

The Quarterly Review Of Interest Rate Risk

Office of Supervision,
Economic Analysis Division



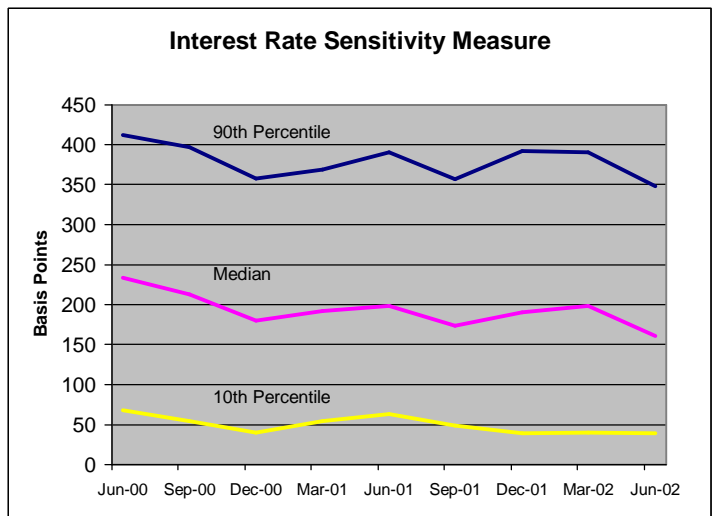
Special points of interest:

- 30-yr mortgage rate falls
- Yield curve becomes more steeply sloped
- Second quarter sees median interest rate sensitivity fall
- Asset duration falls due to rise in the rate of mortgage prepayments
- Feature Article on Traditional and Alternative Mortgages

Median Sensitivity Falls in the Second Quarter

Median thrift sensitivity fell to 161 basis points in the second quarter, down from 192 basis points in March. This decrease reflects the fall in interest rates between the first and second quarters.

The median pre-shock Net Portfolio Value (NPV) ratio remained largely unchanged between the first and second quarters, while the post-shock NPV ratio fell slightly. The second quarter saw the number of thrifts with high interest rate risk fall to 7, down from 10 thrifts in the previous quarter.



See details inside, starting on page 5.

Traditional and Alternative Mortgages

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The word mortgage derives from the French word "mort," meaning death, and the Middle English word "gage," meaning pledge. As such, a mortgage pledges the purchased property as security, or collateral for the mortgage, until the debt is paid off (which might not be achieved by the time the borrower is dead).

By definition, a fixed-rate mortgage is a level-payment, fully-amortizing loan having an interest rate that is fixed over the life of the contract. This type of mortgage is attractive to borrowers who place a high value on having mortgage payments that are the same over the life of the loan. With this kind of mortgage,

there is no uncertainty as to the size of monthly payments. Fixed-rate mortgages became the standard after the Federal Housing Administration introduced its insurance program for these mortgages in the 1930s.

The high rates of inflation and interest rates prevailing in the U.S. in the 1970s led to the development of new, or "alternative," mortgage products. This is because the traditional 30-year fixed-rate mortgage (FRM) presented asset-liability management (ALM) issues to financial institutions holding them and affordability issues to potential homebuyers.

The ALM issues stem from the large "duration mismatch" that occurs when depository institutions fund FRMs with deposits tied to short-term interest rates. The affordability issue becomes acute during periods of high inflation and interest rates because they drive up the monthly payment on newly originated traditional FRMs.

Some mortgage market participants observed that part of the affordability issue derives from the structure of the FRM itself. This is known as the "tilt problem." The tilt problem refers to the fact that the real financial burden on the borrower tends to be greater in

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Traditional and Alternative Mortgages (continued)

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the early years of the loan than in the later years. This is especially true during periods of rapidly rising prices and incomes. As a result, the high initial mortgage payments in real terms force many potential borrowers to forego home ownership.

Most of the important alternative mortgage products that have developed over the past 20 years have attempted to address the duration mismatch problem and/or the tilt problem. These include the adjustable-rate mortgage, the graduated payment mortgage, the growing equity mortgage, the reverse annuity mortgage, the shared appreciation mortgage, the price level adjusted mortgage, the rollover mortgage, and the buydown mortgage. (See J. Starke and A. Starke, *Mortgage Lending and Investing* for details on the various alternative mortgage instruments).

Adjustable-rate mortgages (ARMs), while they do address the tilt problem, were created primarily to address the duration mismatch problem. The other types of alternative mortgages, however, were all created solely to address the tilt problem. (See F. Fabozzi and F. Modigliani, *Mortgage & Mortgage-Backed Securities Markets* for details). By far, the most important of all alternative mortgage instruments in use today is the ARM.

Besides their popularity among borrowers, especially during periods of high interest rates, ARMs can be used effectively by

savings associations to manage their interest rate risk. Unlike fixed-rate mortgages, ARMs provide savings associations, and other financial institutions that hold these mortgages in their portfolios, with the ability to better match the return on their mortgage portfolio with the short-term cost of funds.

Because the contract interest rate of an ARM is reset as market rates change, the duration mismatch between these mortgages and the liabilities used to fund them is less than with FRMs. Unlike FRMs, the risk of rising rates is borne by the borrower with ARMs. When interest rates fall, both types of mortgages confront savings associations with interest rate risk in the form of prepayment risk.

In contrast to a fixed-rate mortgage, an ARM has an interest rate that is not fixed for the life of the loan. Instead, the mortgage contract rate is reset periodically based on the movements of a benchmark, or reference rate index, typically a short-term market rate. Typical reset periods are one month, six months, one year, three years, or five years. A margin, or spread, is added to the index rate to derive the fully-indexed contract rate on an adjustable-rate mortgage. The margin reflects credit risk, operational risk, market factors, and the cost of servicing.

ARM contracts have periodic caps and floors, as well as lifetime caps and floors. These specify

the maximum change in either the contract rate or monthly payment that can occur over the reset period and the life of the mortgage. Rate and payment caps on ARMs benefit borrowers in rising rate environments. In contrast, rate and payment floors benefit lending institutions when rates fall.

ARMs with payment caps, but no rate caps, can present a borrower with the prospect of negative amortization when interest rates rise. Negative amortization occurs when the monthly mortgage payment is insufficient to cover current period interest, resulting in an increase in the mortgage balance. Negative amortization can never occur for adjustable-rate mortgages having rate caps, but no payment caps.

An ARM rate will not be fully-indexed if either a rate cap or rate floor is preventing that from happening, or if a "teaser rate" is in effect. Frequently, mortgage originators offer "teaser" rates on ARMs to make them more attractive to borrowers. Teaser rates are below-market rates that are in force during some initial period of the loan.

Although nationwide ARM originations began in earnest in the early 1980s, the Federal Home Loan Bank Board (FHLBB) had attempted to get Congressional approval for this type of mortgage in the early 1970s without success. Critics at the time viewed ARMs as a dangerous type of mortgage product for borrowers during peri-

ods of rising interest rates. However, some state-chartered savings and loans were allowed to originate ARMs (notably in California) during this time.

With the advent of the savings and loan crisis in the late 1970s, the FHLBB finally was able to move forward with an experiment with ARMs in federally-chartered savings associations in California. The immense and immediate popularity of the ARM in California soon spread throughout the U.S. The relatively quick acceptance of ARMs probably stems in part from the fact that the approach used in setting the contract rate for these products had already been used successfully for other financial instruments, such as floating-rate notes, adjustable-rate preferred stock, and floating-rate certificates of deposit.

Two types of benchmark, or reference rate, indexes are used in setting the contract rate on ARMs. One set of indexes is based on market-determined interest rates, while the other set is based on the cost of funds for thrifts. For the most part, the market-determined indexes are based on rates of U.S. Treasury bills and notes. The most popular of these are the six-month Treasury bill rate, and the one-year and five-year Treasury note rates. ARMs based on Constant Maturity Treasury (CMT) rates, or other market interest rates, are known as "current index ARMs."

