

The Quarterly Review Of Interest Rate Risk

Economic Analysis Division,
Office of Thrift Supervision



Special points of interest:

- Interest rate sensitivity decreases
- Yield curve remains inverted
- Volatility and option valuation
- Post-shock NPV increases
- Mortgage rates fall
- CMR Changes for March 2001

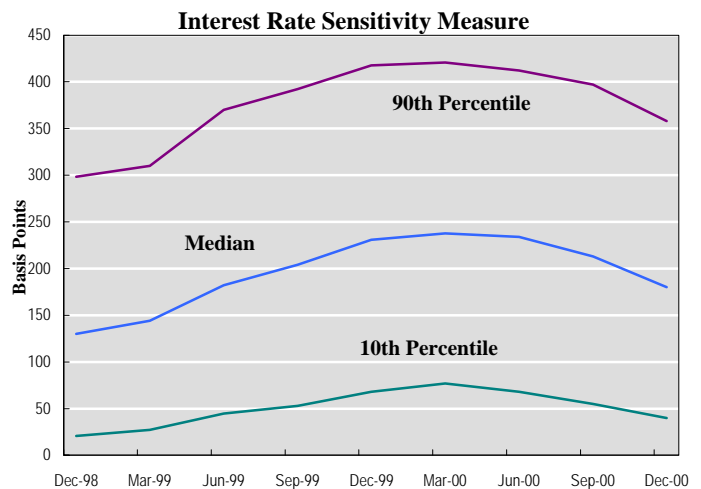
Sensitivity Falls for Third Consecutive Quarter

Thrift industry interest rate sensitivity fell 31 basis points in the fourth quarter, as interest rates fell.

Median thrift sensitivity fell to 180 basis points, down from 211 basis points in September, the third consecutive quarterly decline.

The median pre-shock Net Portfolio Value (NPV) ratio fell, while the post-shock NPV ratio rose in the fourth quarter. Capital ratios remained strong.

The number of thrifts with “significant or high interest rate risk” declined for the fourth consecutive



quarter. See details inside, starting on page 3.

Volatility and Option Valuation

Options of all kinds are scattered throughout thrift portfolios, some buried, some in clear view. These options can be embedded in fixed-income securities, such as callable and puttable FHLB advances, or in mortgages and mortgage-backed securities.

For example, the embedded call option in mortgages allows homeowners to prepay their mortgages if market interest rates fall far enough below mortgage coupon rates.

Options can also include interest-rate derivatives, such as options on futures, caps and floors, optional commitments to

purchase or sell mortgages and mortgage-backed securities, and swaptions (i.e., options on swaps).

The value of these options are often quite volatile. They change as the price (or rate) on the instrument underlying the option changes, as the time remaining to expiration of the option diminishes, as the risk-free interest rate changes, and as the relevant expected volatility varies.

Of these factors, the most important affecting the valuation of embedded options and interest-rate derivatives is volatility.

What we mean here by

“volatility” is the standard deviation of the price or the yield on the so-called underlying instrument. Some options contracts (e.g., calls or puts on T-bonds) are specified in terms of the price of the underlying security.

Others, such as caps and floors, are specified in terms of a well-defined interest rate (e.g., three-month LIBOR or one-year T-bill). In addition, options valuation models can, with a simple transformation, employ either price or yield volatility, regardless of how a particular contract is specified. To illustrate,

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Volatility and Option Valuation (continued)

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OTS uses yield volatility for all interest-rate derivatives in the NPV Model.

Holding everything else constant, option values vary directly with volatility. As volatility rises, the value of an option also rises, and vice versa.

Option value rises because the option will more likely be in the money at some future point as the price of the underlying instrument varies more.

Because of this factor, the value of thrifts' portfolios can be directly affected by changes in volatility in the fixed-income markets.

Unlike the other factors that determine option value, volatility is not directly observable but must be estimated.

Two types of volatility measures are typically used in option pricing—implied volatility and historical volatility.

Option pricing models can calculate the price of an option if all pricing factors are known, including volatility. To estimate implied volatility, you use all the observable factors, and an observed option price from an active market. Using your option pricing model, you derive the volatility that equates the observed market price of the option with its option model price.

This estimate of volatility is the market's expectation of future volatility.

Historical volatility is a measure of the historical price movements in the underlying instrument. The wider the price swings, on a percentage basis, the higher the historical volatility will be.

OTS's NPV Model employs historical yield vola-

50-day three-month LIBOR volatility as the annualized

“Of these factors, the most important affecting the valuation of embedded options and interest-rate derivatives is volatility.”

tivity estimates to value all interest-rate options using Black's (1976) model.

To show the effect that volatility changes have on option values, we calculate theoretical option prices for a three-month LIBOR cap for various volatility values using Black's model.

Three-Month Cap Prices (Expiration: Two Years)	
Price (b.p.)	Volatility (%)
60	10
77	15
95	20
113	25
131	30
149	35
166	40

The table above reports prices for a cap having an expiration of two years and a strike rate of 5.80 percent. We assume that LIBOR remains constant at 6 percent over the life of the cap. As shown in the table, the cap price varies directly with volatility.

The volatility estimate that OTS uses in the NPV Model is the 50-day volatility, as reported by Bloomberg, on the last trading day of the quarter. OTS uses the 50-day volatility because it has provided the most stable volatility estimates in the past.

For example, Bloomberg calculates the

standard deviation of three-month LIBOR over the last 50 days.

To illustrate the effect of changes in volatility on actual interest-rate option values, we examine what happened to the prices of caps with a one-year expiration indexed to three-month LIBOR between December 1999 and December 2000.

The 50-day volatility of three-month LIBOR stood, at the end of December 1999, at 7.72 percent. By the end of 2000, it had fallen to 3.40 percent.

The table below shows the three-month LIBOR cap prices for the base case interest rate scenario produced by the NPV Model for the fourth quarter 1999 and 2000. Cap prices are reported for various strike rates from 3.0 percent up through 6.0 percent.

As shown in the table, the cap prices in December 2000 are smaller than those in December 1999 at all strike rates. The smaller cap prices are driven, for the most part, by the lower LIBOR volatility in December 2000.

All else the same, thrift institutions can expect lower valuations on interest-rate options at the end of December 2000 because of the lower rate volatility.

