

# The Quarterly Review Of Interest Rate Risk

Office of Supervision,  
Economic Analysis Division



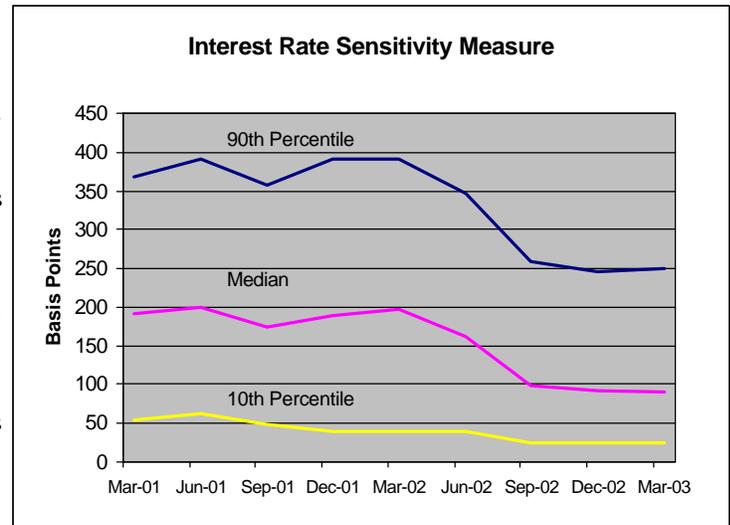
## Special points of interest:

- 30-yr mortgage rate falls
- Yield curve steepens in the first quarter
- First quarter median interest rate sensitivity improves slightly
- Asset and liability durations rise
- Comparative Regional Analysis
- Feature Article on Mortgage Servicing and OTS's Net Portfolio Value Model

## Median Sensitivity Remains Stable in the First Quarter

Median thrift sensitivity remained relatively stable in the first quarter, improving slightly to 91 basis points from 93 basis points in December. This slight improvement reflects the net effect of a fall in both short- to medium-term interest rates and an increase in long-term rates in the first quarter.

Both the median pre-shock and post-shock Net Portfolio Value (NPV) ratios rose in the first quarter. The number of thrifts with high risk was two, remaining unchanged from the previous quarter.



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## Mortgage Servicing and OTS's Net Portfolio Value Model

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With mortgage rates remaining at historically low levels during the past several quarters, mortgage-refinancing activity has continued at a record pace. As a result, mortgage servicing rights (MSRs) and their corresponding valuations have been affected dramatically.

The surge in mortgage refinancings has forced servicers to become much more aware of the market risks associated with owning MSRs, in particular interest rate risk, and the difficulties in both valuing and hedging MSRs.

This is especially true with the adoption of FAS 133 and its hedge-accounting requirement

that the carrying value of MSRs be adjusted, to the degree allowable, in accordance with the movement in their associated hedges.

Mortgage servicing rights owned by financial institutions are contracts that permit them to collect a small part of the mortgage's payment as a fee in exchange for collecting and passing on payments and for reporting on the status of the execution of the mortgage note.

The present value of MSRs is determined by the expected income produced by servicing fees, ancillary income, and income from escrow accounts and payment float, less the operating costs associated with

servicing a mortgage, discounted by an appropriate required rate of return.

Prepayment risk is by far the most important risk borne by mortgage servicers. As interest rates have fallen to historically low levels, high prepayment rates have negatively affected the valuations of MSRs by dramatically decreasing the mortgage balances on which servicing income is based.

OTS's Net Portfolio Value (NPV) Model provides important insight into how the recent spate of refinancing has affected the economic values of MSRs currently held on thrifts' balance sheets. Fluctuations

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## Mortgage Servicing and OTS's Net Portfolio Value Model (continued)

(Continued from page 1)  
in the values of MSR--and their associated hedges--due to historically low and falling interest rates represent key supervisory concerns when evaluating interest rate risk profiles of thrifts today.

With the recent surge in mortgage refinancings, many thrifts have found it profitable to engage in mortgage banking activities. Mortgage banking involves the buying, selling, originating, and servicing of mortgage loans.

The previous issue of this publication discussed the buying, selling, and originating aspects of mortgage banking and how the NPV Model provides valuations for these activities. The focus in the current issue is mortgage servicing and how the NPV Model generates present value estimates of the cash flows associated with this aspect of mortgage banking.

### **Mortgage Servicing**

Servicing is required for each mortgage loan. Loan servicing entails many different activities associated with repayment of the mortgage by the borrower, or mortgagor.

Mortgage servicers collect monthly payments, forward the proceeds to loan owners or investors, send notices to mortgagors, remind borrowers of overdue payments, maintain loan records, administer escrow accounts for real estate taxes and hazard insurance, initiate foreclosure proceedings,

and provide tax information to mortgagors.

Mortgage servicing generates income from five sources. First, servicers collect fees on each mortgage they service. These servicing fees are based on a fixed percentage of the outstanding mortgage balance.

Second, servicers earn interest on the escrow accounts associated with each mortgage loan.

Third, income in the form of float arises on monthly mortgage payments. This occurs because of the delay between the time payment is received from the borrower and the time payment is sent to investors.

Fourth, servicers receive ancillary income. This income can take the form, for example, of late fees on loans currently being serviced.

And fifth, servicers may directly market other products to the mortgage borrowers they service.

The NPV Model provides valuations for mortgage servicing done for thrifts by other financial institutions, as well as mortgage servicing done by thrifts for other financial institutions.

These two valuations are our focus here. Additionally, the NPV Model also produces values for escrow accounts on serviced mortgages and the payment float from servicing mortgage loans.

### **Hedging of Mortgage Servicing**

The rapid rate of mortgage refinancings during the recent past has forced

those thrifts who engage in mortgage servicing to recognize the importance of hedging their MSRs. For the most part, there are two approaches used to hedge mortgage servicing.

Some commentators suggest that holding mortgages will provide a kind of "natural hedge" against holding MSRs in a down-rate environment. There is a degree of truth in this.

For example, as rates fall, MSRs either vanish due to prepayments or their present values are reduced due to increased expectation of prepayment. The combined effect of these two factors is unambiguously negative on the value of MSR holdings.

On the other hand, for the same fall in interest rates, mortgage loans either will convert to cash in the amount of the unpaid principal balance as they are prepaid, or will increase in value due to the effect of a lower discount rate if they do not prepay. The combined effect of these two factors is typically positive, however, it is not possible to conclude that the effect is unambiguously positive on the value of MSR holdings.

However, an institution cannot simply add a portfolio of mortgages without addressing the question of how they are to be funded. For example, the net addition of 30-year fixed-rate mortgages funded with ten-year unstructured debt is likely to exacerbate, rather than dampen, the effect of falling rates on

the values of MSRs and, hence, on the overall portfolio NPV.

Another approach for hedging mortgage servicing involves the use of either mortgage derivatives, such as principal-only (PO) strips, or financial derivatives, such as interest rate swaps or interest rate floors. These instruments can be used to hedge against interest rate changes and the consequent movements in the value of MSRs.

For example, with a PO strip, a fall in rates will result in an increase in the economic value of the strip. This rise in value will offset the fall in the value of the MSRs.

### **Mortgage Loan Servicing by Others**

On Schedule CMR thrifts report the underlying balances of mortgages serviced by others as either fixed-rate mortgages (FRMs) or adjustable-rate mortgages (ARMs), along with the weighted average servicing fee paid on these loan balances.

Beyond whether the underlying loan balances are ARMs or FRMs, CMR collects no information to further identify the specific types of mortgages being serviced, such as single-family mortgages or multifamily mortgages, so the NPV Model assumes that all mortgages serviced by others are single-family mortgages.

The NPV Model values mortgage loans reported by a thrift as if they were both owned and serviced by that institution. In the

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## Mortgage Servicing and OTS's Net Portfolio Value Model (continued)

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event that other institutions service some of these loans, the estimated present values of these mortgages must be reduced (or increased) to the extent that the servicing fee paid by the thrift is more than (or less than) the servicing cost the NPV Model assumes the institution incurs by servicing the loans internally.

The present-value adjustment is made by calculating the present value of the future fees to be paid to the servicer less the present value of the internal cost of servicing the mortgage balance internally.

This present value adjustment is calculated separately for both fixed-rate and adjustable-rate mortgage balances in four steps. First, cost tables are created that report present value estimates of the NPV Model's assumed internal cost of servicing (per \$100 outstanding mortgage balance) for 30-year conventional fixed-rate mortgages and five different types of adjustable-rate mortgages in the five interest rate scenarios currently used.

The NPV Model currently assumes an annual servicing cost of 20 basis points for fixed-rate mortgages and 38 basis points for adjustable-rate mortgages. The present value estimates in the cost tables are generated using the option-adjusted spread approach.

Second, the NPV Model disaggregates the reported fixed-rate and adjustable-rate mortgage balances that are serviced

by others into several mortgage sub-balances with different characteristics (e.g., weighted average coupon (WAC), weighted average remaining maturity (WARM), reset frequency, etc.). For example, the reported balance of FRMs serviced by others is assumed to consist entirely of 30-year conventional fixed-rate mortgages broken down into five sub-balances.