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Traditional and Alternative Mortgages (continued)

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ARMs whose rates are tied to thrift cost of funds (COF) indexes are known as COF ARMs or, alternatively, "lagging index ARMs." COF indexes are composite indexes in that they include recent borrowing costs incurred by thrifts from all their different funding sources (deposits, advances, bonds, etc.). Depending on the structure of a thrift's liabilities portfolio, much of these borrowing costs may have been locked in some time ago. This is the main reason that changes in a COF index will lag changes in current market interest rates. When interest rates change, the composite funding cost index will reflect the rate changes along with locked in longer-term rates. The extent to which recent rate changes will be reflected in a given institution's cost of funds will depend on the degree of turnover in its liabilities.

As a result, an institution's cost of funds will be lower than the current cost of obtaining these same liabilities when rates rise. When rates fall, just the opposite situation occurs. Besides lagging movements in market indexes, COF indexes are also less volatile and smoother in appearance because they consist of both historical and current interest costs.

The two most widely used of these COF indexes are: the Eleventh District Cost of Funds Index (COFI) and the National Cost of Funds Index (NCOFI). The COFI is the weighted-average cost

of funds of Federal Home Loan Bank member thrift institutions in California, Nevada, and Arizona. Since 1981, the San Francisco Home Loan Bank has published this index monthly with a one-month lag. The NCOFI is based on the median cost of funds of all federally regulated thrifts, and OTS publishes this index with about a six-week delay. These publishing delays are another source of the "lag" in lagging indexes.

Several areas of concern arise with ARMs tied to the two COF indexes. The first area of concern is basis risk. Both the COFI and NCOFI are based on the cost of funds of a representative thrift. For the COFI, since it is a mean, or weighted average, cost of funds, the biggest institutions in the Eleventh District largely determine the index value. For the NCOFI, the median thrift's cost of funds determines the index value. Being a median, rather than a mean, the NCOFI is much less subject to changes in the costs of funds at the largest institutions.

The real issue in pricing ARMs tied to COF indexes is not so much the level of the index relative to an institution's own cost of funds, but rather, the degree of correlation between changes in the COF index and changes in the institution's own cost of funds. The degree to which these changes are not perfectly correlated is a source of what is known as "basis risk." While this term derives from the use of futures contracts to hedge (where

the difference between the spot and futures price is known as the "basis"), it has come to have broader application to all kinds of hedges, both natural and synthetic.

Basis risk occurs when the financial instrument one is trying to hedge is not perfectly correlated with the hedging instrument. For example, in the case where an institution is attempting to maintain some amount of spread between its interest income and its interest expense, it can try to do so through the use of ARMs. This strategy is a kind of "natural hedge," where ARMs are used to hedge the cost of liabilities.

For a depository institution, CMT ARMs are likely to produce more basis risk than COF ARMs. For an institution using COF ARMs, the greater the difference between its funding structure and that of the mean institution— or median institution in the case of the NCOFI— the less correlated its own funding costs will be with that of the ARM index, and the greater will be its basis risk.

A non-depository will have more basis risk when it holds lagging, versus current, index ARMs because its funding structure differs from that of a depository institution. It can eliminate much of this risk by using a COFI for LIBOR swap. However, this has tended to be a relatively illiquid and expensive product due, perhaps in part to the instability and unpredictability of the re-

lationship between COFI and LIBOR. As a consequence of this, institutions with more market-based funding costs, such as Fannie Mae and Freddie Mac, will have more risk that they cannot hedge away, with lagging versus current index ARMs. Thus, COF ARMs have less appeal and less acceptance in the secondary market.

A second area of concern with respect to ARMs is liquidity. For the reasons just given, Fannie Mae and Freddie Mac prefer to securitize ARMs tied to CMT rates. Thus, institutions originating COF, or lagging index, ARMs intend to hold them, due to their relative attractiveness as a natural hedge and their relative lack of liquidity.

A third area of concern is the linkages between interest rate risk and credit risk in current versus lagging index ARMs. Current market ARMs typically have rate caps, while lagging index ARMs typically have payment caps. As a result, interest rate risk is greater for current market ARMs because the contract rate on these mortgages does not always fully adjust to the higher levels of market rates, while the contract rate on a cost of funds ARM adjusts completely to the higher level of the COF index. On the other hand, credit risk is greater for lagging market index ARMs, because the payment caps associated with these mortgages can sometimes result in negative amortization, driving

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Traditional and Alternative Mortgages (continued)

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up the probability of borrower default.

Other connections between interest rate risk and credit risk can be seen in the different roles played by teaser rates in current versus lagging index ARMs. Teaser rates offered on current index ARMs mean something completely different from what they mean for lagging index ARMs. For current index ARMs, the teaser rate sets the contract rate, which is in force over some initial period of the loan. With this arrangement, the lender loses money to the borrower because the teaser rate is a below-market rate.

In contrast, the teaser rate on a lagging index ARM is used to set the initial monthly payment, but then the contract rate on the ARM rises to the fully-indexed rate. As a result, the borrower pays the fully-indexed rate. In the event that this initial payment is insufficient to cover the fully-indexed interest costs of the mortgage, negative amortization will occur. This involves a transfer of the borrower's equity stake in the property to the lender in the form of an increased debt claim held by the lender. Typically, if a COF ARM permits negative amortization, it will also contain a reset date, at which point, the loan must be placed on a fully-amortizing schedule.

The same issues that we observe with respect to teasers in current versus lagging index ARMs apply to the built-in caps in these instruments. If

rates rise on current index ARMs such that the fully-indexed rate is above the current rate cap, the lender will receive less than full compensation. Unless the lending institution offsets this problem with a financial derivative position, such as the purchase of a cap, it will have experienced the adverse effects of interest rate risk.