It is industry practice to use Black's model to

value interest-rate options that do not depend on the future path of interest rates. The NPV Model uses Black's model to value caps and floors, options on futures, swaptions, and optional commitments to purchase or sell mortgages and MBS.

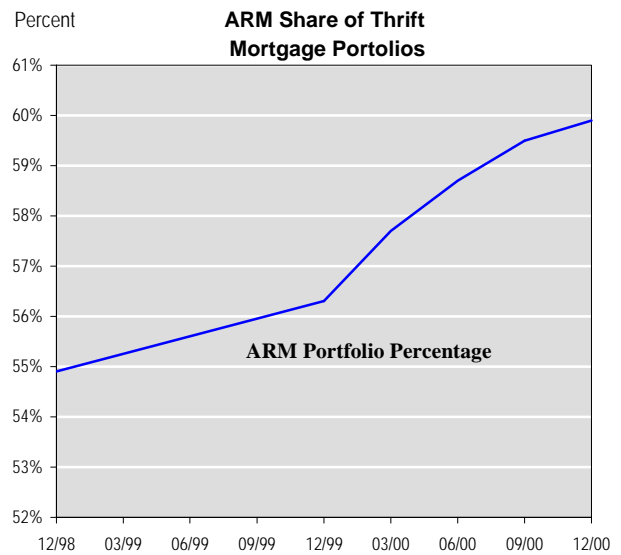
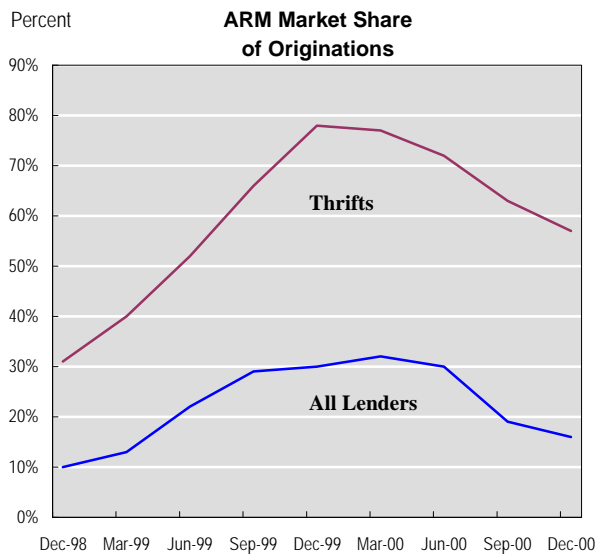
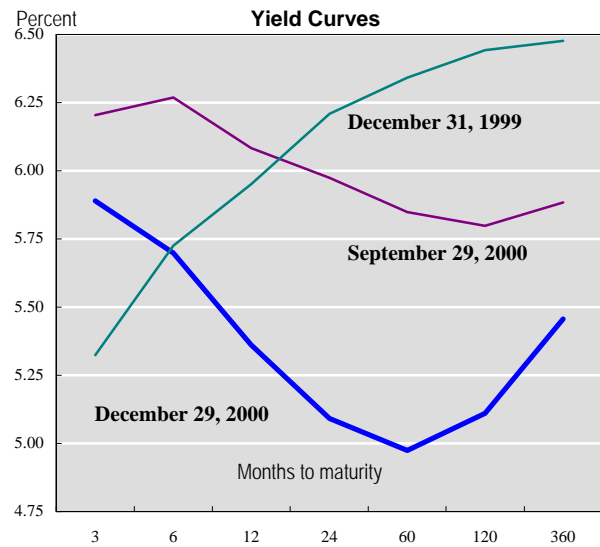
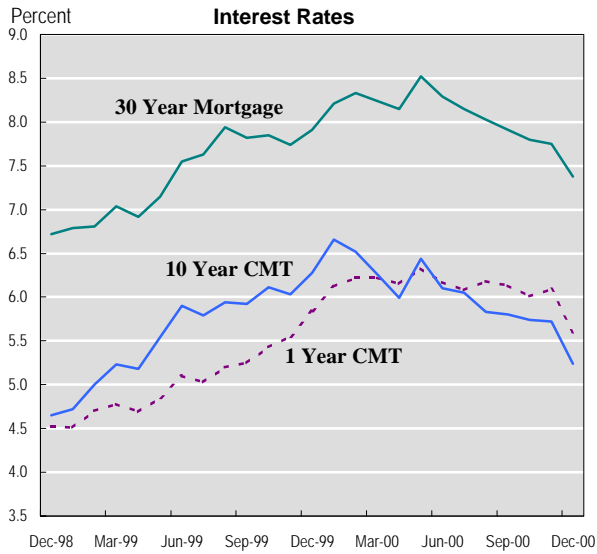
However, the valuations of embedded options and interest-rate derivatives that can be exercised early depend on the path taken by interest rates. Such products require option models that permit randomly generated interest rate paths. Examples of such approaches would include trees, Monte Carlo simulations, and option-adjusted spreads.

In future issues of this publication, we will review these other option-modeling techniques.

**Interest Rate Cap Prices
Dec. 1999 vs. Dec 2000
(Expiration: One Year)**

December 1999	
Strike Rate	Price (b.p.)
3.0	317
3.5	270
4.0	222
4.5	175
5.0	128
5.5	82
6.0	40
December 2000	
Strike Rate	Price (b.p.)
3.0	282
3.5	234
4.0	187
4.5	140
5.0	93
5.5	49
6.0	15

Interest Rates and ARM Market Share



Interest rates at all maturities fell in the fourth quarter, with particularly sharp declines in rates over the one-year to five-year range of the Treasury yield curve. The 30-year mortgage rate also fell to its lowest level since June 1999.

While the Treasury yield curve remained inverted, the gap between the 1-year CMT and 10-year CMT decreased to 25 basis points in the fourth quarter, down from 28 basis points in the prior quarter.

With the increased attractiveness of long-term, fixed-rate mort-

gages, ARM originations by thrifts fell. Although thrifts' ARM originations fell, the ARM share of mortgages held in portfolio rose in the fourth quarter, but at a slower rate compared to prior quarters.

Fourth-quarter 1-4 family mortgage originations by thrifts were \$55.3 billion, up from \$53.2 billion in the third quarter.

Thrifts' share of all 1-4 family originations was 21.1 percent in the fourth quarter, up from 18.6 percent in the third quarter.