Each of these sub-balances is calculated as the pro-rata share of the 30-year FRM loans reported on CMR by the institution with the same WAC and WARM. The reported balance of ARMs serviced by others is assumed to consist of pro-rata shares of the 400 possible sub-balances that the institution's ARM portfolio is broken down into by the NPV Model (see *NPV Model Manual, Chapter 5.J*, for details), and to have the same characteristics (e.g., rate index, reset frequency, caps, floors, etc.) as those sub-balances.

Third, the NPV Model calculates the present value of internal servicing for each sub-balance in each interest rate scenario by locating the appropriate cost in the table (based on the characteristics of that sub-balance), and then multiplying the amount of the sub-balance by each of the present value estimates.

Finally, the NPV Model calculates the multiple by which the actual servicing fee being paid by the thrift exceeds (or is less than) the assumed cost of internal servicing, and uses that multiple to

scale the present value estimates in the third step. The NPV Model then aggregates across sub-balances, for each scenario, the extra servicing cost (or the cost saving) that a thrift realizes by having its mortgages serviced by others.

The Interest Rate Risk Exposure Report presents the aggregate extra cost or the cost saving associated with the reported mortgage servicing by others for each rate scenario on page 2 on the line titled "Value of Servicing on Mortgages Serviced by Others." This item is reported as a contra-asset, which means that positive (or negative) values on the line indicate that the servicing arrangements result in a reduction (or an increase) in the estimated value of the institution's mortgage portfolio assets, and hence, its NPV.

### **Mortgage Loan Servicing for Others**

The total value of mortgage loan servicing for other financial institutions performed by thrifts represents the economic value of servicing rights on all performing mortgages for which the reporting institution receives a fee. The total value is broken down into three components: fixed-rate servicing, adjustable-rate servicing, and float from escrows on mortgages serviced for others.

Balances of FRMs serviced for others are reported in five coupon ranges on CMR. Additionally, institutions also re-

port the number of fixed-rate conventional loans and fixed-rate FHA/VA loans represented by those balances, as well as the number of loans that are sub-serviced by a third party.

Balances of adjustable-rate mortgages serviced for others are reported on CMR as either current-market index or lagging-index ARMs.

The NPV Model follows four steps in calculating the economic value of mortgage servicing for others. First, the reported fixed-rate balances are disaggregated into sub-balances for conventional and FHA/VA balances on a pro-rata basis using the reported number of loans serviced for each type.

Second, those fixed-rate sub-balances and the balances of current-market and lagging-market ARMs are multiplied by the appropriate fee from the fee tables to derive the present value of the fee stream. The numbers of loans serviced (net of those loans sub-serviced) are then multiplied by the appropriate cost from the cost tables to derive the present value of the cost stream.

The calculation of the present values in both the fee and cost tables are estimated in the second step of the process using the option-based approach. Servicing fees reported in the fee tables are the present value of the stream of servicing fee income generated by \$100 of mortgage balances over their remaining life.

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## Mortgage Servicing and OTS's Net Portfolio Value Model (continued)

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In calculating the present values, the NPV Model currently assumes an annual servicing fee of 50 basis points for fixed-rate mortgages and 75 basis points for adjustable-rate mortgages. Servicing costs reported in the cost tables are the present value of the cost to service one mortgage loan over its remaining life.

The NPV Model currently assumes that it costs \$110.90 annually per loan to service fixed-rate mortgages and \$125.90 annually per loan to service adjustable-rate mortgages. It also assumes that both fixed-rate and adjustable-rate mortgages produce an average of \$37 of ancillary income (e.g., late fees) annually per loan, resulting in a net servicing cost of \$73.90 and \$88.90 for

fixed-rate and adjustable-rate loans, respectively.

Third, for each sub-balance, the present value of the cost is subtracted from the present value of the fee.

Fourth, the total value of fixed-rate servicing is calculated by aggregating the economic values of all fixed-rate sub-balances.

Similarly, the total value of adjustable-rate servicing is calculated by aggregating the economic value of current-market and lagging-market index ARM balances.

The Interest Rate Risk Exposure Report presents aggregate estimates of Fixed-rate Servicing for Others, Adjustable-rate Servicing for Others, and Float from Escrows on Mortgages Serviced for Others on page 4 of the report.

### Summary

Recent fluctuations in the value of MSRs precipitated by the record pace of mortgage refinancings remain a supervisory concern for both the valuation and hedging of MSRs. Prepayment risk is the most important component of interest rate risk confronting thrifts in today's falling rate environment.

This risk is magnified in MSRs. While mortgages may prepay and a financial institution will receive the unpaid principal balance, the mortgage servicing right will simply vanish.

Although the potential for risk remains high, there are a small number of OTS-regulated institutions that have significant exposure in this area. At these thrifts, the valuation of MSRs is closely

monitored.

It should also be noted that thrifts have been diligent at recognizing impairment and taking appropriate write-downs when necessary. To further mitigate the risks associated with MSRs, OTS, along with the other federal banking regulatory agencies issued the *Inter-agency Advisory on Mortgage Banking*.

This document, issued February 25, 2003, details the supervisory concerns surrounding mortgage-banking activities and provides guidance regarding the valuation and hedging of MSRs. This guidance was released to ensure institutions remain informed of the market risks posed by these instruments.

## Median Sensitivity Remains Stable in the First Quarter (continued)

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Treasury rates fell for short- and medium-term maturities, but rose for longer-term maturities. Interest rates on maturities greater than five years rose in the first quarter, while those rates on maturities of five years or less fell.

The combination of rate changes in the first quarter produced a slightly steeper yield curve than was true at year-end 2002. The 30-year mortgage rate declined to 5.79 percent at the end of the first quarter from 5.93 percent in the previous quarter.

The steepening of the yield curve affected thrift profitability positively. Profitability improved for the thrift industry; the average return on assets (ROA) rose to a record 1.30 percent in the first quarter from 1.20 percent in the prior quarter. ROA is a key measure of profitability.

Along with the fall in both short-term to medium-term rates and the rise in long-term rates, average net interest margin rose from 294 basis points in December to 300 basis points in March 2003. This occurred because the declines in

shorter-term interest rates reduced funding costs while long-term earning asset yields rose.

In conjunction with the increase in average net interest margin in the first quarter, earnings, which were already at quite healthy levels, increased substantially in the first quarter. Consequently, thrift industry earnings rose to \$3.32 billion in the first quarter, from \$2.98 billion in the prior quarter.