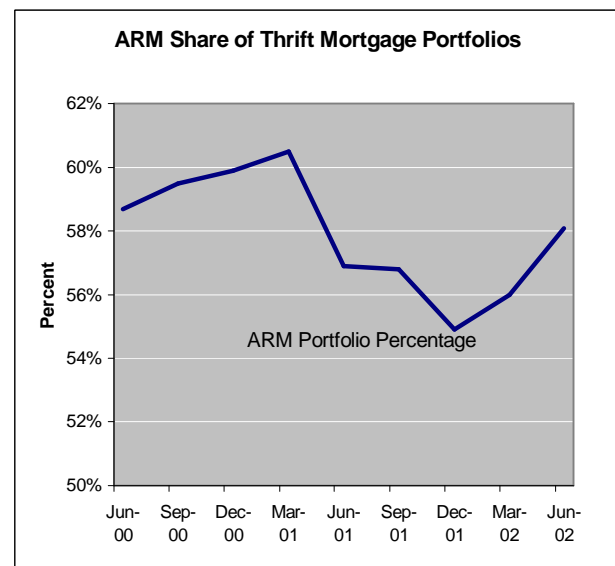
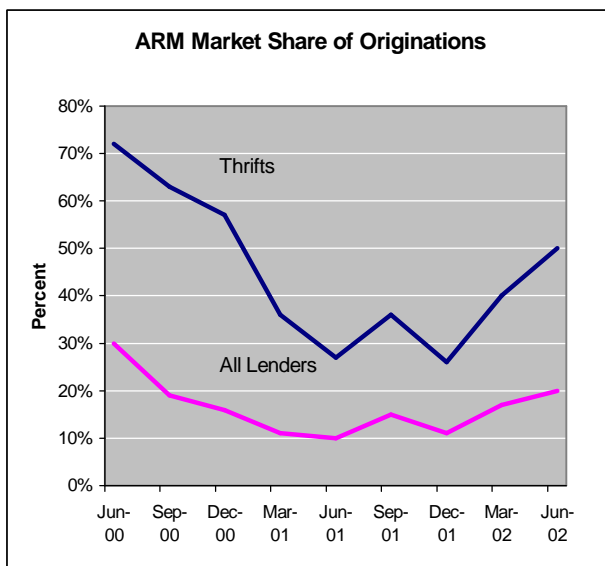
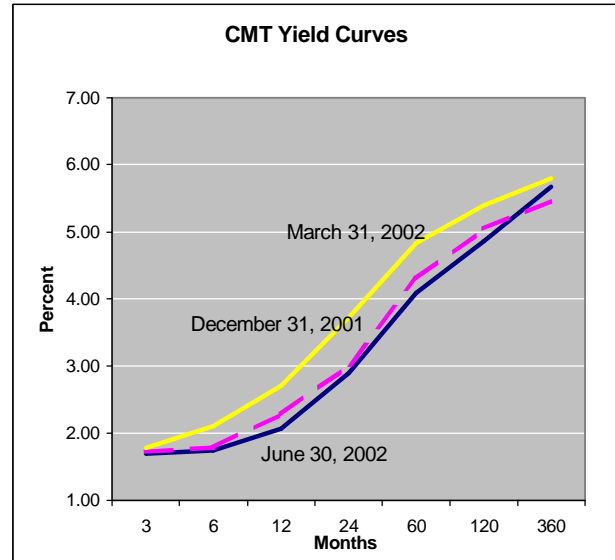
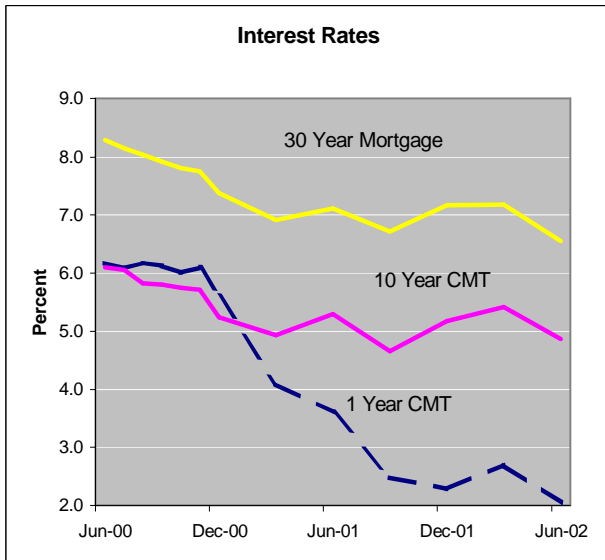
With the lagging index ARM, on the other hand, the payment cannot go up by more than that permitted by the payment cap, but the rate will be nevertheless be fully indexed. This again allows the possibility that the interest payment alone might be more than permitted by the payment cap, resulting in negative amortization and a further increase in the transfer of the borrower's equity stake to the lender in the form of an increased loan balance.

The general perception in the marketplace is that COF ARMs have been declining in their share of total mortgage originations. This perception notwithstanding, they remain an important component of thrift mortgage assets. As of June 2002, these mortgages represented 30.8 percent of total single-family mortgages and MBS, and 53.1 percent of total single-family ARMs and MBS held by OTS-regulated thrifts.

The fact that lagging index ARMs are tied to thrift institutions' costs of funds and not to the market rates makes them more desirable for thrifts to hold, but less desirable

for non-depositaries to buy. Both current and lagging index ARMs have been a great benefit to thrift institutions trying to manage their interest rate risk and to borrowers trying to minimize their monthly payments. From the institution's perspective, the current index ARM provides superior liquidity, while the lagging index ARM provides a superior natural hedge. •

Interest Rates and ARM Market Share



Median Sensitivity Falls in the Second Quarter (continued)

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Treasury rates fell at all maturities between the first and second quarters. In addition, the 30-year mortgage rate declined to 6.55 percent at the end of the second quarter from 7.18 percent at the end of the first quarter.

The behavior of the yield curve during the second quarter allowed the

already favorable lending environment to persist for yet another quarter. Thus, profitability remained healthy with the movements in the yield curve producing somewhat off-setting, and therefore, mixed net results.

The decline in the yield curve, to the extent that fixed-rate mortgages pre-pay and ARMs reprice,

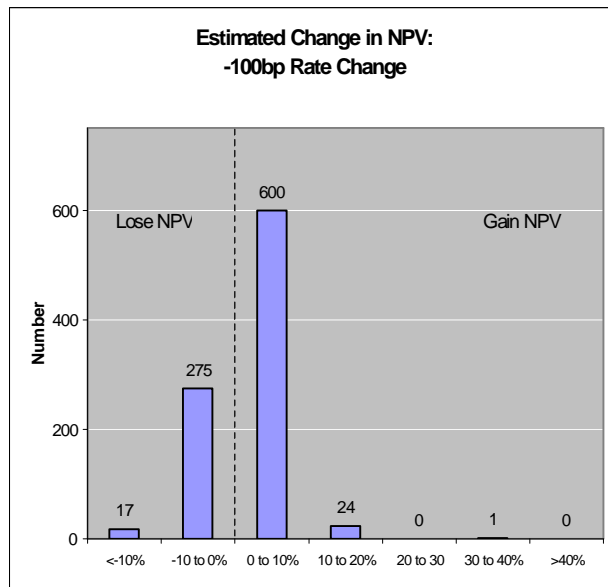
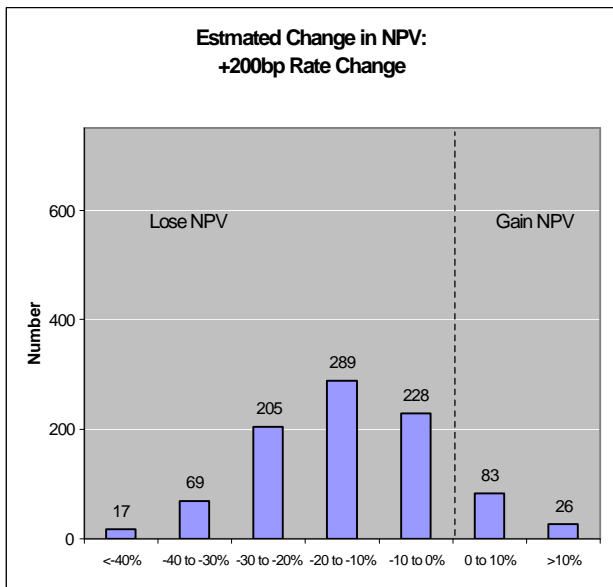
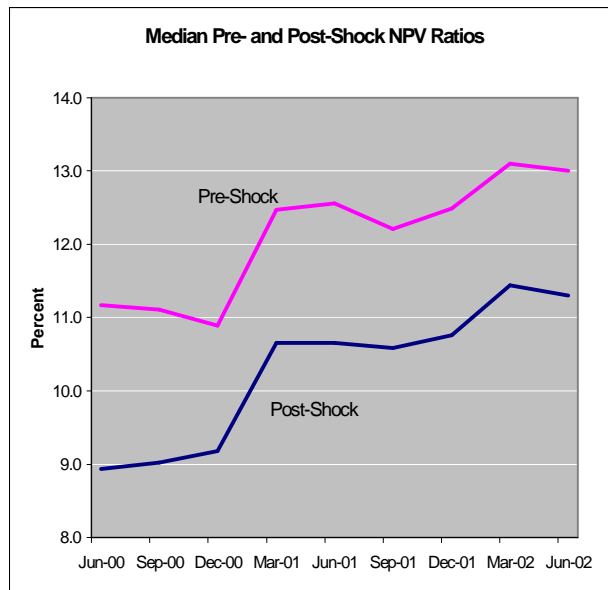
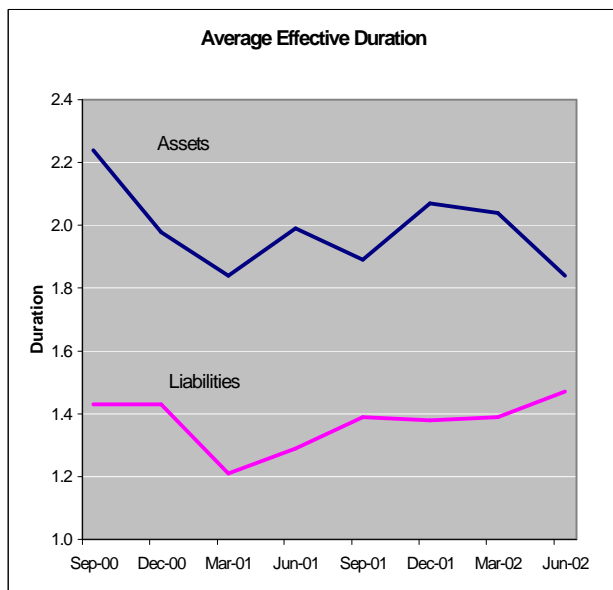
means that institutions will have lower yielding assets on their books. This same decline in the yield curve means that institutions should have lower costs of funding (to the extent that liabilities reprice). Given that the yield curve not only fell but also became steeper, the decline in rates should be favorable to a typical thrift whose

funding is at shorter-term rates than its assets.