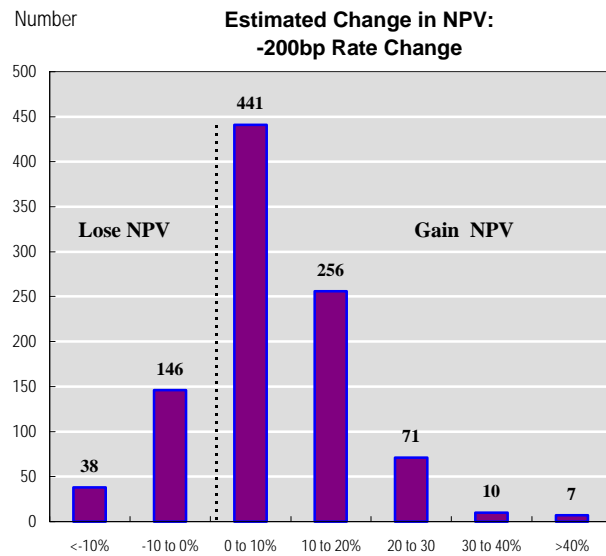
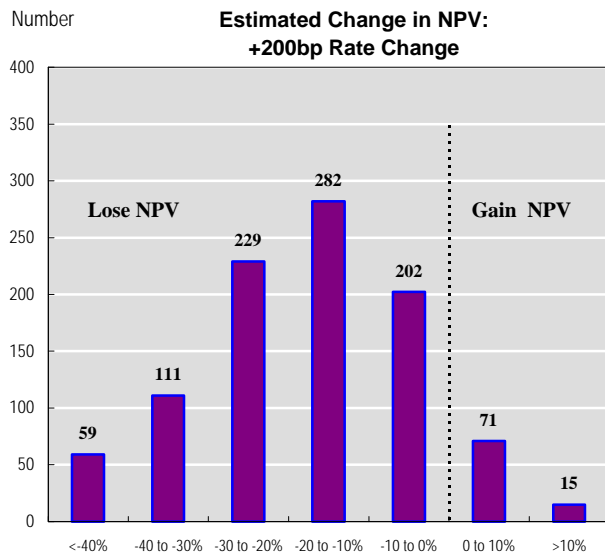
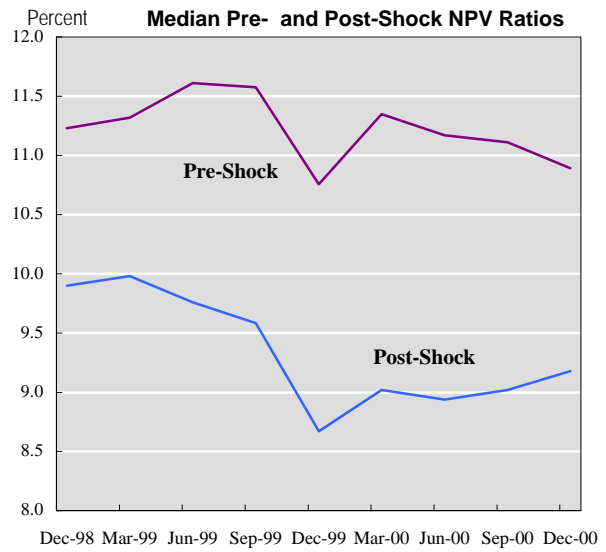
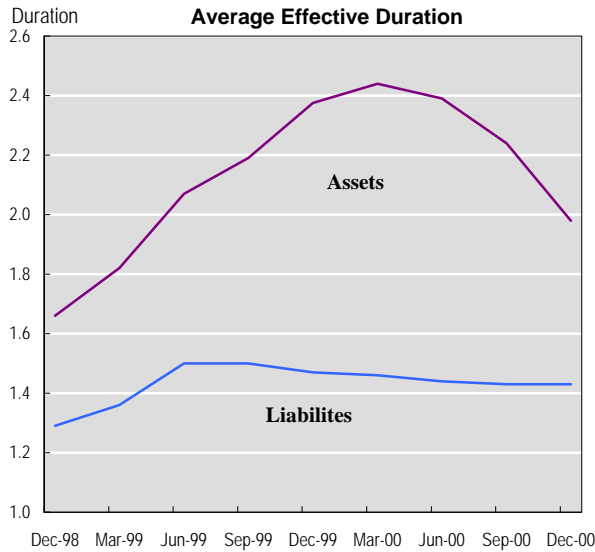
Refinancing activity of all mortgages accounted for 10.8 per-

cent of thrift originations in the fourth quarter, up from 9.0 percent in the third quarter. Overall, the pace of refinancing activity has increased recently as long-term interest rates declined.

Despite the continuing inversion of the yield curve, net interest margin for the thrift industry was 259 basis points in the fourth quarter, unchanged from the previous quarter. The fall in interest rates helped to stabilize margins. While interest income rose, interest expense also rose due to greater

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Duration and NPV Sensitivity Measures



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use of higher cost FHLB advances and the rollover of maturing CDs into shorter-term, higher-cost CDs with a maturity of less than one year.

Median assets duration for the industry fell from 2.0 to 1.8 between the third and fourth quarters, due to the fall in interest rates. As rates decline, the NPV Model estimates a greater likelihood that mortgage prepayments will increase. As a result, mortgage durations fall.

The median pre-shock NPV ratio for the industry fell from 11.1 percent to 10.0 percent between the third and fourth quarters, despite the fall in rates.

Several factors served to offset the positive valuation effects of lower rates on pre-shock capital levels. First, deposit intangibles fell by roughly 39 percent between the third and fourth quarters. Second, the value of mortgage loan servicing declined by a substantial amount. And, the value of derivatives fell because most derivative

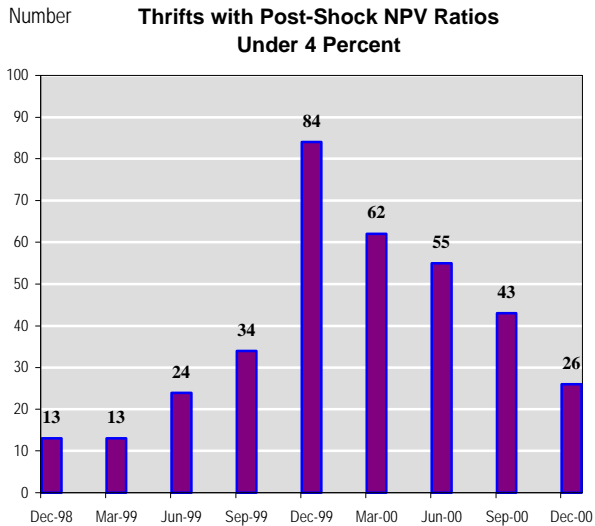
positions held by thrifts in the fourth quarter were established to offset a potential increase in rates.

