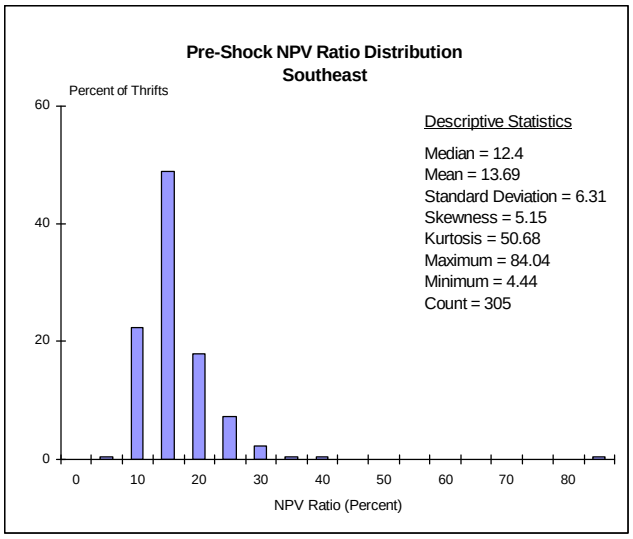


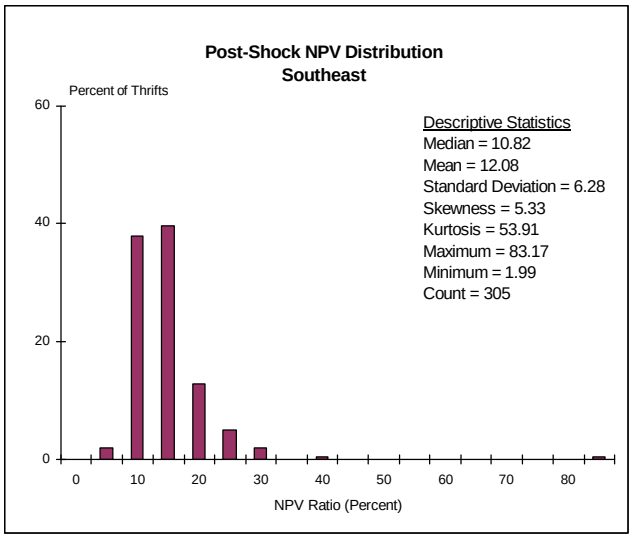


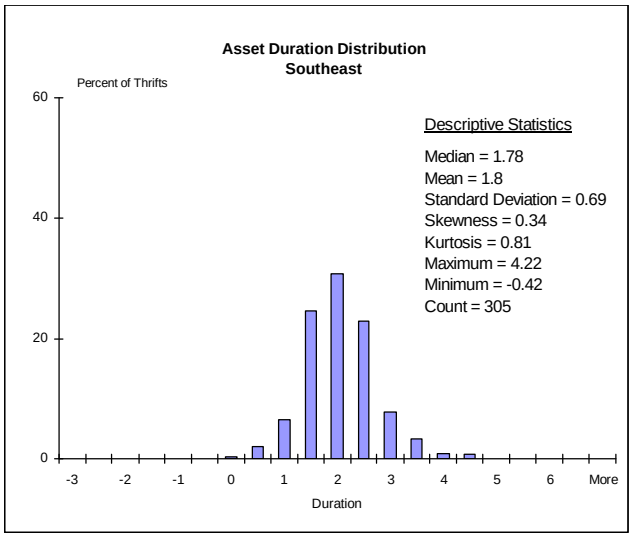


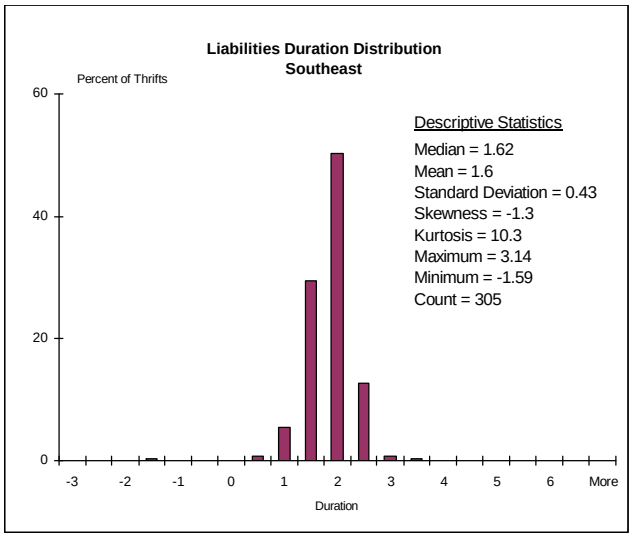
Appendix C – Southeast Region



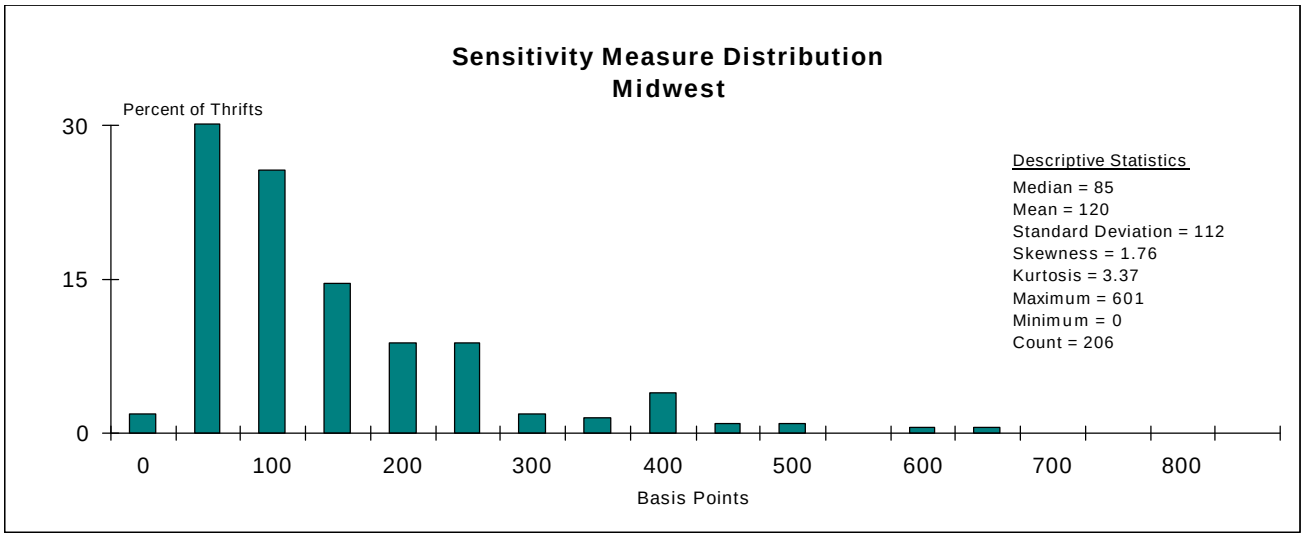


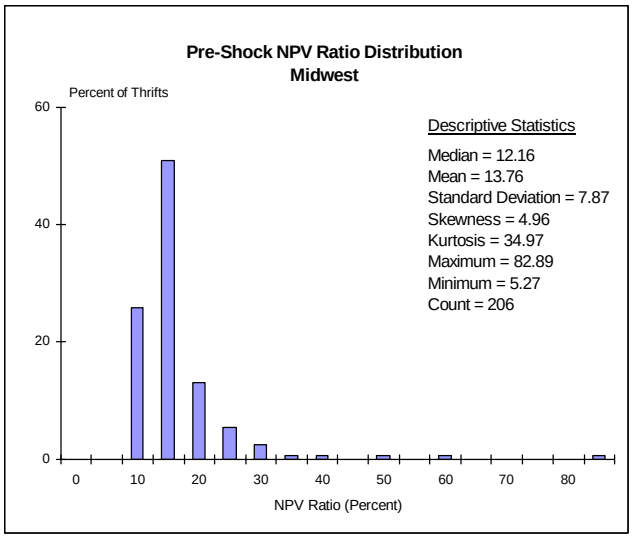


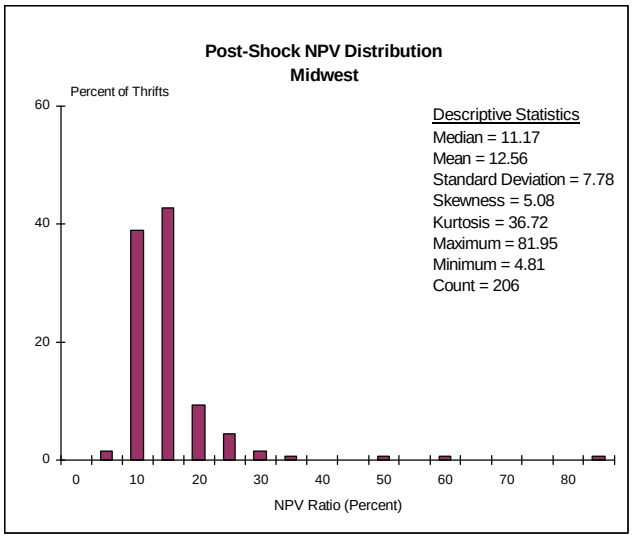


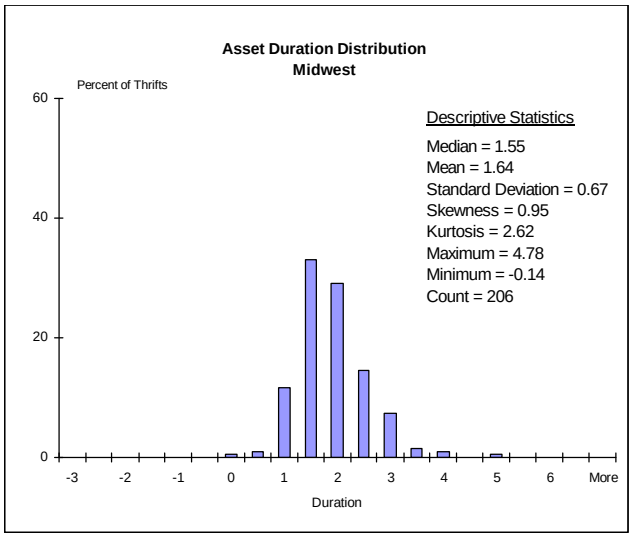


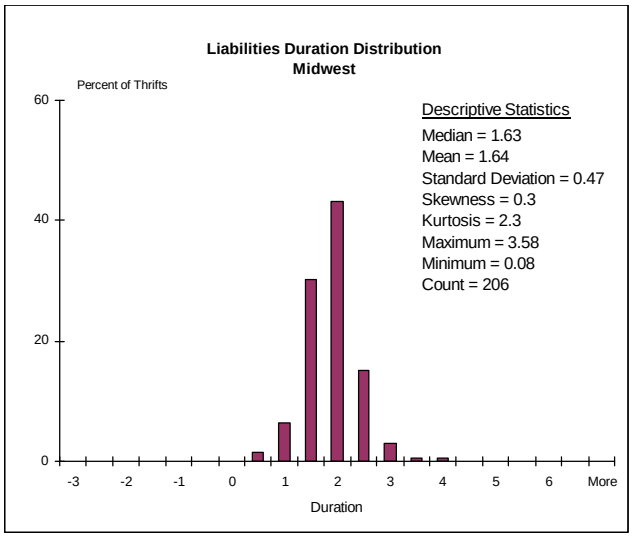
Appendix D – Midwest Region



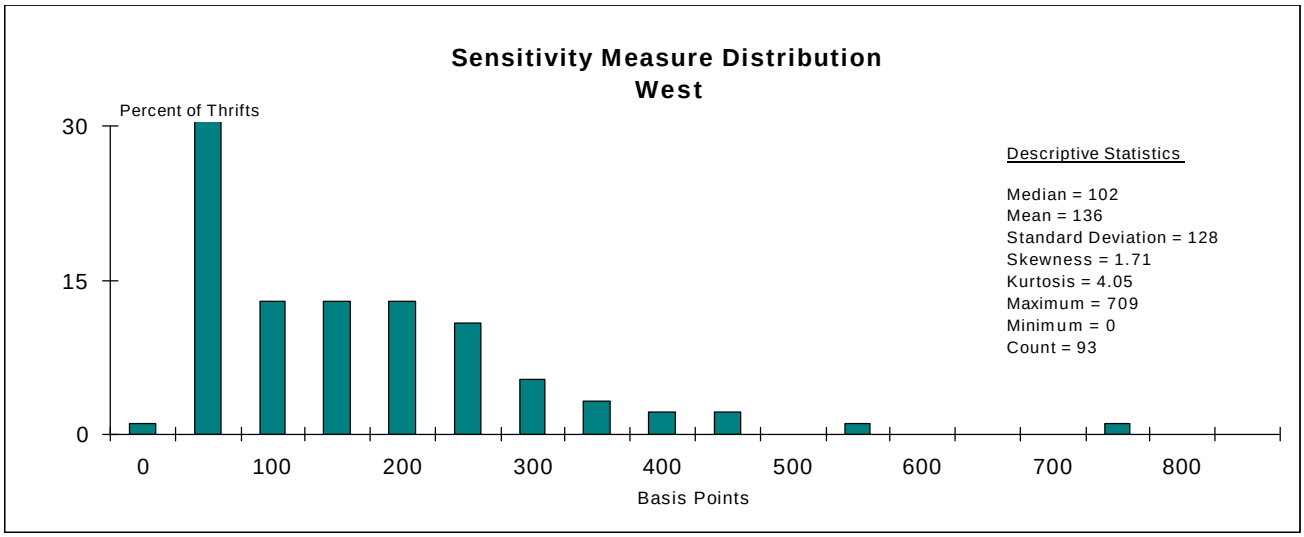