The median thrift saw its net interest margin rise from 308 basis points in March to 318 basis points in June. While the median net interest margin rose by 10 basis points during the second quarter, the average net interest margin fell by 9 basis points.

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Duration and NPV Sensitivity Measures



Median Sensitivity Falls in the Second Quarter (continued)

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Consistent with this last point, aggregate thrift industry earnings fell in the second quarter. Second-quarter thrift industry earnings were \$2.85 billion, down from the record \$3.05 billion in the first quarter.

Another factor contributing to downward pressure on operating margins

was the fact that some institutions, seeking to take advantage of the current rate environment, substituted longer maturity borrowings for their maturing shorter-term funds.

The ARM share of total thrift mortgage originations rose to 50 percent, up from 40 percent in the prior quarter. Along with the relative rise in ARM origi-

nations, the ARM share of total 1-4 family mortgages held in portfolio climbed to 58.1 percent in the second quarter.

The second quarter saw an easing in mortgage originations due to a slowdown in the rate of refinancings. Second-quarter 1-4 family mortgage originations by thrifts stood at \$92.8 billion, down from

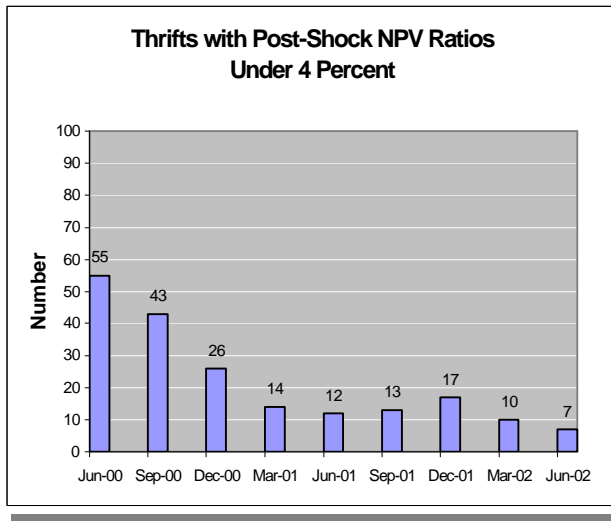
\$97.4 billion in the first quarter. Total mortgage originations in the second quarter were \$109.2 billion, down from \$111.0 billion in the first quarter.

Thrifts' share of all 1-4 family originations was 19.4 percent in the second quarter, up from 18 percent in the first quarter.

The second quarter with-

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Interest Rate Risk Measures



	Ratio of NPV to Assets		% Change in NPV	% Change in NPV
	Mar-02	Jun-02	Mar-02	Jun-02
+300	8.2	9.7	-29%	-19%
+200	9.4	10.6	-17%	-10%
+100	10.4	11.2	-6%	-3%
Base	10.9	11.5	0	0
-100	11.3	11.3	5%	0%
-200	N/A	N/A	N/A	N/A
-300	N/A	N/A	N/A	N/A

	Under 100bp	101-200bp	201-400bp	Over 400bp	Total
Over 10%	215	126	211	50	602
6% to 10%	48	69	145	23	285
4% to 6%	3	2	14	5	24
Below 4%	0	1	3	6	10
Total	266	198	373	84	921

Minimal
Moderate
Significant
High

	Under 100bp	101-200bp	201-400bp	Over 400bp	Total
Over 10%	227	147	204	27	605
6% to 10%	87	77	108	14	286
4% to 6%	2	6	8	3	19
Below 4%	1	1	3	2	7
Total	317	231	323	46	917

Minimal
Moderate
Significant
High

Median Sensitivity Falls in the Second Quarter (continued)

(Continued from page 6)
 nessed a slight decrease in the rate of U.S. home ownership, falling to 67.6 percent from 67.8 percent.

Refinancing accounted for 30.3 percent of thrift originations of single-family mortgages in the second quarter, down from 38.9 percent in the first quarter. This decrease is consistent with the refi-

ancing activity of all lenders, where the rate fell to 43 percent in the second quarter, down from 60 percent in the prior quarter.

Other effects of the fall and steepening of the yield curve during the second quarter are to shorten the duration of assets and increase the duration of liabilities. Consistent with this, the percentage of

thrifts having a positive effective duration gap fell from 86 percent in March to 79 percent in June, while the percentage of thrifts having a negative effective duration gap increased from 14 percent to 21 percent.

Thus, the same factors that produced a negative duration gap at Fannie Mae, as reported recently

in the business press, have had somewhat similar effects on the thrift industry. However, as the numbers show, the vast majority of thrift institutions still have positive effective duration gaps. That is, they are affected adversely when rates rise, and vice versa. Since this particular issue has be-

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Median Sensitivity Falls in the Second Quarter (continued)

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come increasingly important, as well as topical, we plan to devote the next issue's feature article to discussing it in greater detail.

The industry's average effective duration of assets fell from 2.02 to 1.84 between the first and second quarters. (With the recent fall in rates, the NPV Model predicts an increase in mortgage prepayments, which lowers mortgage duration, and, therefore, asset duration.) Meanwhile, the industry's average effective duration of liabilities rose from 1.39 to 1.47 in the second quarter.

The median pre-shock NPV ratio for the industry remained essentially unchanged between the first and second quarters. The median post-shock NPV ratio fell slightly to 11.3 percent in the second quarter, down from 11.4 percent in the prior quar-

ter.

At the end of the second quarter, a 200 basis point increase in rates would result in a loss in net portfolio value for 808 thrifts, while 109 thrifts would see their net portfolio values rise. If rates fell by 100 basis points, 292 thrifts would see their net portfolio values decrease, while 625 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 7. This represents the second consecutive quarterly decrease.

With a 200 basis point increase in interest rates, the thrift industry would lose 10 percent of its net portfolio value. This is down from 17 percent in the previous quarter, and is consistent with the fall in median sensitivity.

The percentage of

thrifts with a post-shock NPV ratio over 6 percent increased between the first and second quarters. In the second quarter, such thrifts comprised 97.2 percent of the industry compared to 96.3 percent in the prior quarter.