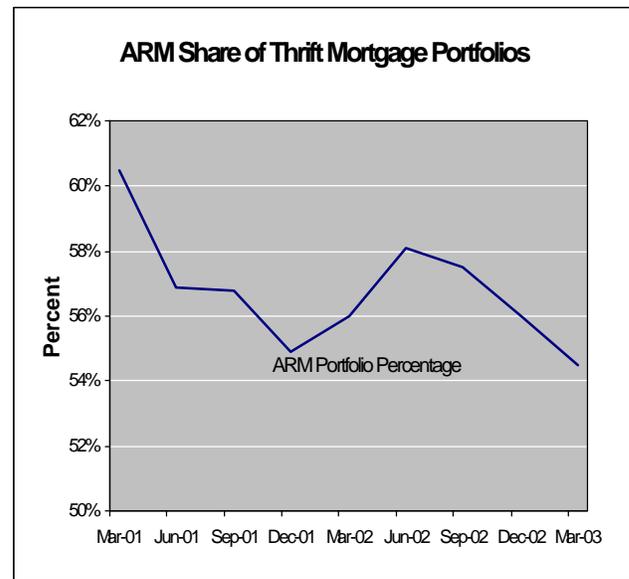
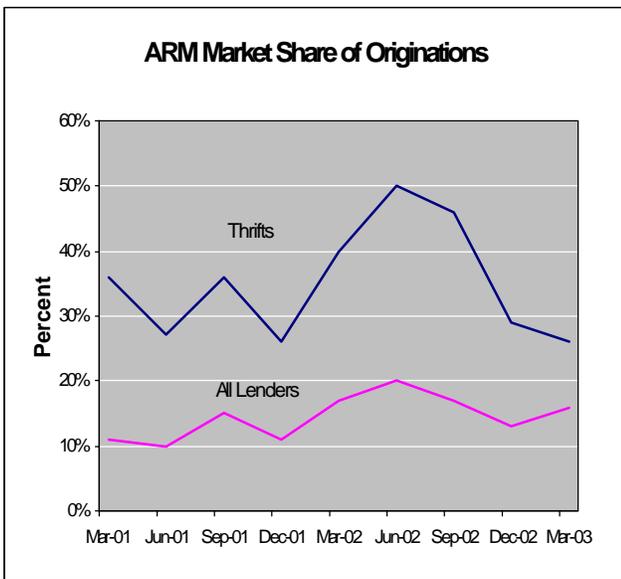
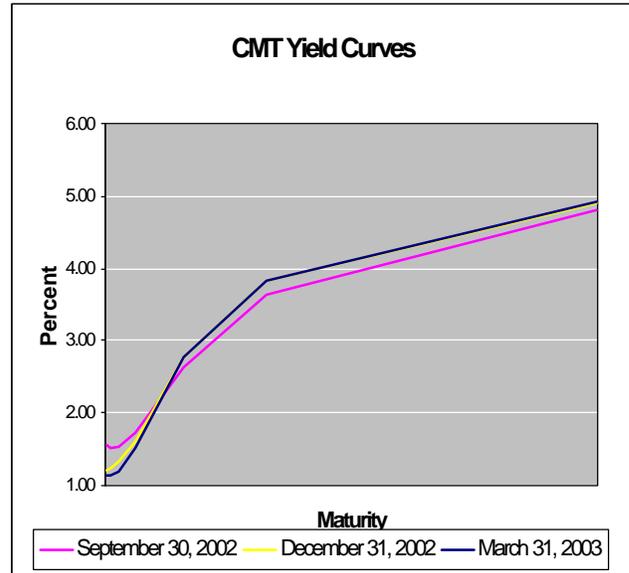
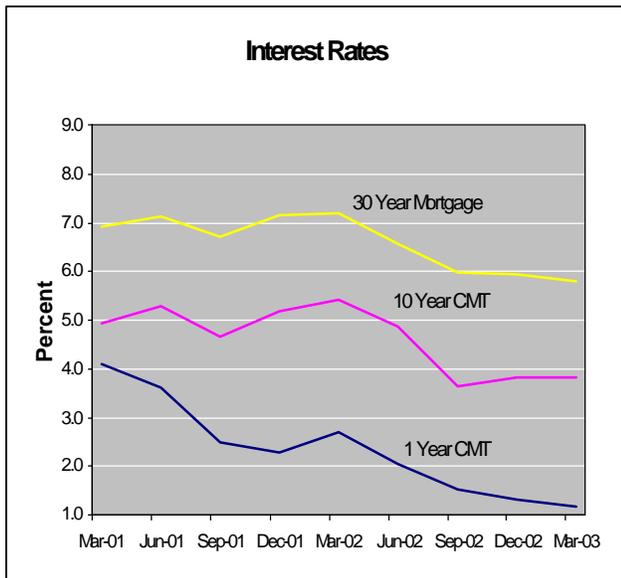
This was due to increases in both mortgage loan servicing fee income and other fee income from sources unrelated to in-

terest rates. Mortgage loan servicing fee income rose to 0.66 percent of average assets in the first quarter, up from 0.64 percent in the fourth quarter. Other fee income includes retail banking fees, mutual fund and annuity sales commissions, and loan servicing income from nonmortgage loans.

The ARM share of total thrift mortgage originations fell to 26 percent, down from 29 percent in the prior quarter. Along with the relative fall in ARM originations, the ARM share of total 1-4 family mortgages held in

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## Interest Rates and ARM Market Share



### Median Sensitivity Remains Stable in the First Quarter (continued)

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 portfolio fell to 54.5 per cent from 56 per cent in the fourth quarter.

First-quarter 1-4 family mortgage originations by thrifts were \$145.4 billion, down from a record level of \$159.6 billion in the fourth quarter. Total mortgage originations in the first quarter were \$161.4 billion, down from \$177.4

billion in the fourth quarter.

Thrifts' share of all 1-4 family originations was 19.9 percent in the first quarter, down from 21.4 percent in the fourth quarter. The first quarter of 2003 witnessed a slight decrease in the rate of U.S. home ownership, falling to 68 percent from 68.3 percent in the prior quarter.

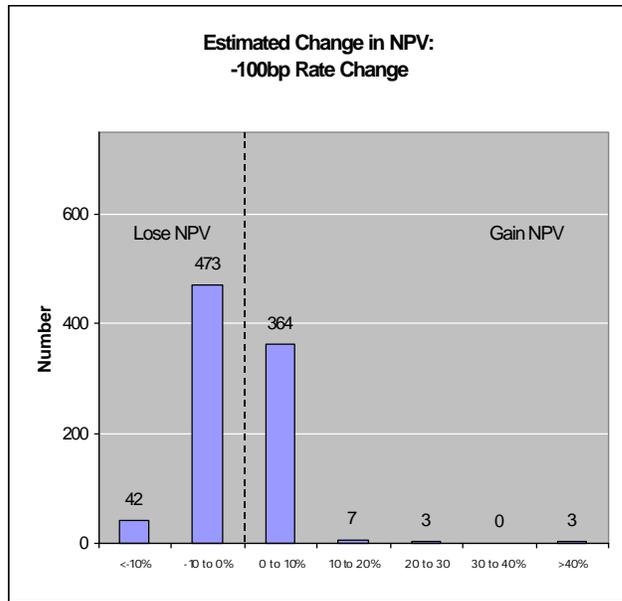
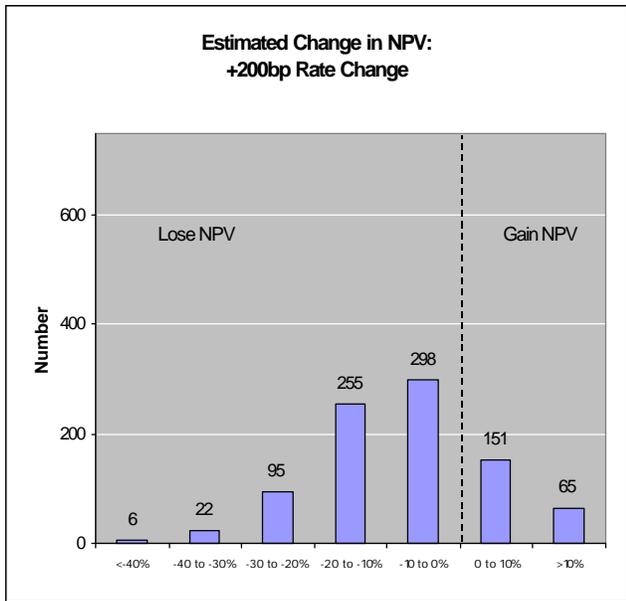
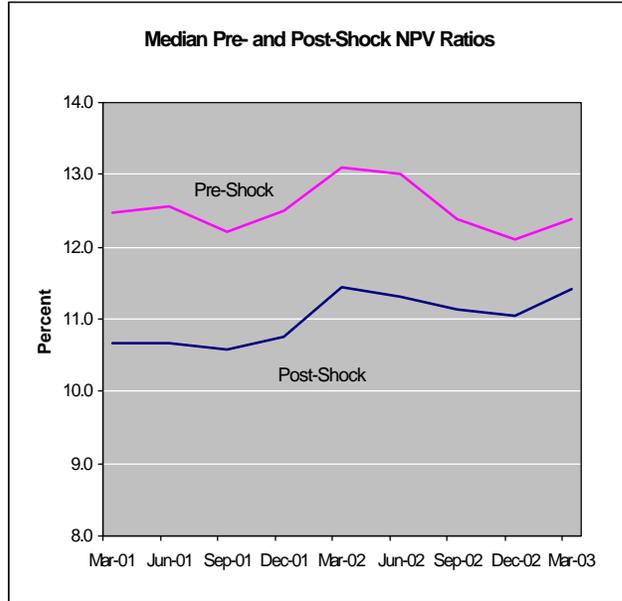
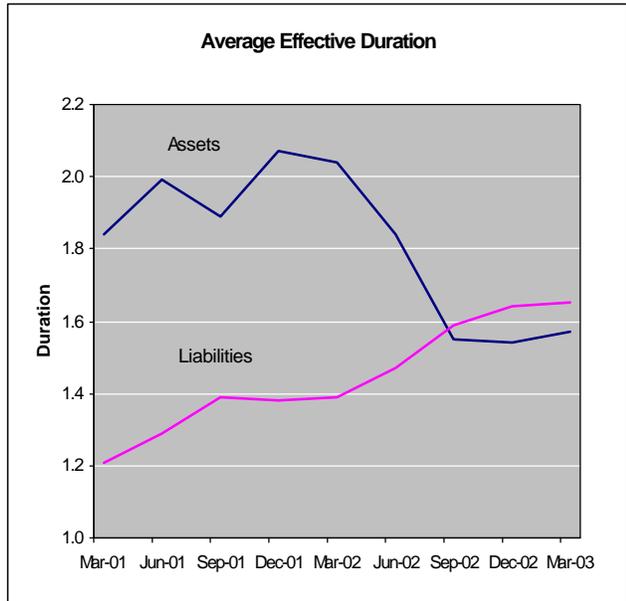
Refinancing accounted for 55.4 percent of thrift originations of single-family mortgages in the first quarter, up from 49.4 percent in the fourth quarter. This increase is consistent with the refinancing activity of all lenders, where the rate rose to 71 percent in the first quarter, up from 69 percent in the prior quarter.