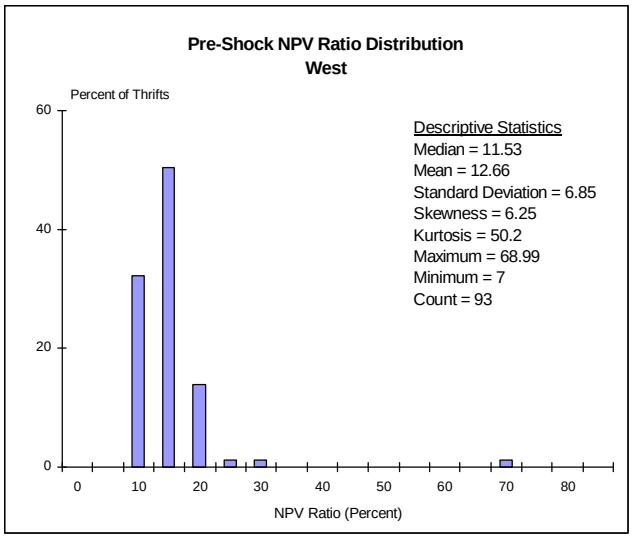


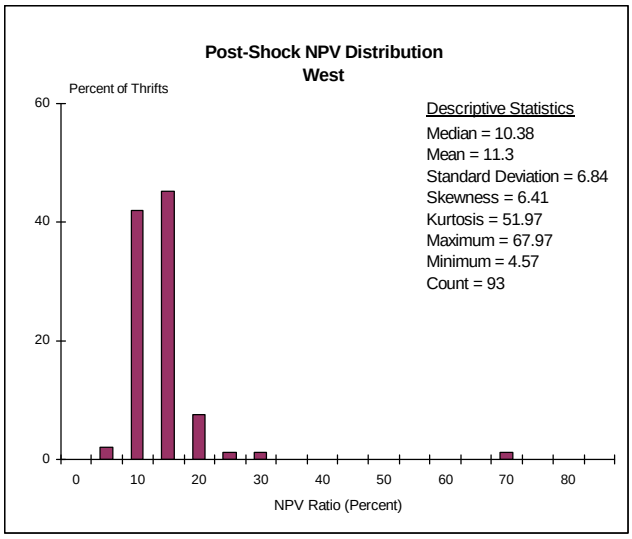


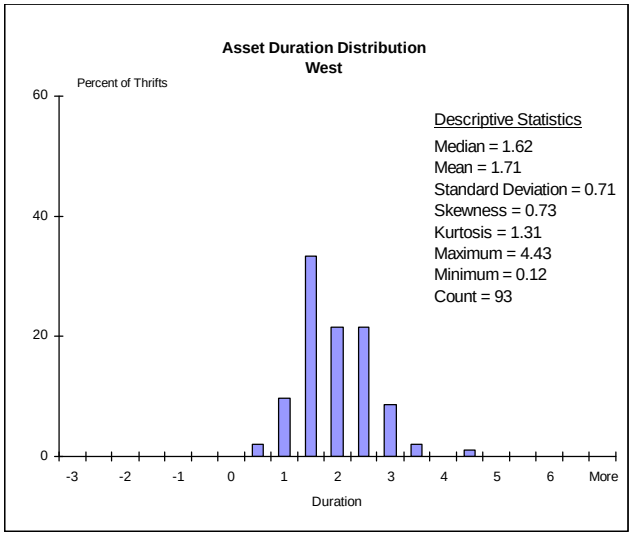


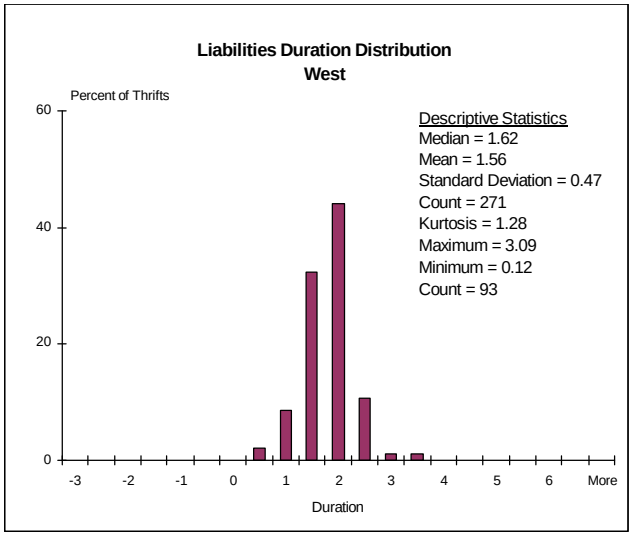
Appendix E – West Region











Glossary

Duration: A first-order approximation of the price sensitivity of a financial instrument to changes in yield. The higher the duration, the greater the instrument's price sensitivity. For example, an asset with a duration of 1.6 would be predicted to appreciate in value by about 1.6 percent for a 1 percent decline in yield.

Effective Duration: The average rate of price change in a financial instrument over a given discrete range from the current market interest rate (usually, +/-100 basis points).

Estimated Change in NPV: The percentage change in base case NPV caused by an interest rate shock.

Kurtosis: A statistical measure of the tendency of data to be distributed toward the tails, or ends, of the distribution. A normal distribution has a kurtosis statistic of three.

NPV Model: Measures how six hypothetical changes in interest rates (three successive 100 basis point increases and three successive 100 basis point decreases, assuming a normal interest rate environment) affect the estimated market value of a thrift's net worth.

Post-Shock NPV Ratio: Equity-to-assets ratio, following an adverse 200 basis point interest rate shock (assuming a normal interest rate environment), expressed in present value terms (i.e., post-shock NPV divided by post-shock present value of assets). Also referred to as the exposure ratio.

Pre-Shock NPV Ratio: Equity-to-assets expressed in present value terms (i.e., base case NPV divided by base case present value of assets).

Sensitivity Measure: The difference between Pre-shock and Post– shock NPV Ratios (expressed in basis points).

Skewness: A statistical measure of the degree to which a distribution is more spread out on one side than the other. A distribution that is symmetric will have a skewness statistic of zero.

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