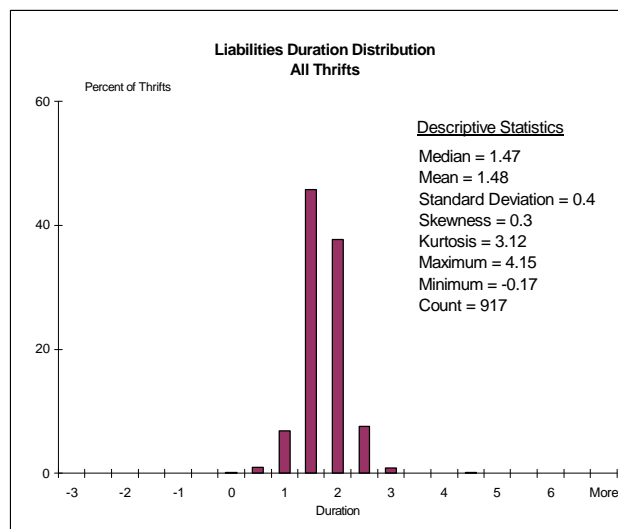
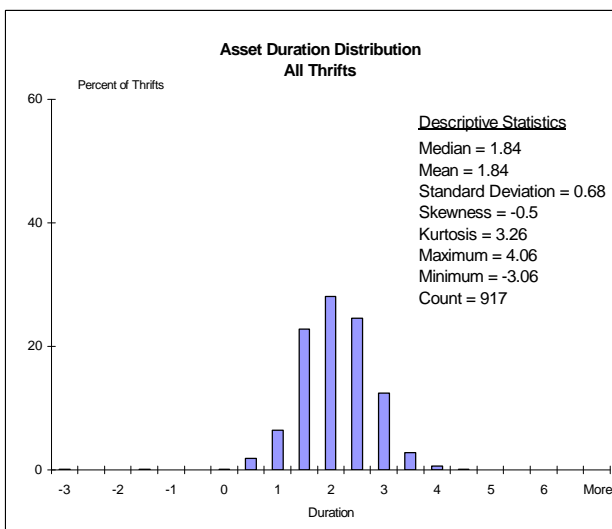
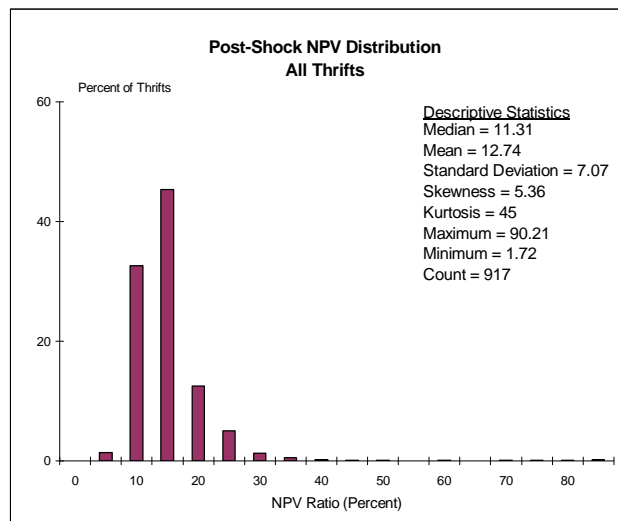
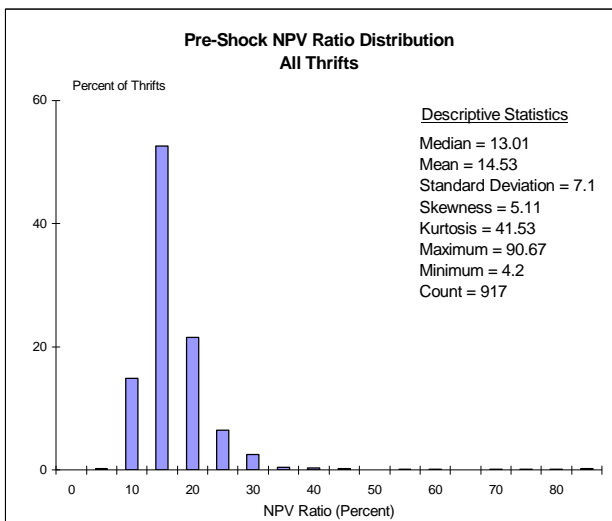
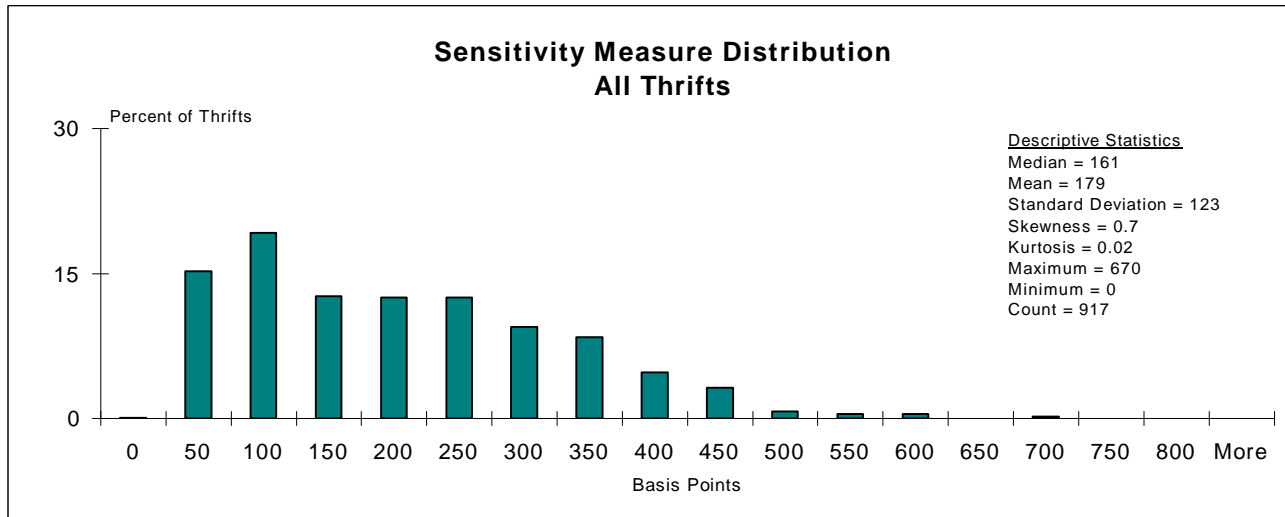
The number of thrifts with a post-shock NPV ratio below 6 percent fell to 26 in the second quarter, down from 34 in the first quarter. The number of thrifts with a sensitivity of 200 basis points or less increased to 548 in the second quarter, from 464 in the first quarter. The number of thrifts with over 400 basis points in sensitivity fell to 46 in the second quarter, down sharply from 84 in the first quarter.

Another point worth noting is that, among the thrifts experiencing an increase in net interest margin, 22.5 percent saw an