The industry's average effective duration of assets rose slightly from 1.54 to 1.57 between the fourth and first quarters.

With the already low and declining interest rates in recent quarters, the NPV model predicts an increase in prepayments of higher coupon mortgages in portfolio. This tends to lower

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## Duration and NPV Sensitivity Measures



### Median Sensitivity Remains Stable in the First Quarter (continued)

(Continued from page 5) mortgage duration and, therefore, assets duration. However, assets duration actually rose in the first quarter. This was due to lower-coupon mortgages replacing higher-coupon mortgages with less prepayment risk resulting in greater durations.

The industry's average effective duration of liabilities

rose very slightly from 1.64 to 1.65 in the first quarter.

Although the increase in the industry's average effective assets duration was greater than the increase in the industry's average effective duration of liabilities, a negative duration gap still exists for the thrift industry as a whole.

The median pre-shock NPV ratio for the industry rose during the first quarter from 12.1 percent to 12.4 percent.

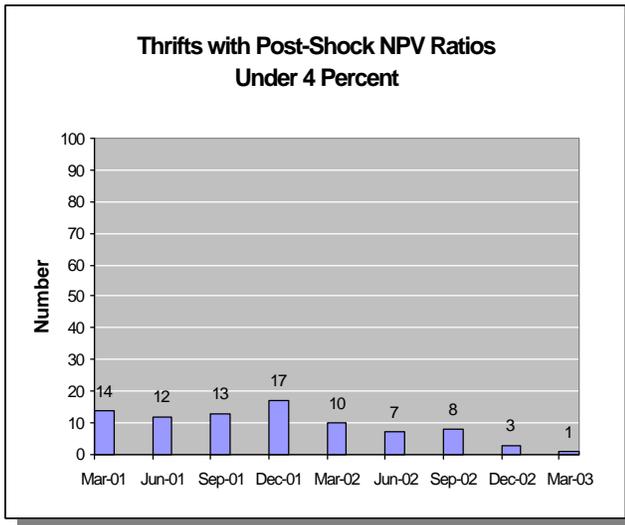
Along with this rise in the median pre-shock NPV ratio, the median post-shock NPV ratio also rose slightly, moving from 11.1 percent at the end of the fourth quarter to 11.4 percent at the end of the first

quarter. This was due to the increase in the median pre-shock NPV ratio.

At the end of the first quarter, a 200 basis point increase in rates would produce a net portfolio value loss for 676 thrifts, while 216 thrifts would see their net portfolio values rise.

If rates fell by 100 ba-  
(Continued on page 7)

## Interest Rate Risk Measures



	NPV as % of PV of Assets		% Change in NPV	
	Dec-02	Mar-03	Dec-02	Mar-03
<b>+300</b>	9.01%	9.16%	-15%	-15%
<b>+200</b>	9.72%	9.76%	-7%	-9%
<b>+100</b>	10.15%	10.18%	-1%	-3%
<b>Base</b>	10.20%	10.43%	0%	0%
<b>-100</b>	10.11%	10.47%	-1%	-1%
<b>-200</b>	N/A	N/A	N/A	N/A
<b>-300</b>	N/A	N/A	N/A	N/A

	Under 100bp	101-200bp	201-400bp	Over 400bp	Total
<b>Over 10%</b>	289	154	105	7	555
<b>6% to 10%</b>	165	102	33	1	301
<b>4% to 6%</b>	16	8	10	0	34
<b>Below 4%</b>	1	0	2	0	3
<b>Total</b>	<b>471</b>	<b>264</b>	<b>150</b>	<b>8</b>	<b>893</b>



	Under 100bp	101-200bp	201-400bp	Over 400bp	Total
<b>Over 10%</b>	313	144	103	5	565
<b>6% to 10%</b>	163	90	43	3	299
<b>4% to 6%</b>	7	11	8	1	27
<b>Below 4%</b>	0	0	1	0	1
<b>Total</b>	<b>483</b>	<b>245</b>	<b>155</b>	<b>9</b>	<b>892</b>



### Median Sensitivity Remains Stable in the First Quarter (continued)

(Continued from page 6)  
sis points, 515 thrifts would see their net portfolio values decrease, while 377 thrifts would see an increase in their net portfolio values.

The number of thrifts with a post-shock NPV ratio below 4 percent fell to one from three in the previous quarter.

With a 200 basis point

increase in interest rates, the thrift industry would lose 9 percent of its net portfolio value. This is up from 7 percent in the previous quarter.

The percentage of thrifts with a post-shock NPV ratio over 6 percent increased between the fourth and first quarters. In the first quarter, such thrifts comprised 96.9 per-

cent of the industry, compared to 95.8 percent in the prior quarter.

The number of thrifts with a post-shock NPV ratio below 6 percent fell to 28 in the first quarter, down from 37 in the fourth quarter.

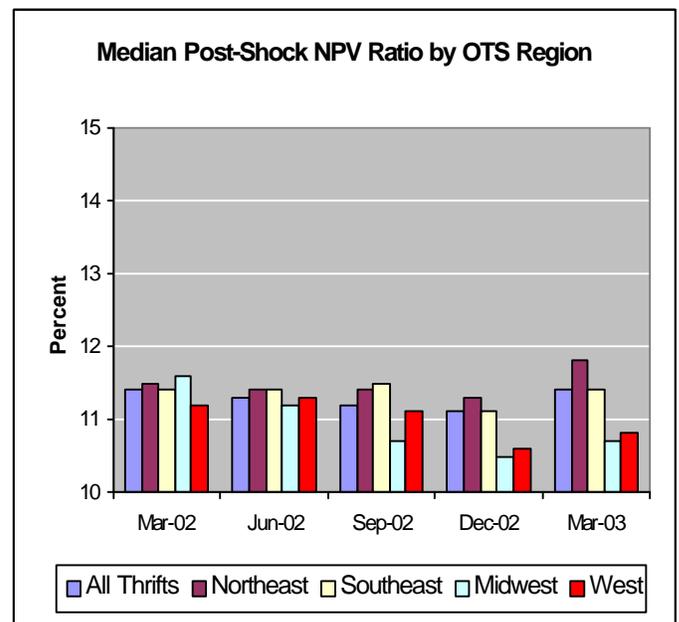
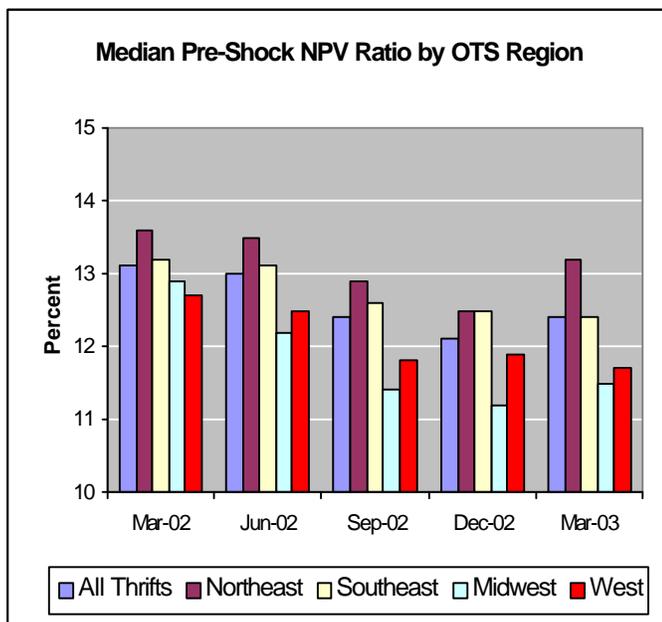
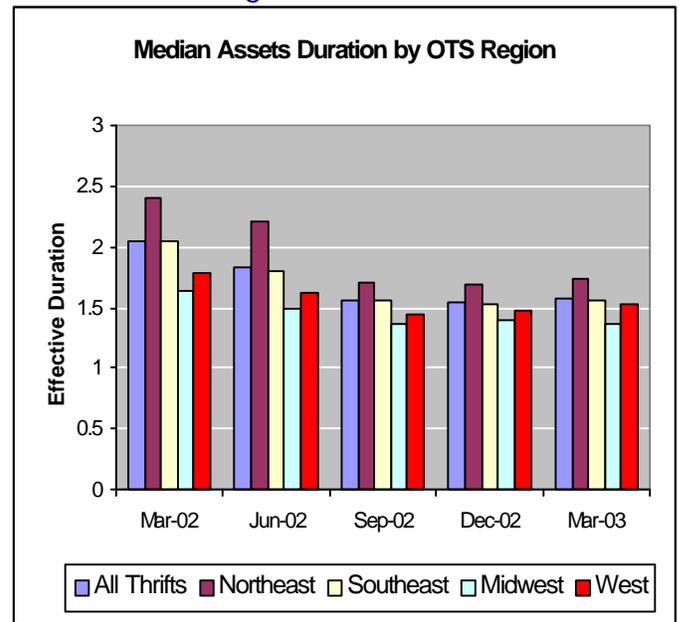
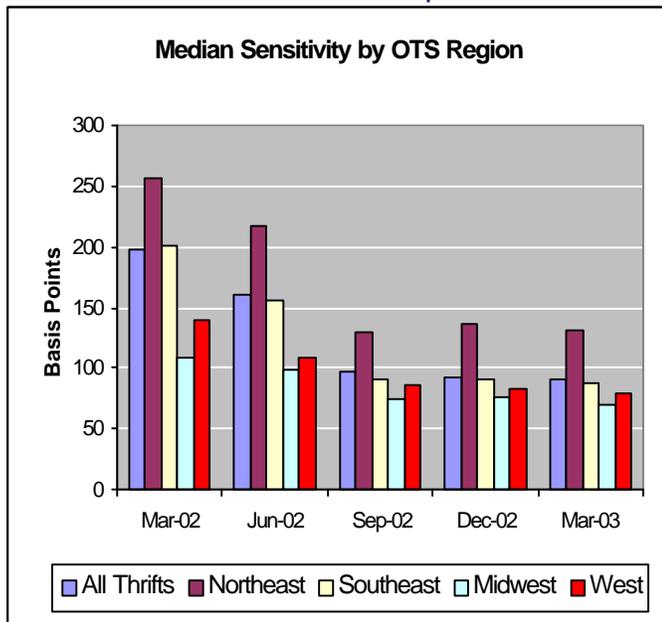
This result is consistent with the rise in the median pre-shock NPV ratio and the fall in median