In contrast to the median pre-shock NPV ratio, the median post-shock NPV ratio rose to 9.2 percent in the fourth quarter, consistent with the decrease in median sensitivity for the industry.

In the fourth quarter, a 200 basis point increase in rates would result in a loss in net portfolio value for 883 thrifts, while 86 thrifts would see their net portfolio

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Interest Rate Risk Measures



Interest Rate Risk Measures Industry Aggregates Last Two Quarters

	Ratio of NPV to Assets		% Change	
	Sep-00	Dec-00	Sep-00	Dec-00
+300	5.3	6.0	-43%	-35%
+200	6.7	7.2	-27%	-22%
+100	7.8	8.2	-12%	-9%
Base	8.7	8.9	0	0
-100	9.3	9.2	+8%	+4%
-200	9.5	9.3	+10%	+7%
-300	9.7	9.6	+14%	+12%

Post-Shock NPV Ratio and Sensitivity Measure Matrix September 2000

	Under 100bp	101-200bp	201-400bp	Over 400bp	Total
Over 10%	118	108	168	28	422
6% to 10%	87	130	162	25	404
4% to 6%	2	28	73	18	121
Below 4%	0	1	23	19	43
Total	207	267	426	90	990

Minimal	Moderate	Significant	High
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Post-Shock NPV Ratio and Sensitivity Measure Matrix December 2000

	Under 100bp	101-200bp	201-400bp	Over 400bp	Total
Over 10%	121	104	154	18	397
6% to 10%	137	153	135	23	448
4% to 6%	8	27	53	10	98
Below 4%	0	2	16	8	26
Total	266	286	358	59	969

Minimal	Moderate	Significant	High
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value rise.

If rates fell by 200 basis points, 785 thrifts would see their net portfolio values rise, while 184 thrifts would see a decrease in their net portfolio values.

Fourth-quarter earnings stood at \$1.9 billion, down slightly from \$2.0 billion in the third quarter.

The new SFAS 133 accounting rule for derivatives had a modest negative effect on thrifts' earnings in the third quarter, although the

accounting rule change will affect more thrifts in the next several quarters.

The number of thrifts with a post-shock NPV ratio below 4 percent fell to 26. This represents the fourth consecutive quarterly fall in the number of thrifts that are highly exposed to fluctuations in interest rates.

With a 200 basis point increase in interest rates, the thrift industry would lose 22 percent of its net portfolio value. This net

portfolio loss is down from 27 percent in the previous quarter.

The number of thrifts with a post-shock NPV ratio over 6 percent increased between the third and fourth quarters. In the fourth quarter, the number of such thrifts was 845 compared to 826 in the third quarter.

The number of thrifts with a post-shock NPV ratio below 6 percent fell to 124 in the fourth quarter, down from 164 in the previous

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quarter.

The number of thrifts with a sensitivity of 200 basis points or less increased to 552 in the fourth quarter, up substantially from 474 in the third quarter. Also, the number of thrifts with a sensitivity over 400 basis points fell sharply to 59 in the fourth quarter, down from 90 in the previous quarter.

As a result of better capital ratios and lower sensitivity, the number of thrifts with high interest rate risk exposure fell by almost 50 percent, from 60 to 34 between the third and fourth quarters.

CMR Changes for March 2001

Effective with the March 2001 reporting cycle, OTS has made some important changes to Schedule CMR. For the most part, these changes involve the collection of additional data on market values and the characteristics of assets and liabilities in order to improve the accuracy of the estimates produced by OTS's NPV Model, and to better enable OTS to identify potential areas of concern.

In particular, the section covering the supplemental reporting for assets and liabilities is no longer completely optional. Supplemental reporting on this schedule is still optional for assets but is now required for reporting variable-rate, fixed-maturity liabilities.

Details of the changes can be found at www.ots.treas.gov/tfrpage.html.



Glossary

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

Post-Shock NPV Ratio: Equity-to-assets ratio expressed in present value terms following an adverse 200 basis point interest rate shock. Also referred to as the exposure ratio.

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

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

Duration: A measure of the price sensitivity of a financial instrument to changes in yield. The higher the duration, the greater the price sensitivity. For example, an asset with duration of 1.6 will appreciate in value by about 1.6 percent for one percentage point (100 basis points) decline in yield.

NPV Model: Measures how six hypothetical changes in interest rates (three successive 100 basis point increases and three successive 100 basis point decreases) affect the model's estimate (based on current interest rates) of a thrift's market value of net worth.

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 close to 0.

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 approximately symmetric has a skewness statistic close to 0.