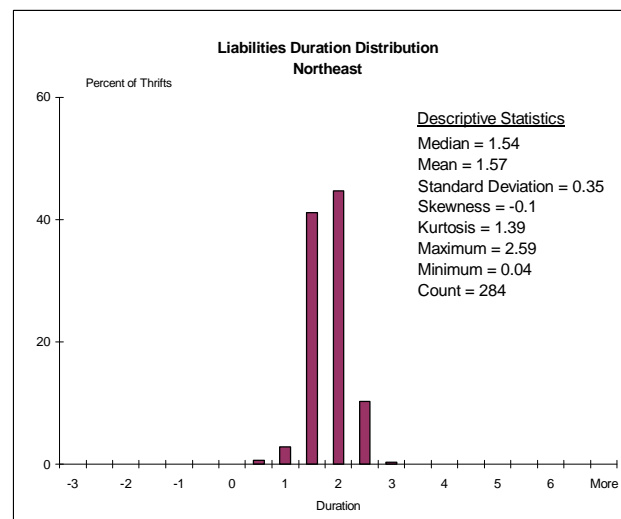
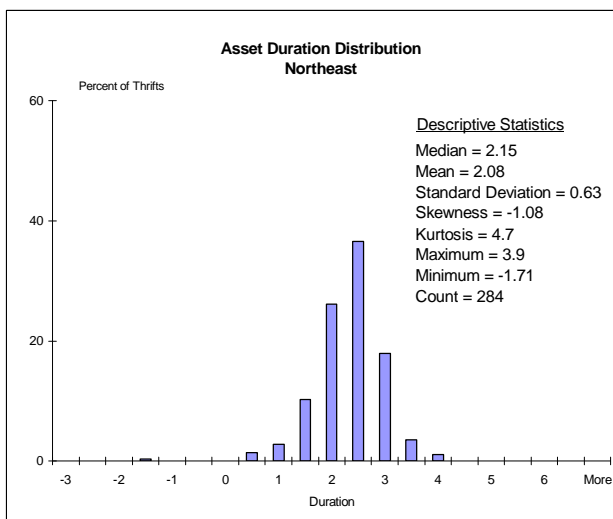
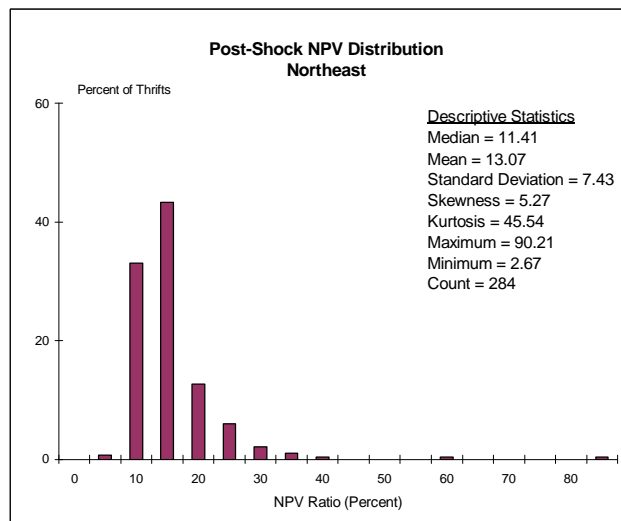
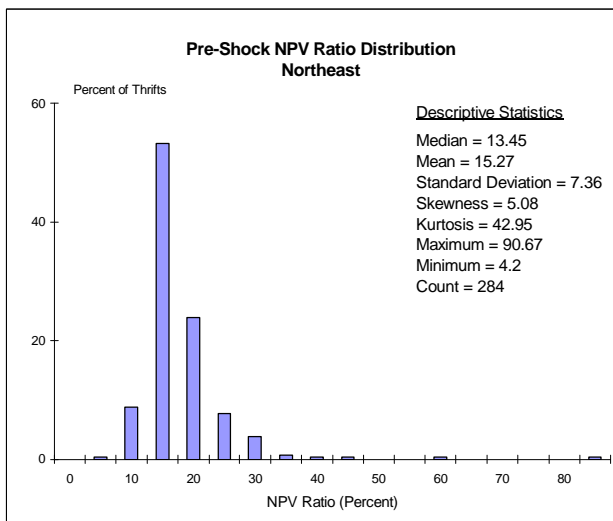
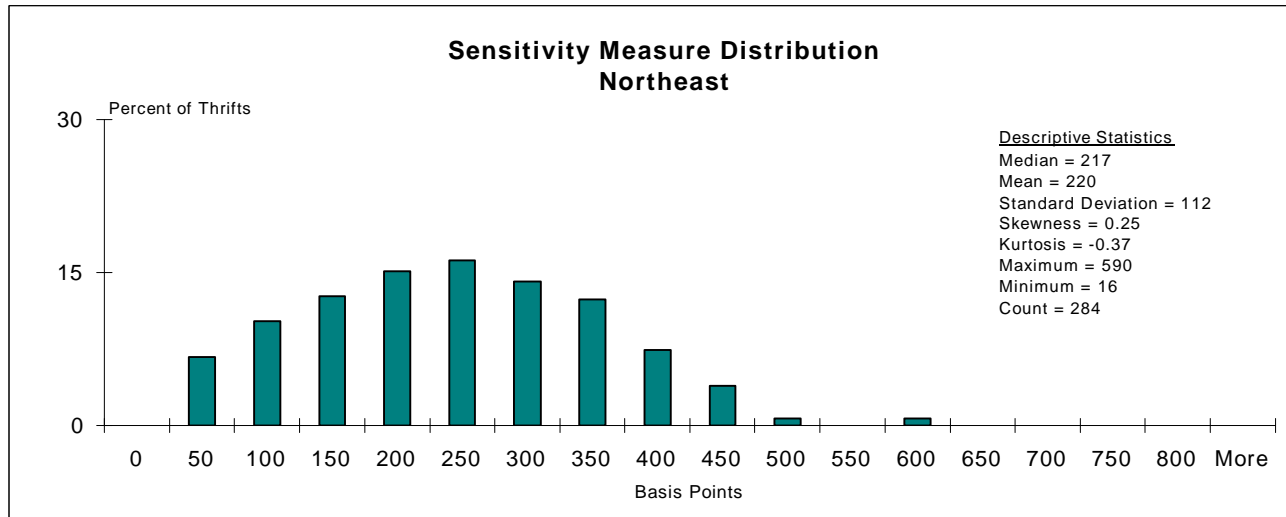
increase in their sensitivity. Also, among the thrifts that experienced an increase in their relative reliance on FHLB putable advances, one-third experienced an increase in their sensitivity. This funding product continues to pose a potential threat to thrifts placing excessive reliance on them should rates spike up in the future.

Due to the low short-term interest rates at the end of the second quarter, the rate shocks for producing sensitivities and post-shock NPVs are +200/-100 bps. •

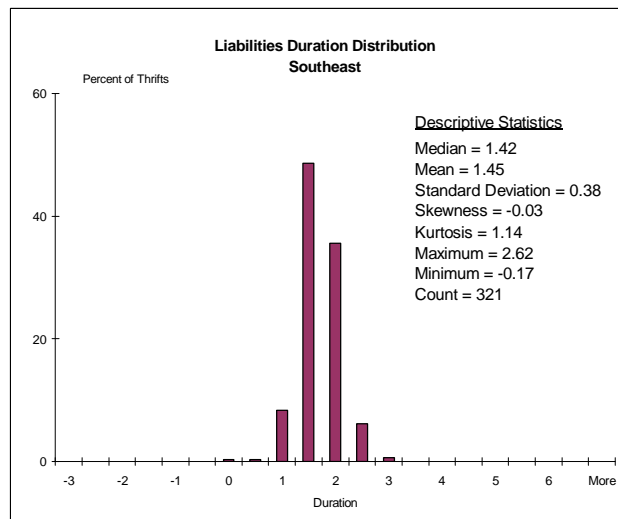
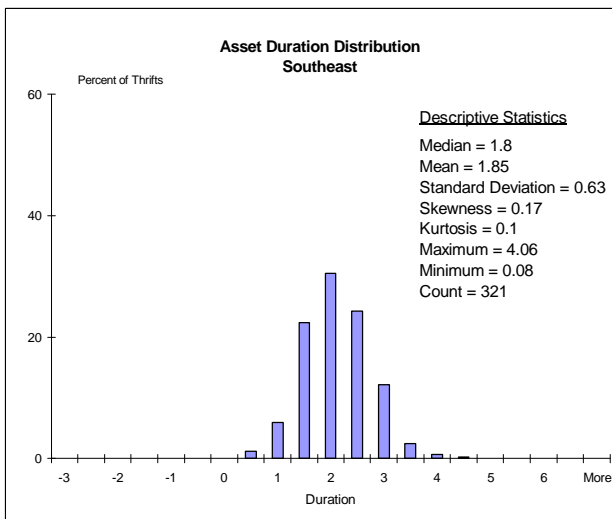
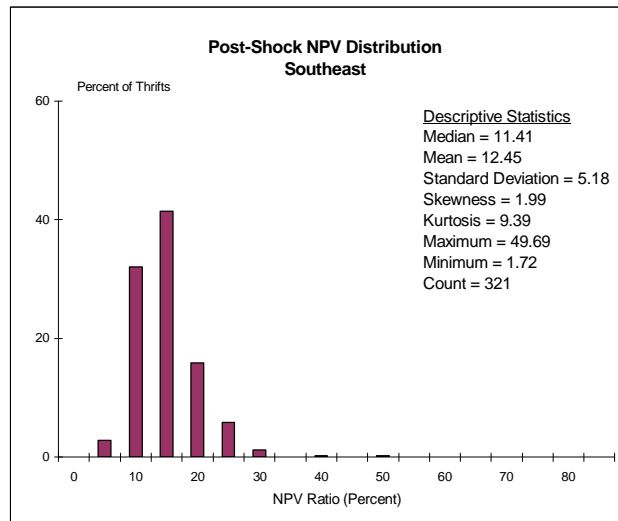
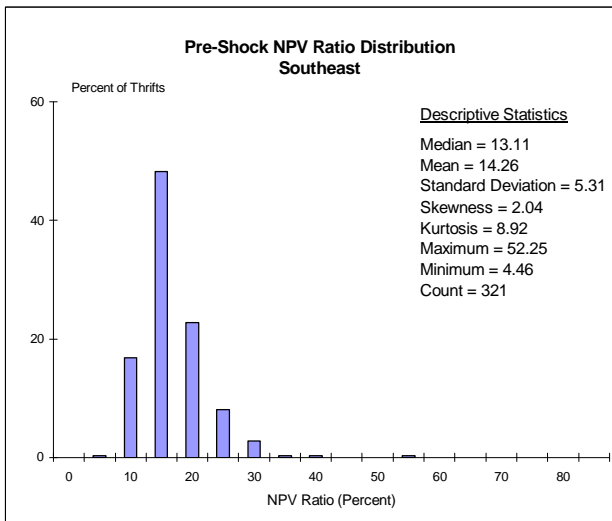
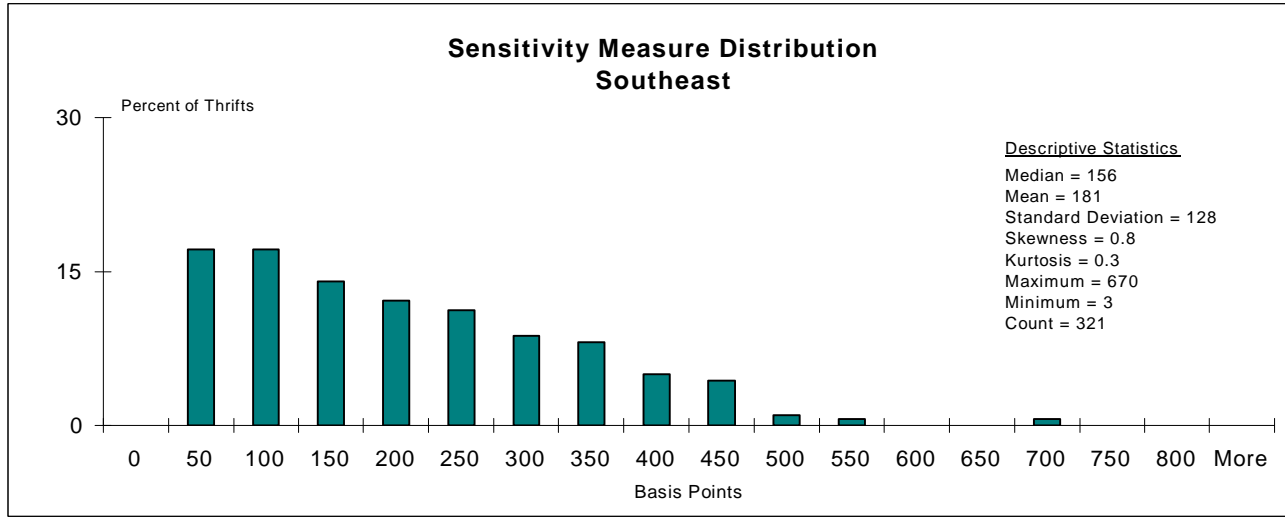
Appendix A – All Thrifts