sensitivity.

The number of thrifts with a sensitivity of 200 basis points or less decreased to 728 in the first quarter, from 735 in the fourth quarter.

The number of thrifts with over 400 basis points in sensitivity rose to nine, from eight in the prior quarter.

## Comparative Trends in the Four OTS Regions



### Regional Comparisons

The Northeast Region had the highest median sensitivity, at 131 basis points at the end of the first quarter, while the Midwest Region had the lowest, with 70 basis points.

All OTS regions experienced a decrease in median sensitivity in the first quarter. The largest per-

centage decrease in sensitivity was in the Midwest Region, where median sensitivity fell 6 basis points or 7.9 percent. In contrast, the Southeast Region saw its median sensitivity fall 3 basis points or 3.3 percent.

Since the creation of the four OTS regions in the first quarter of 2002 until the first quarter of 2003, the largest change in me-

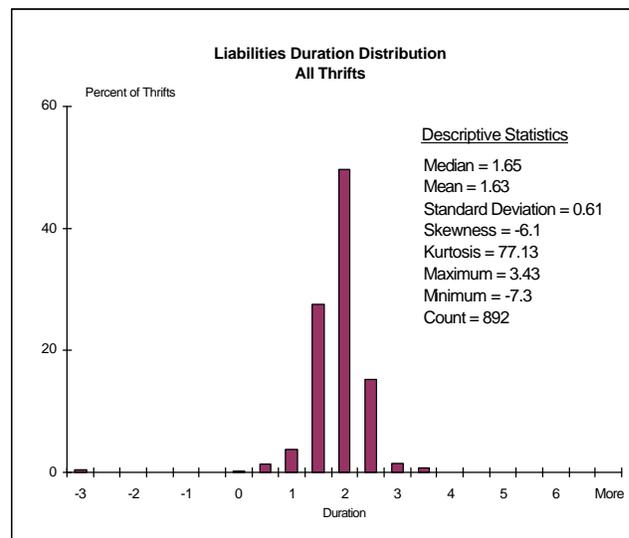
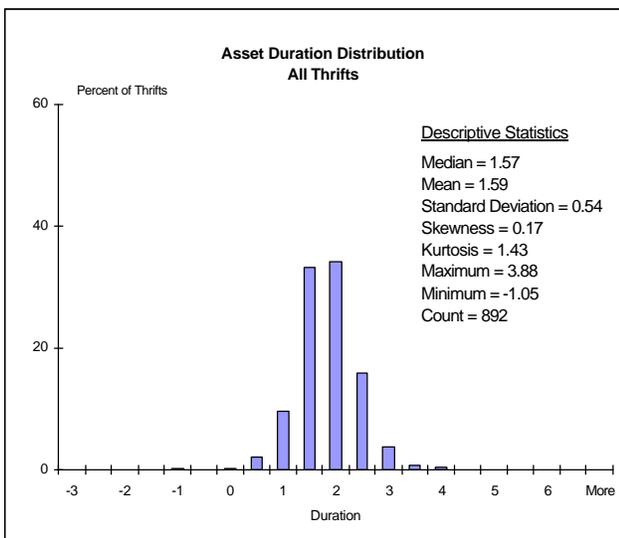
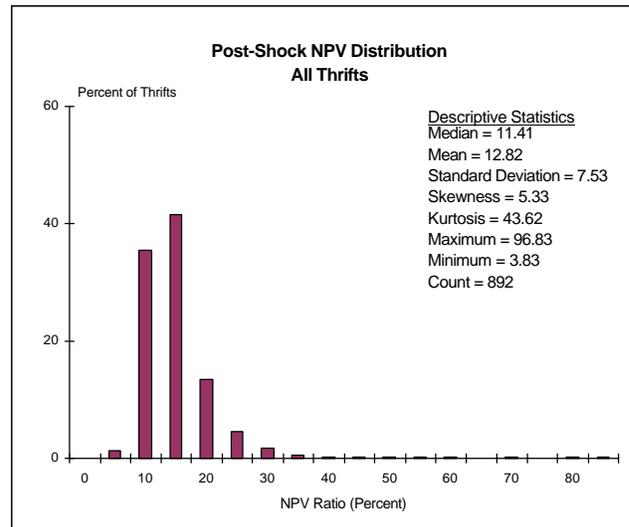
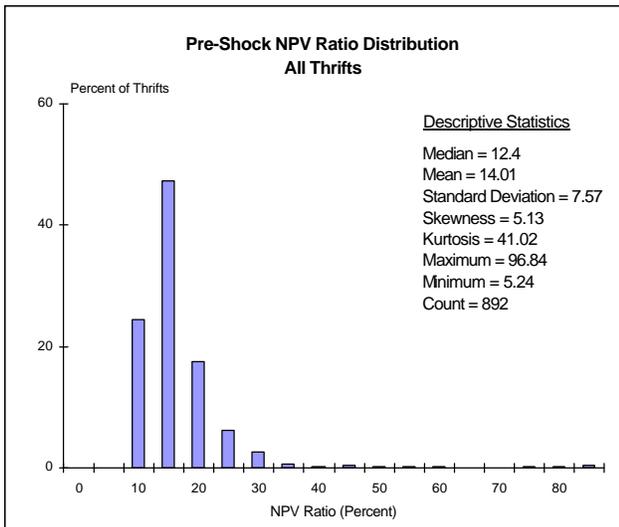
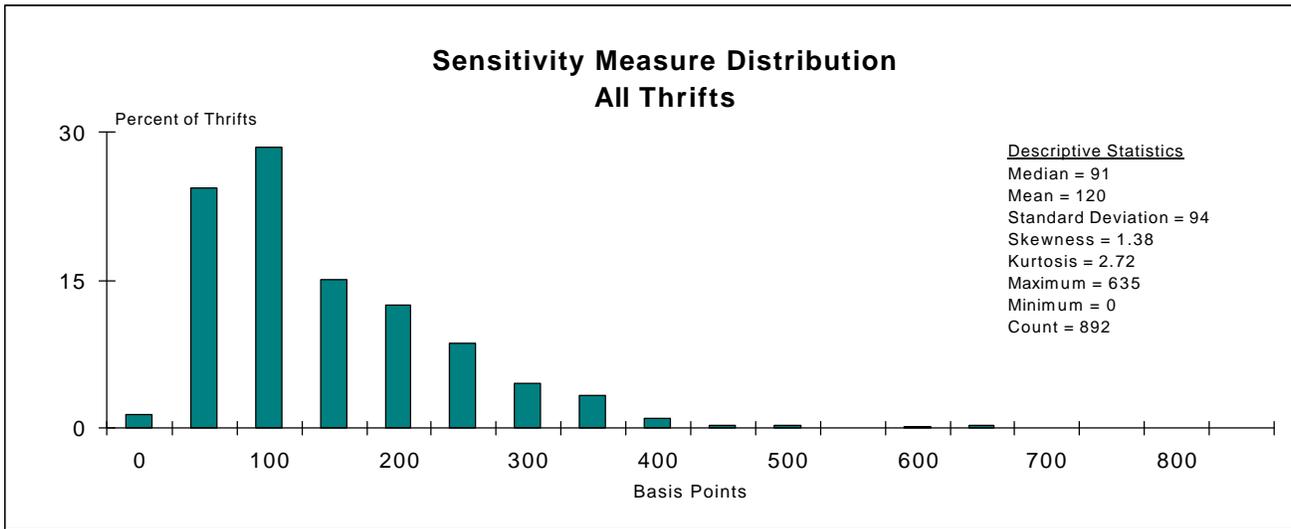
dian sensitivity was in the Southeast Region, where it fell from 201 basis points to 88 basis points.