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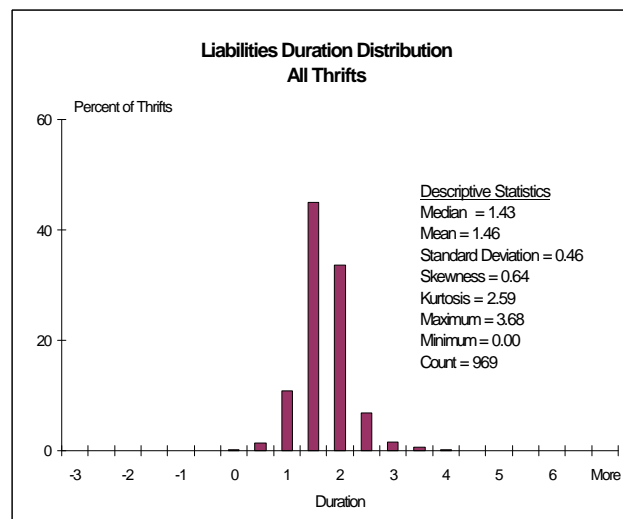
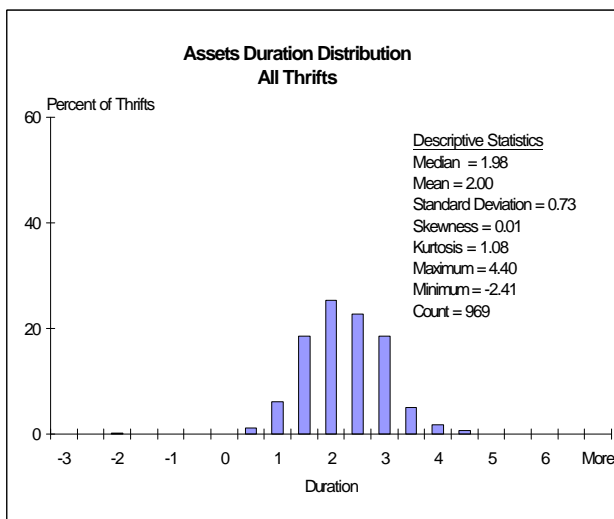
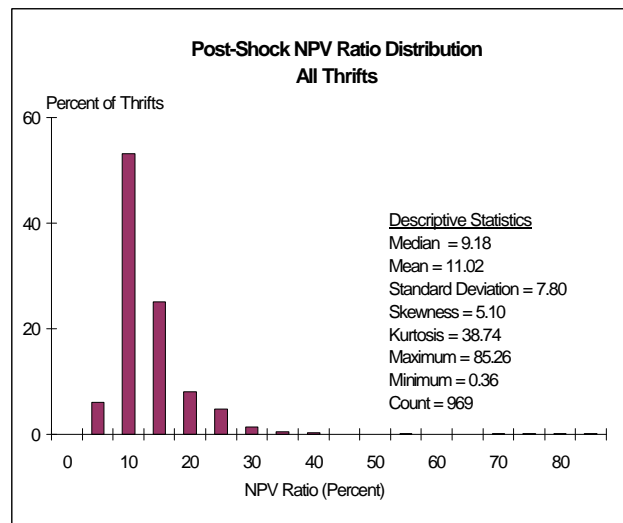
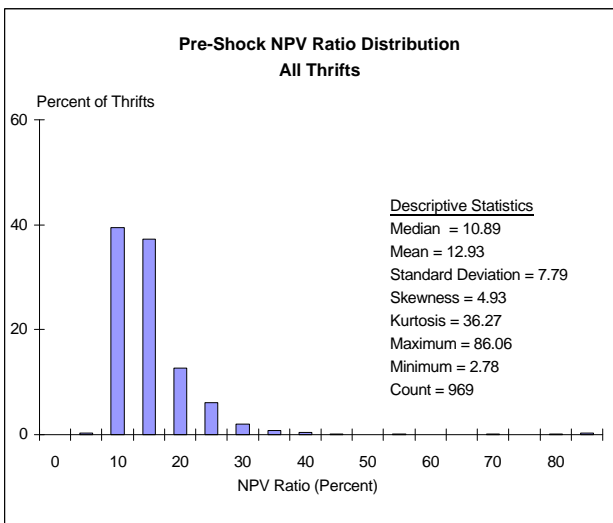
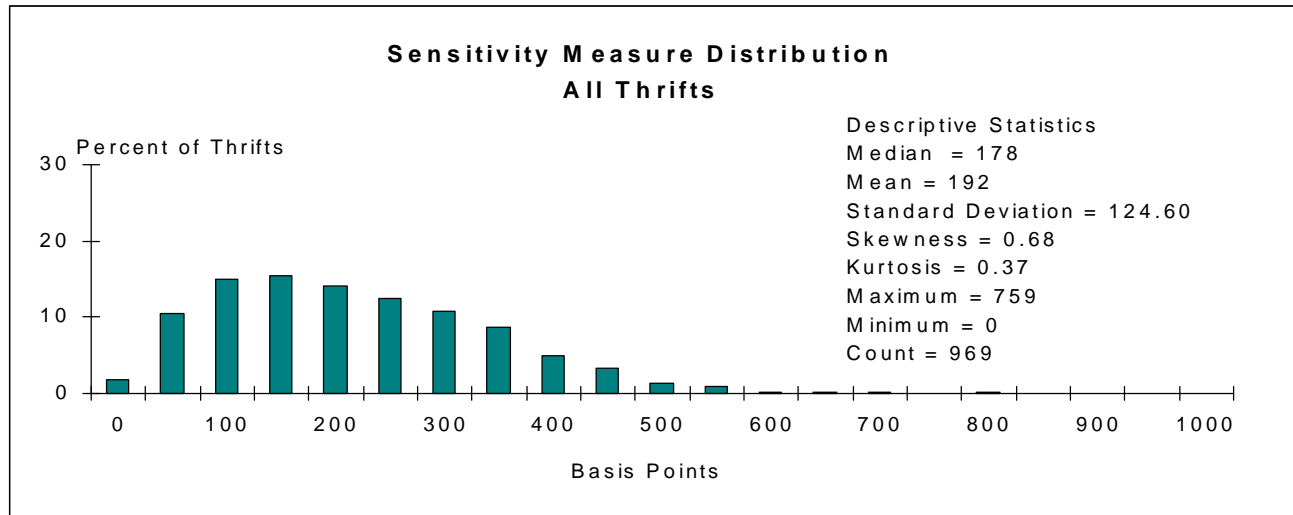