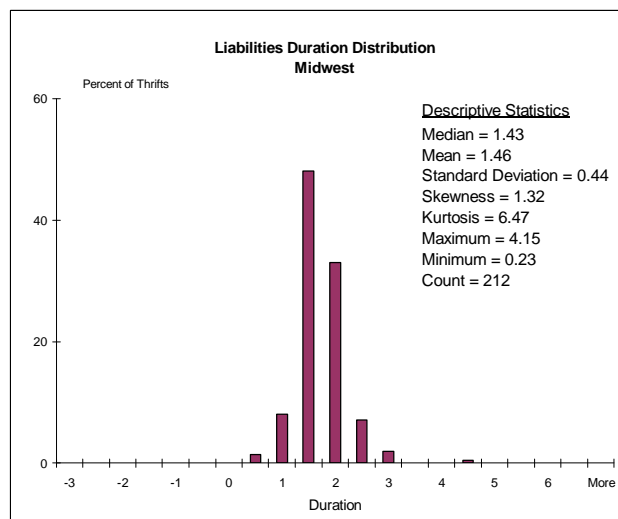
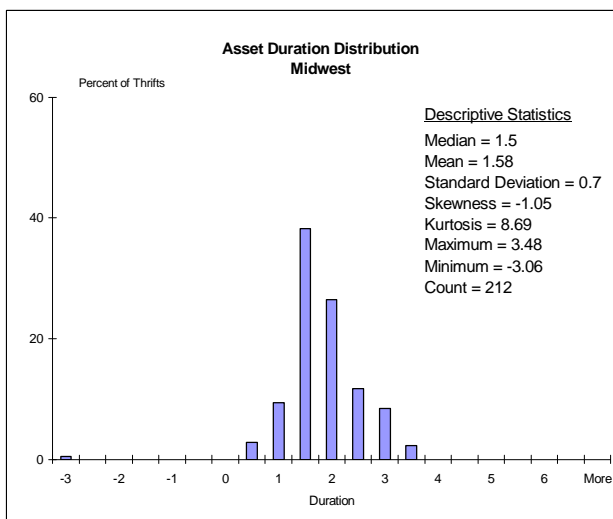
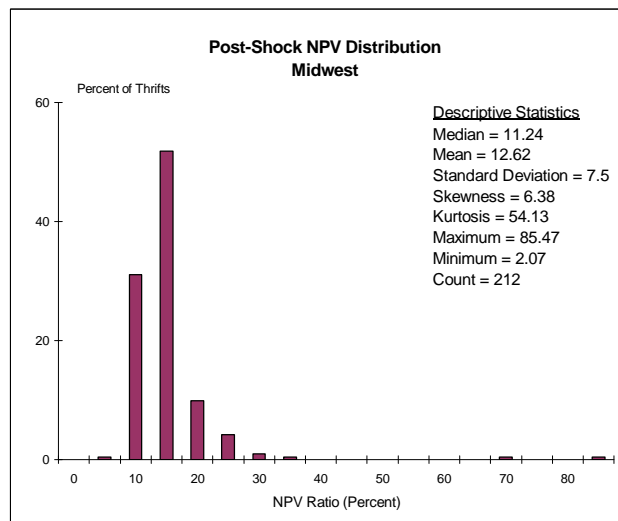
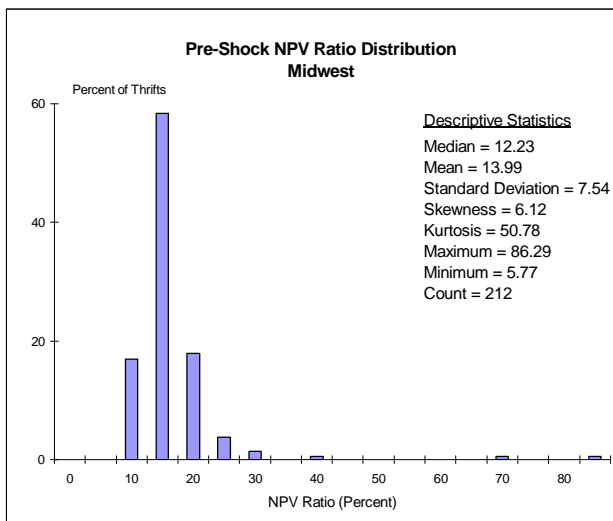
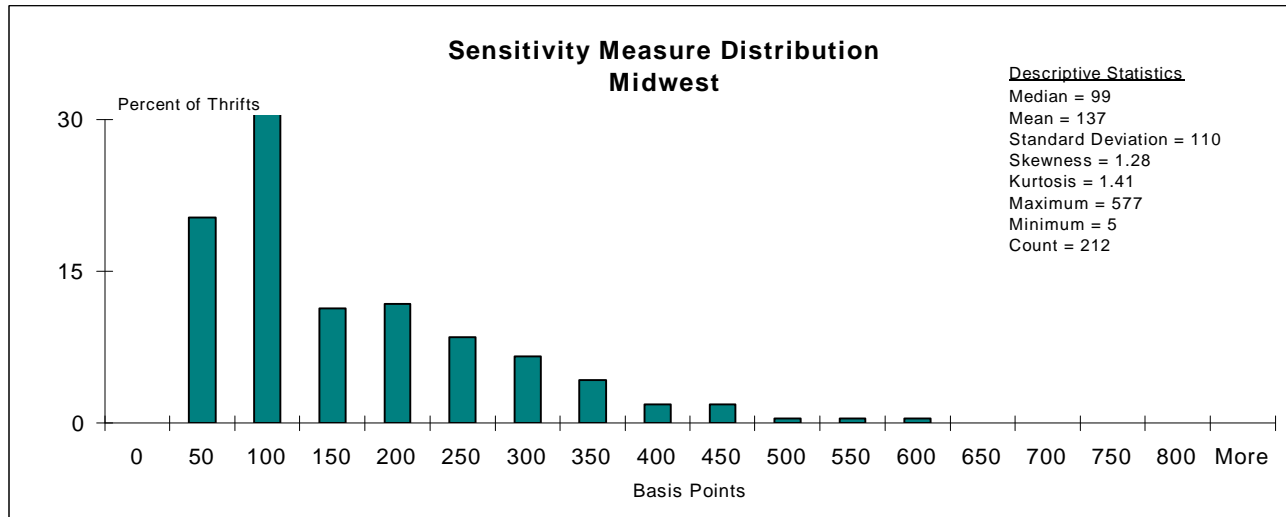
Appendix B – Northeast Region