The Northeast and Midwest Regions experienced increases in their pre-shock NPV ratios, while the Southeast and West Regions saw their pre-shock NPV ratios fall. The Northeast Region's median pre-shock NPV ra-

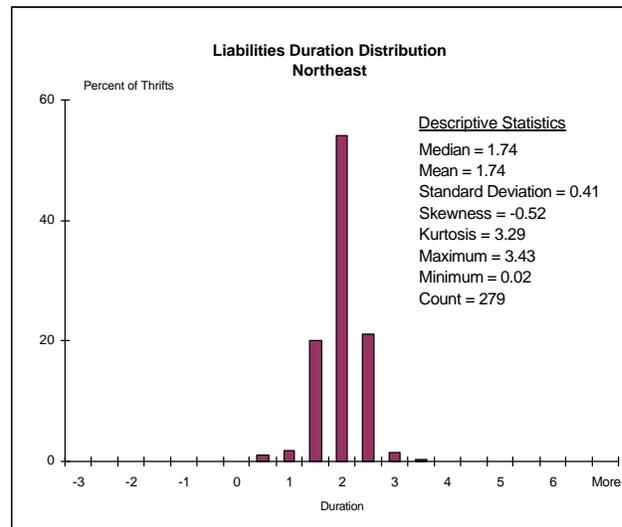
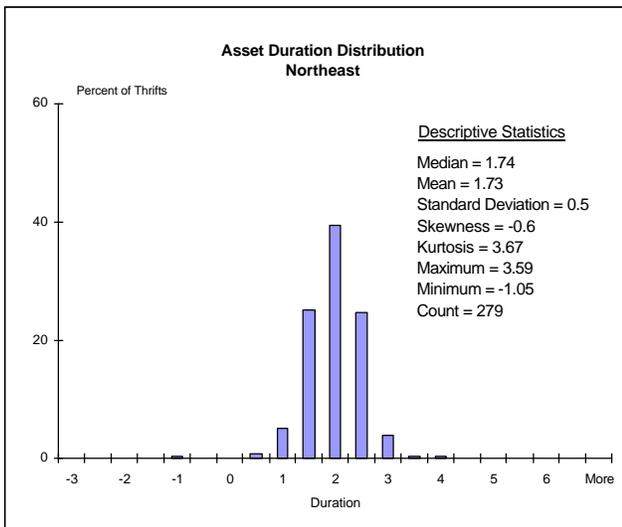
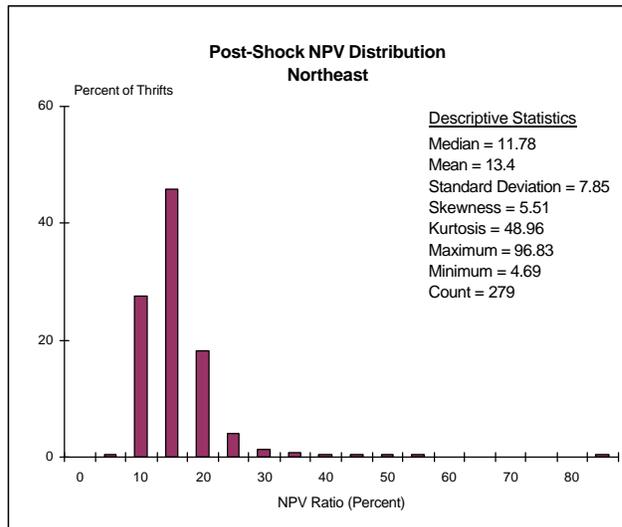
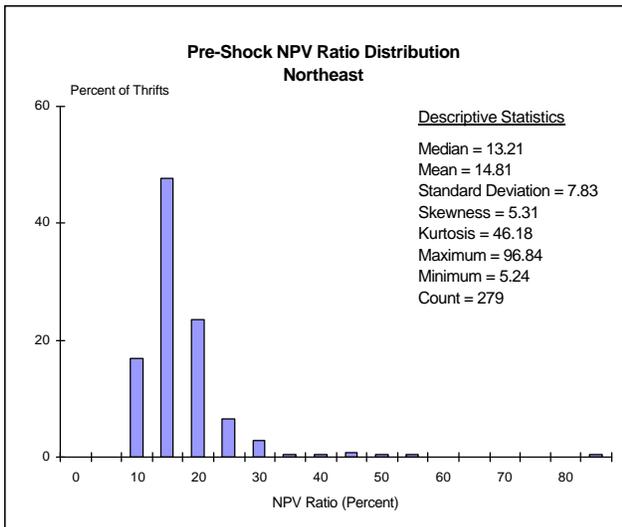
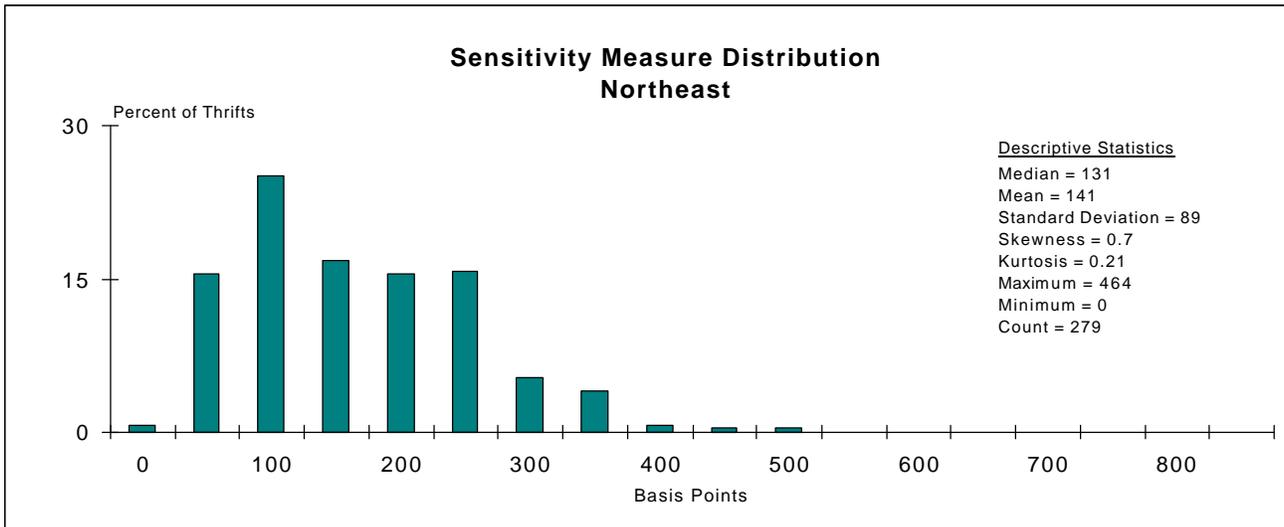
tio rose 5.6 percent, while the West Region's median pre-shock ratio fell 1.7 percent. The Northeast Region had the largest increase in the median post-shock ratio, rising 4.4 percent or 50 basis points.

All OTS regions saw their median assets durations rise in the first quarter.