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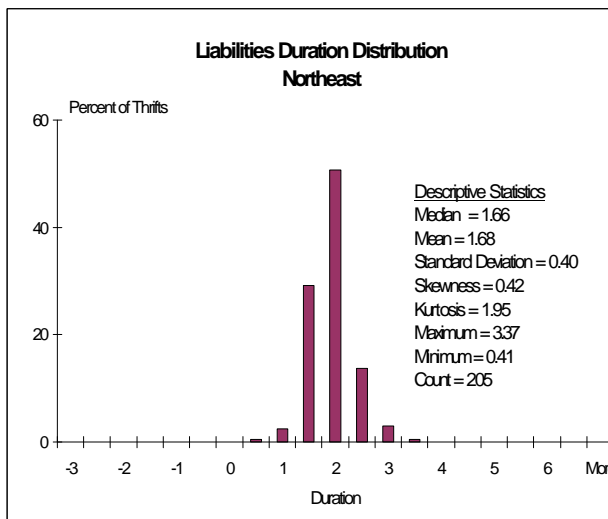
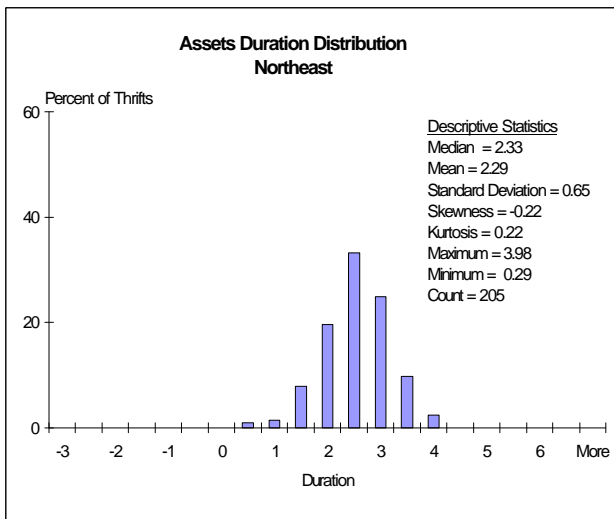
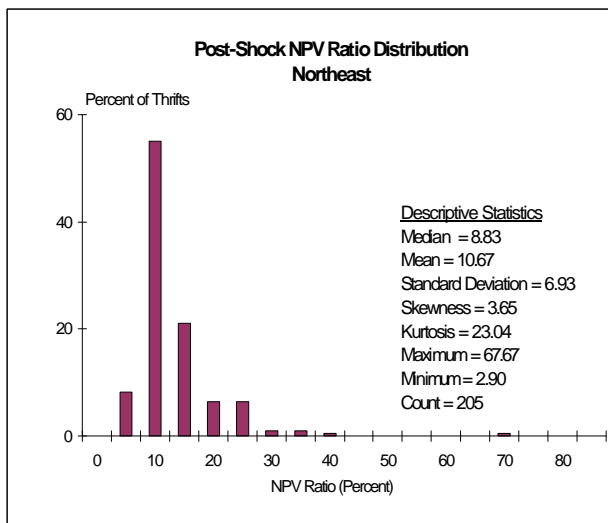
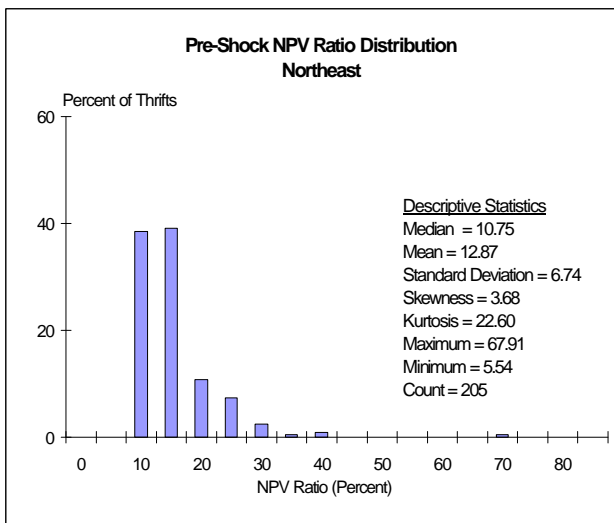
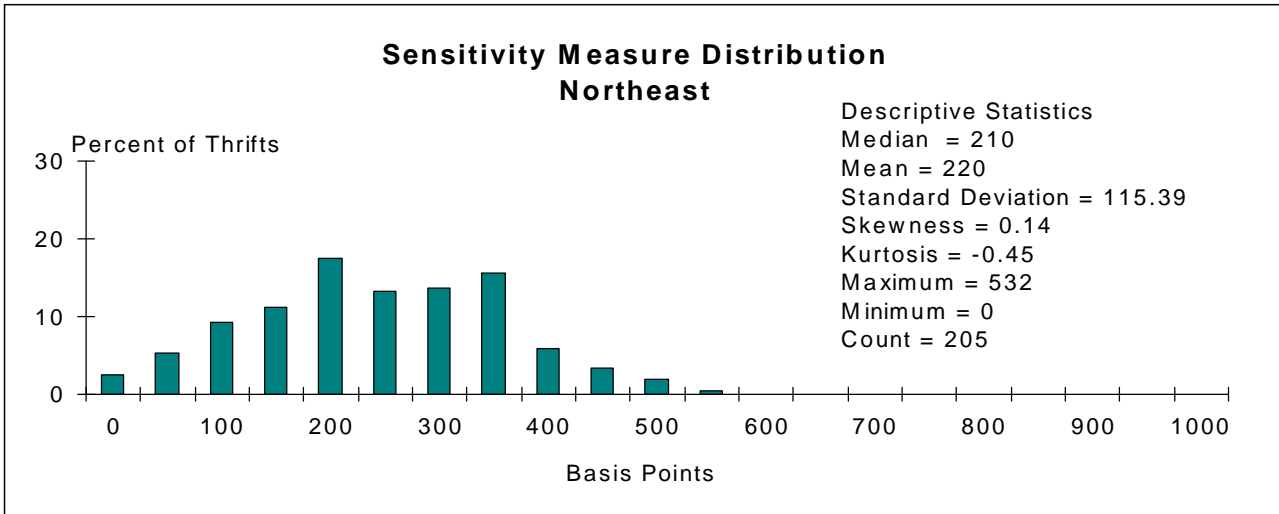