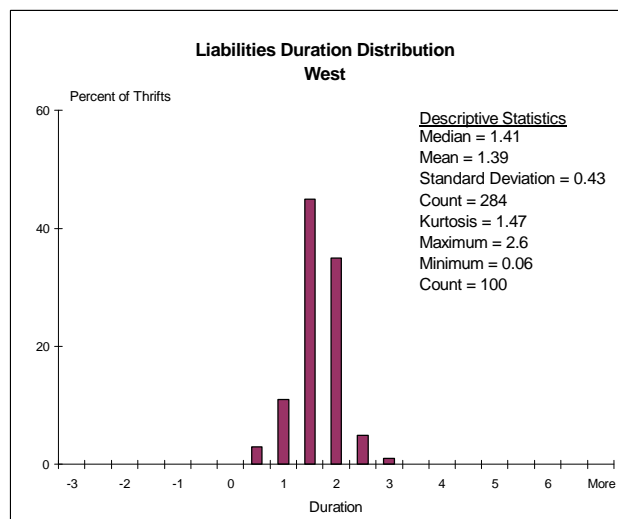
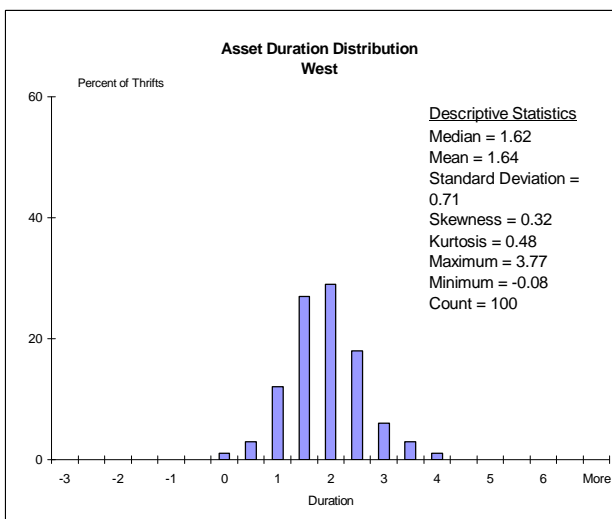
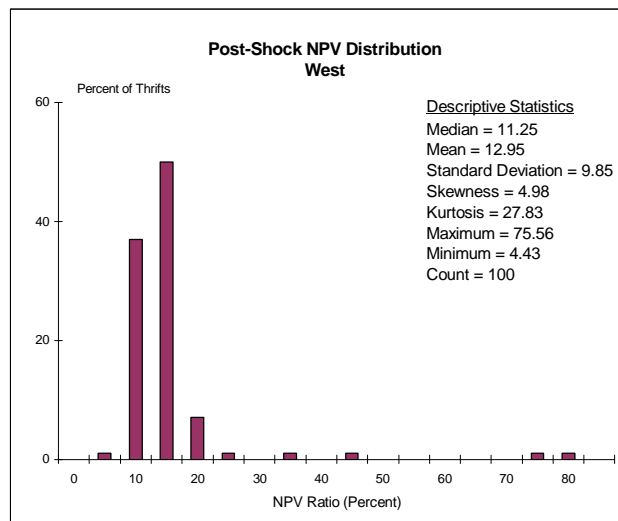
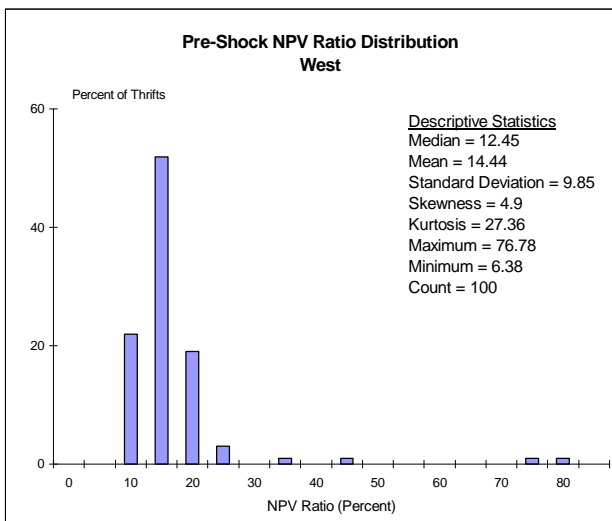
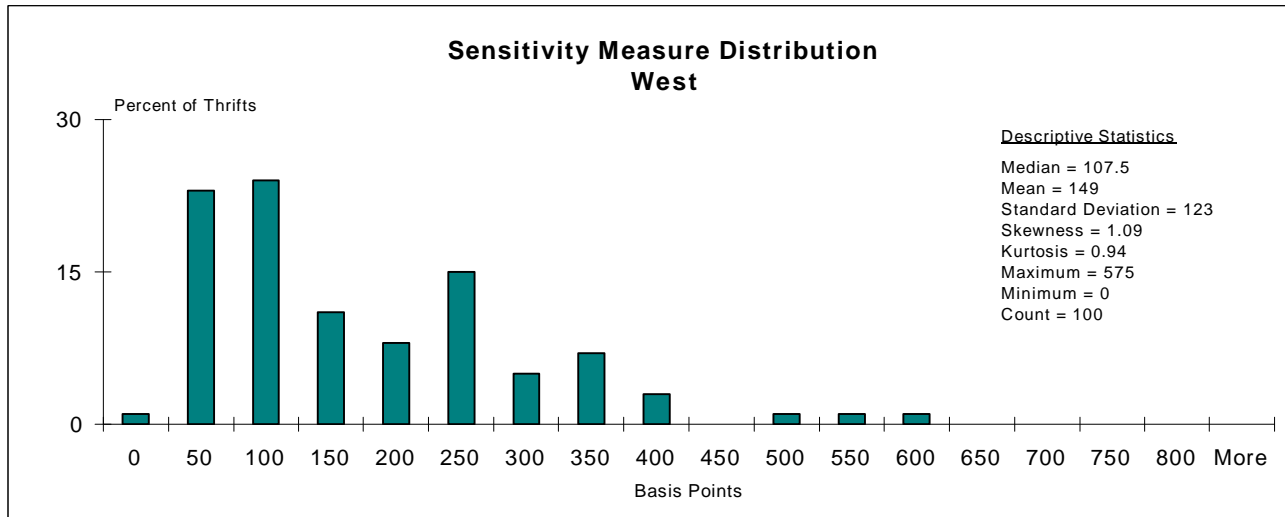
Appendix C – Southeast Region



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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