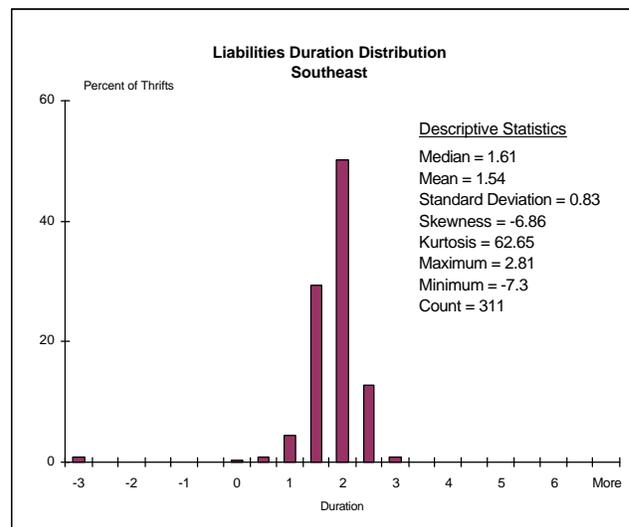
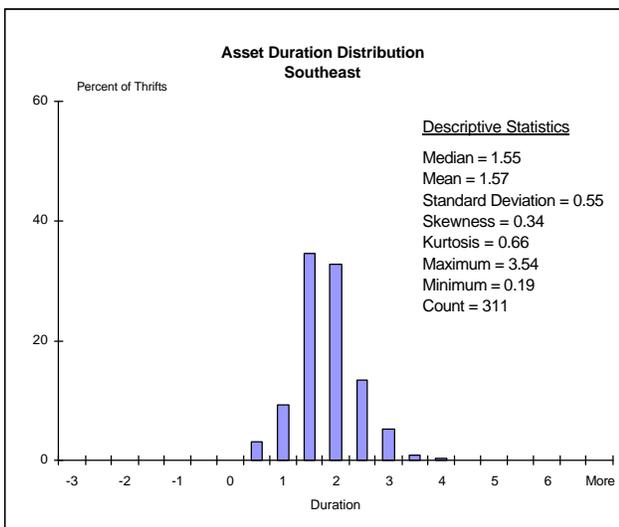
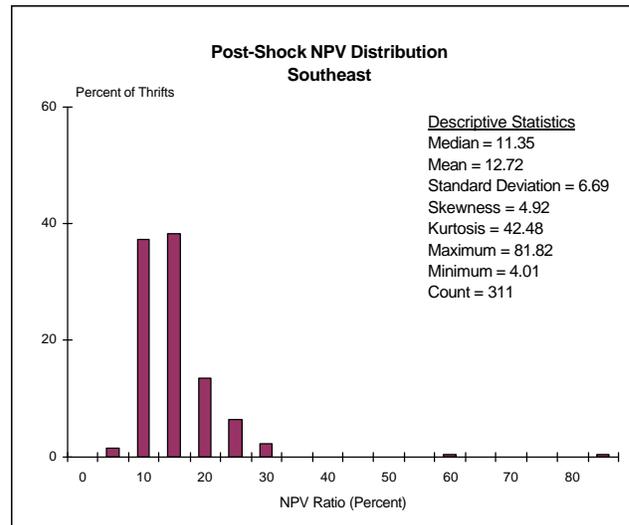
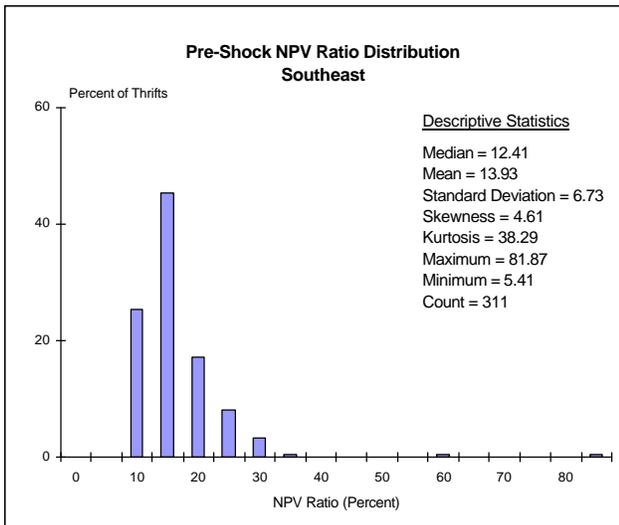
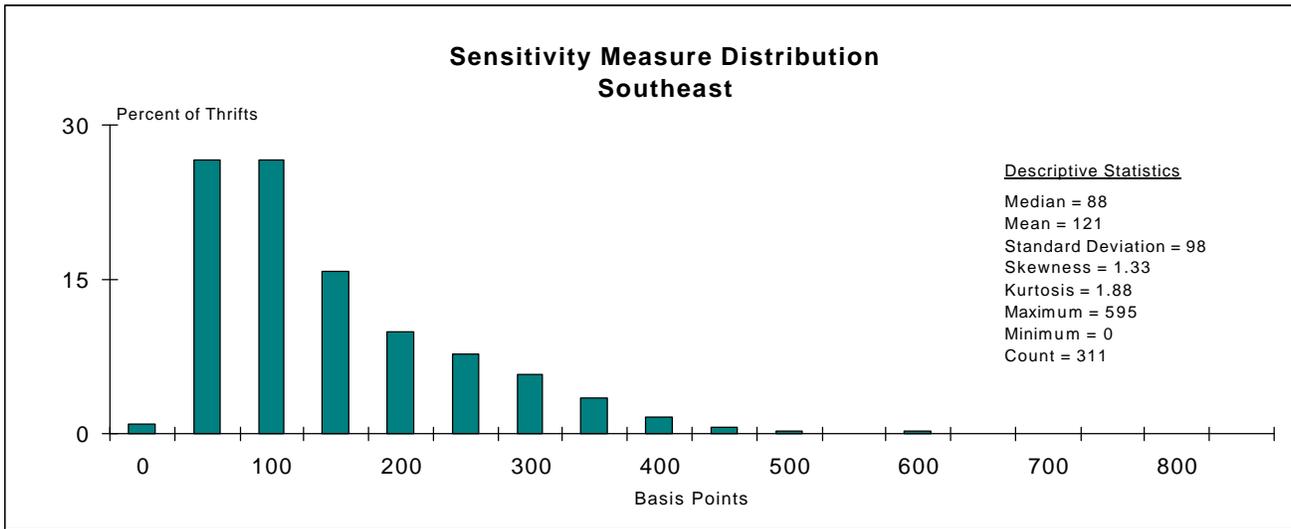
## Appendix A – All Thrifts



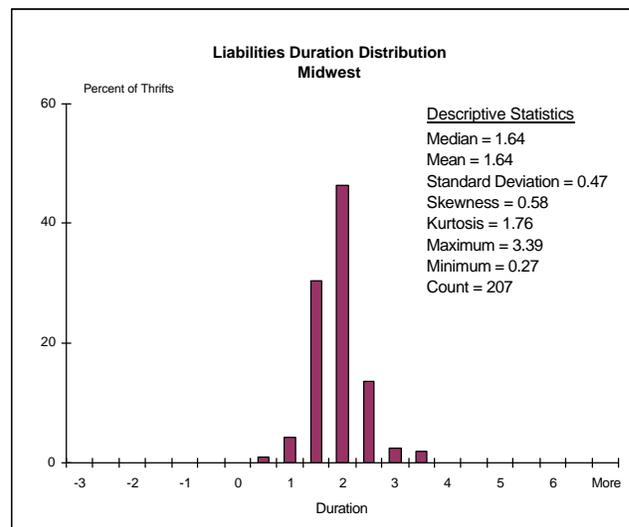
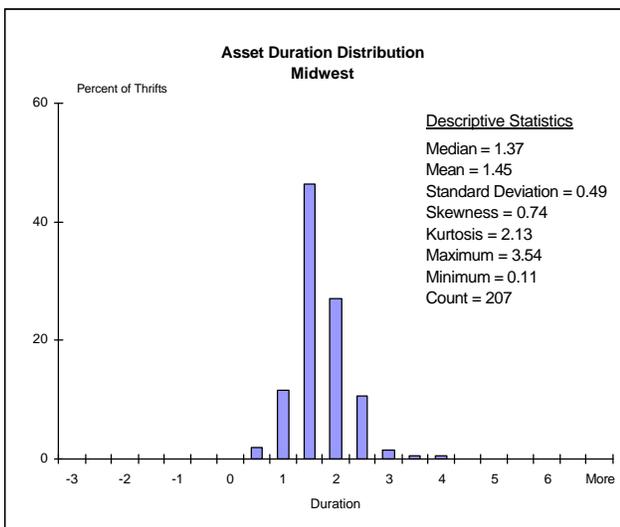
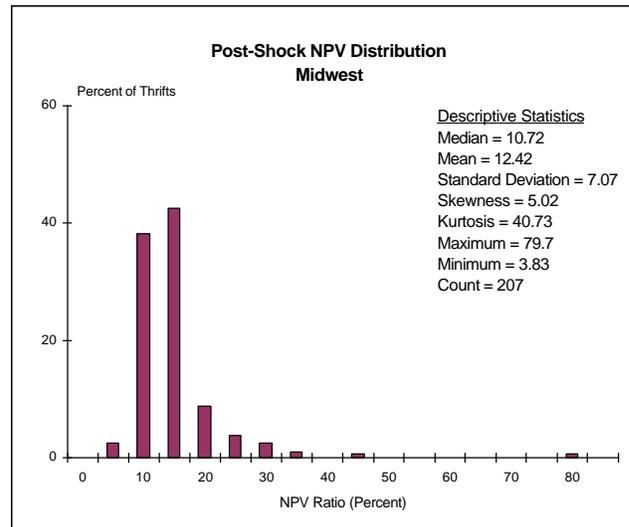
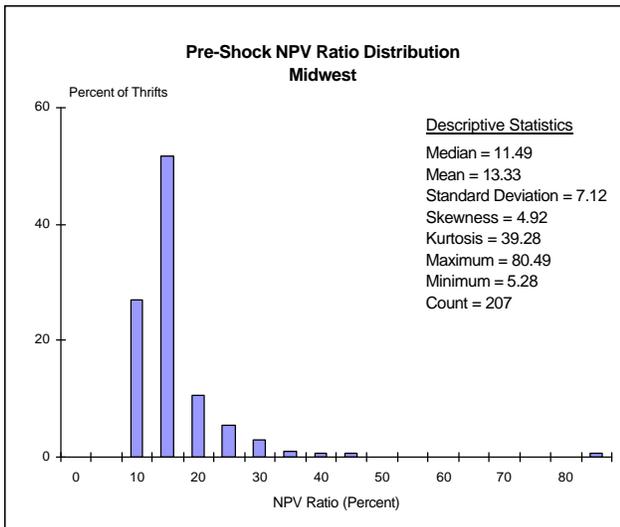
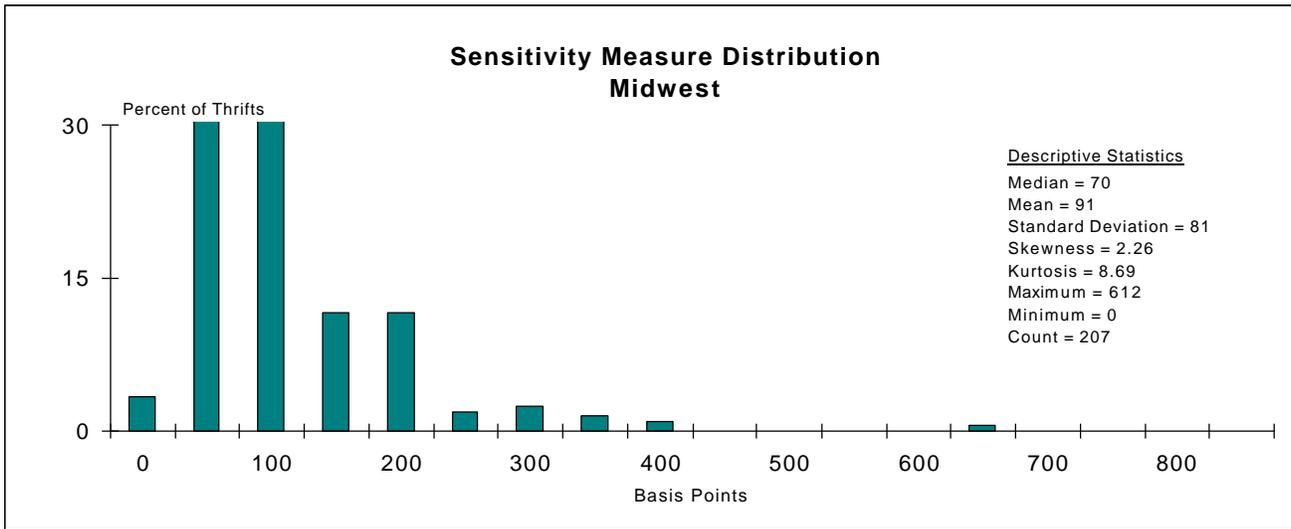
## Appendix B – Northeast Region