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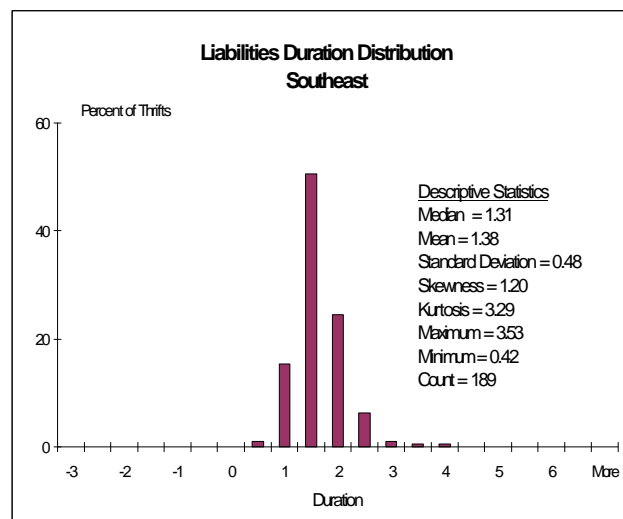
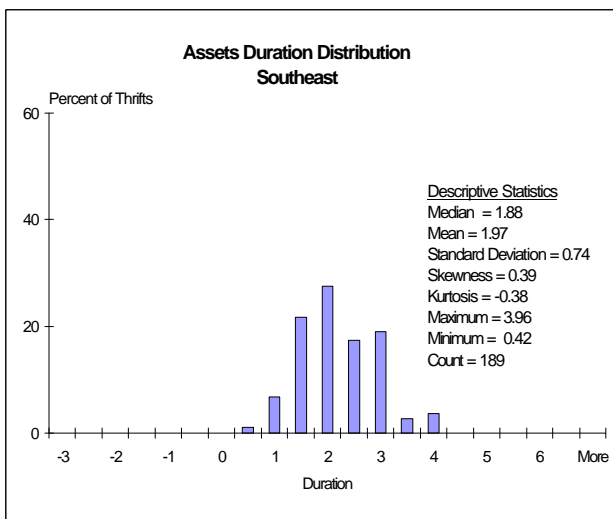
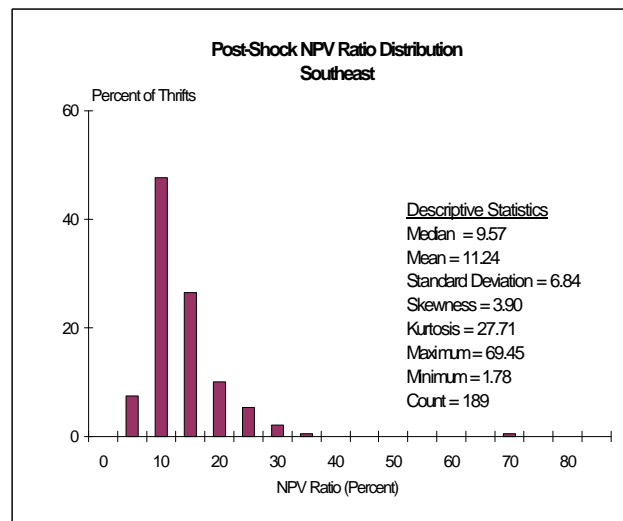
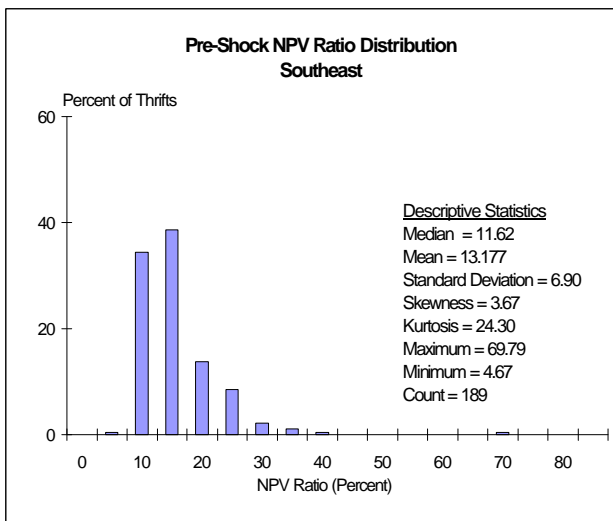
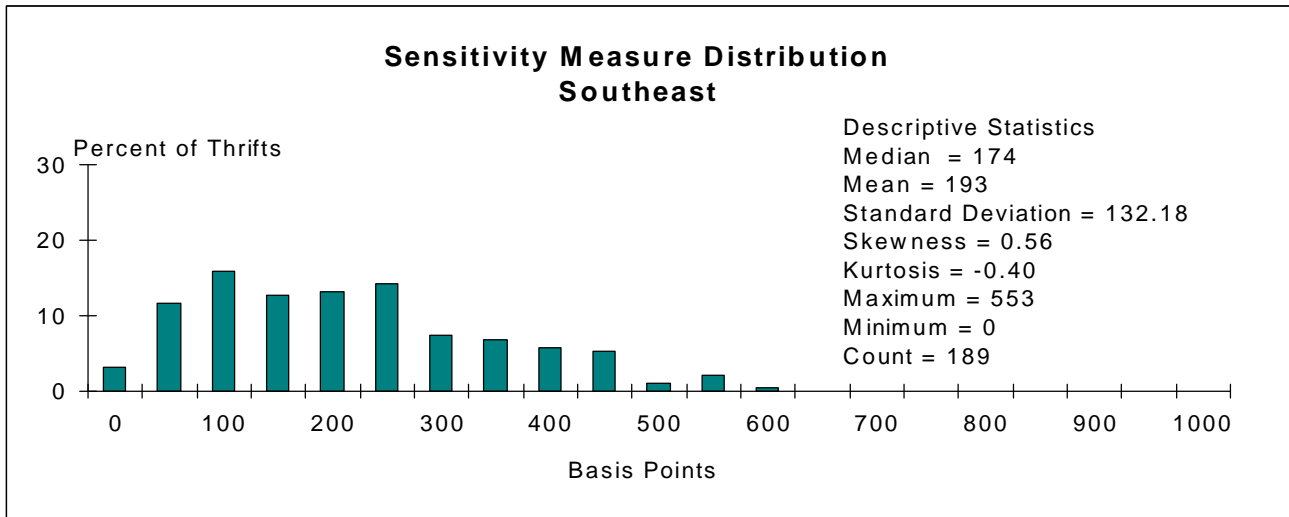
Appendix A – All Thrifts