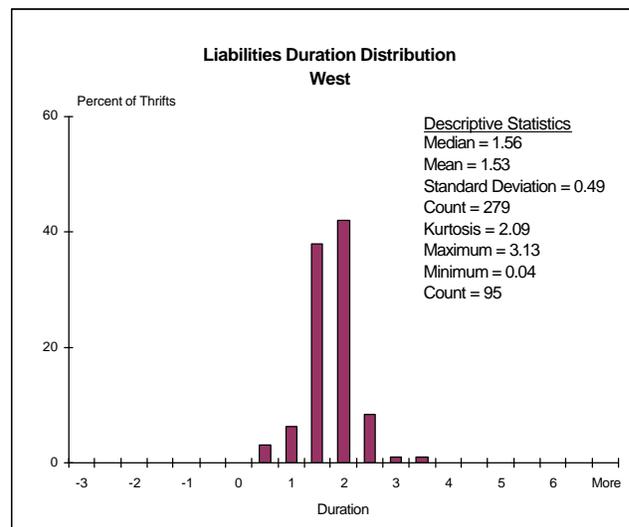
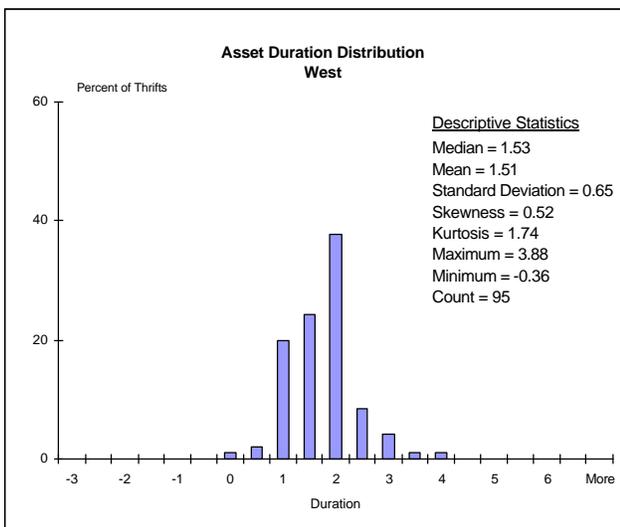
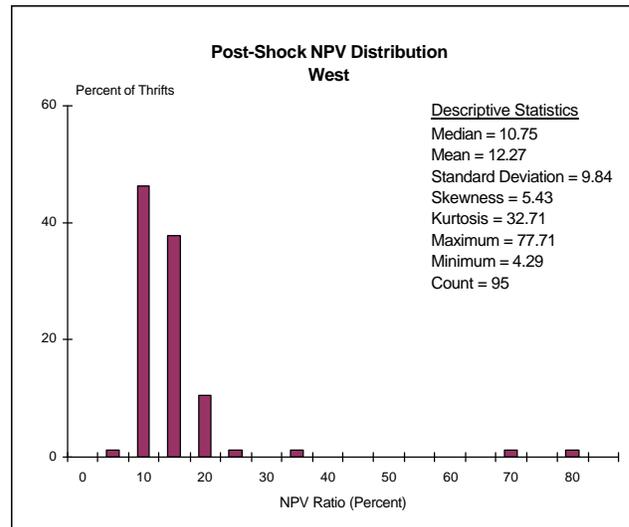
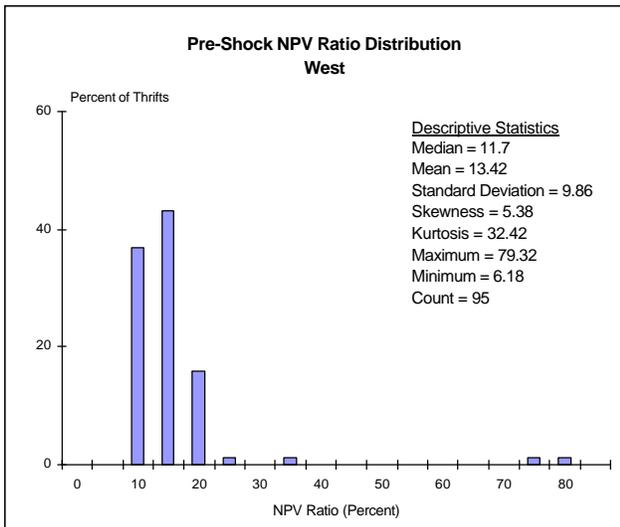
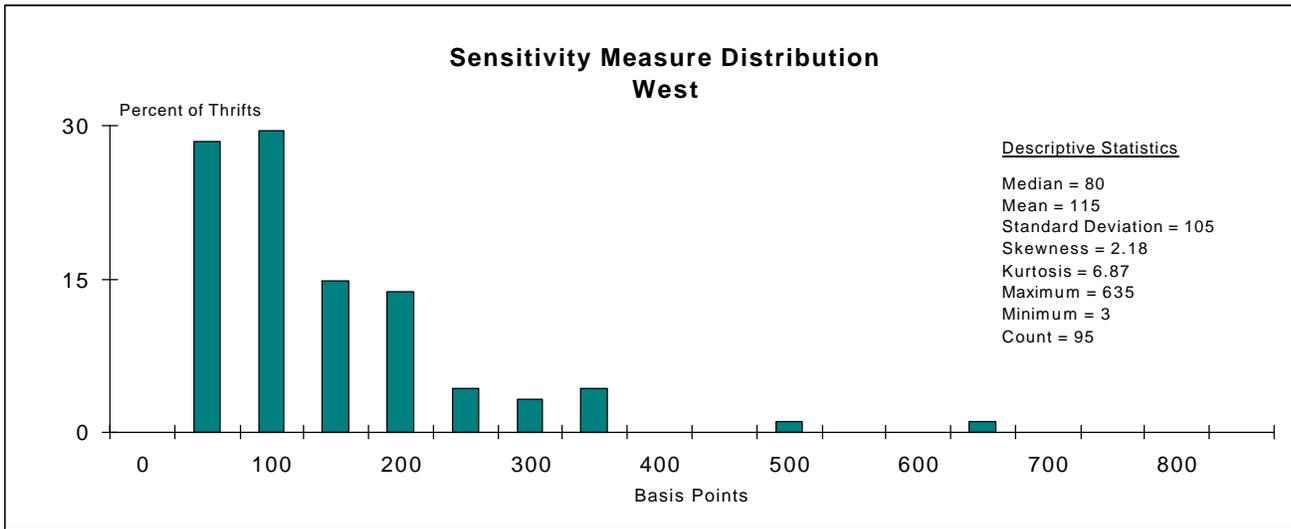
## Appendix C – Southeast Region



## 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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