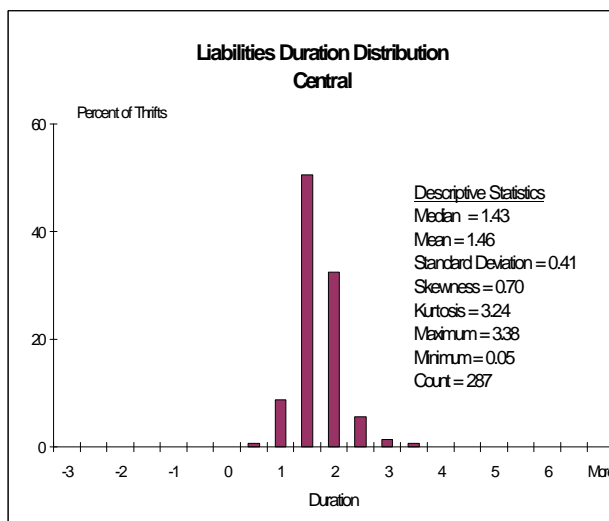
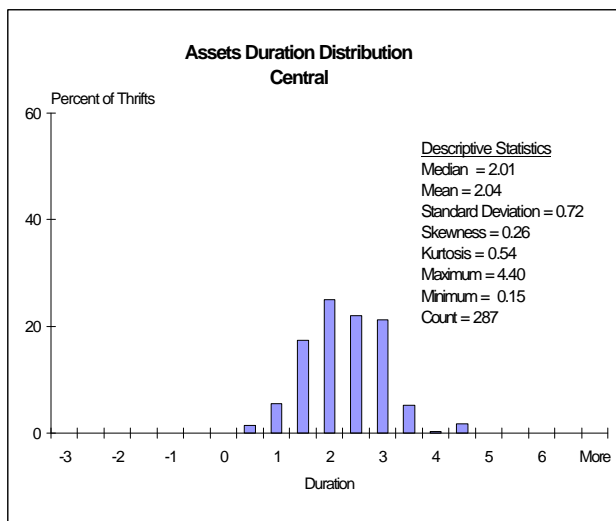
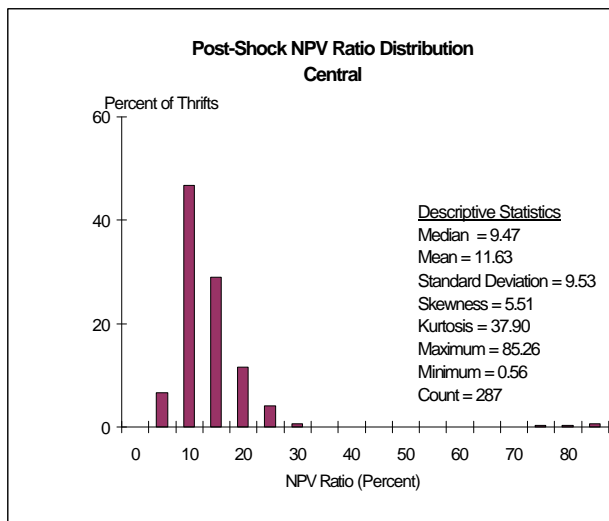
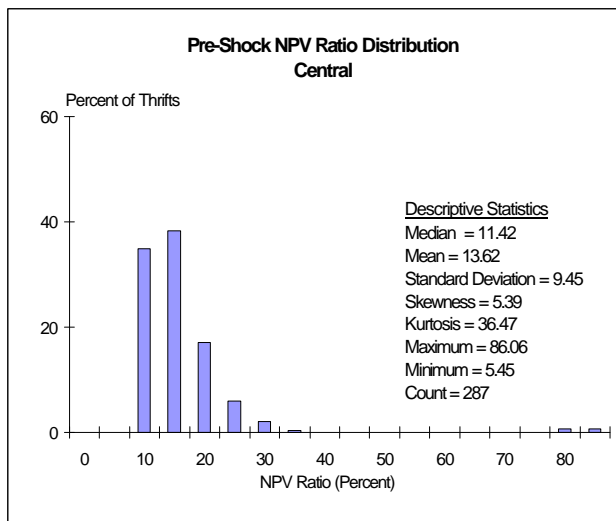
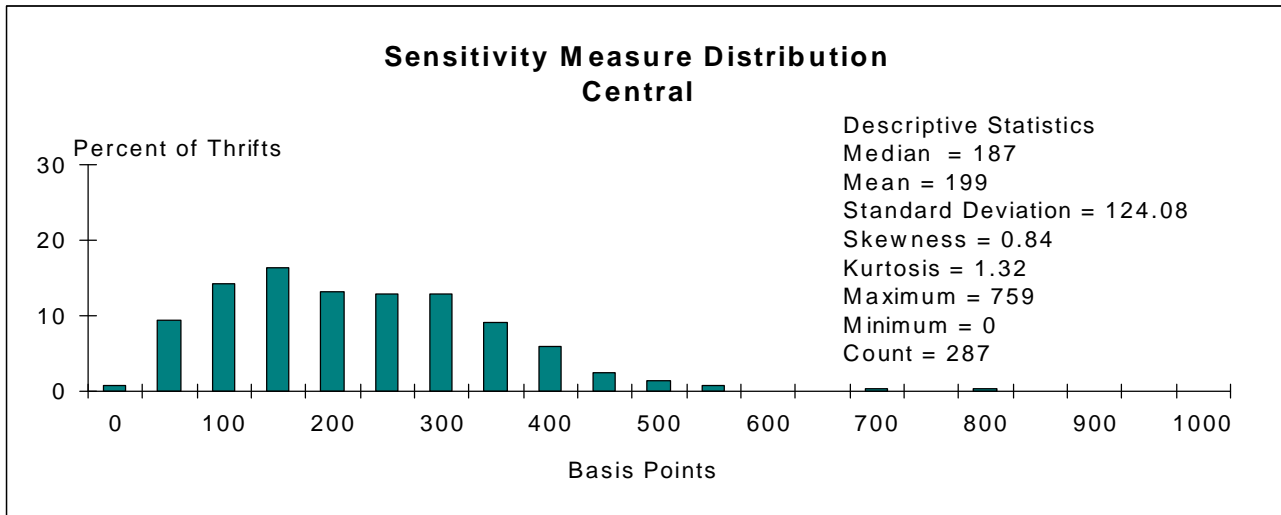
Appendix B – Northeast Region



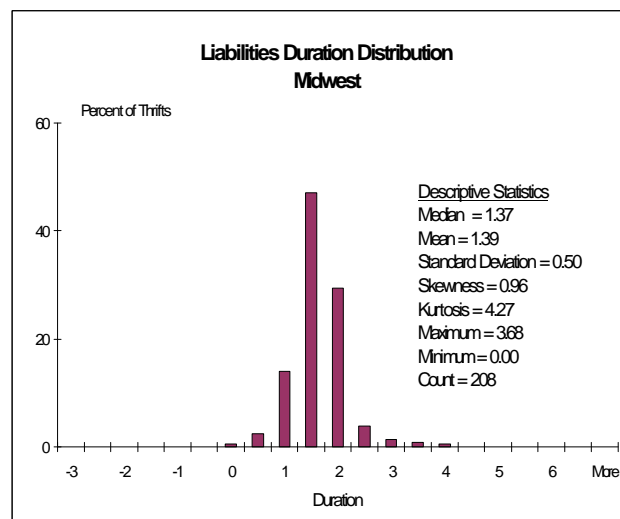
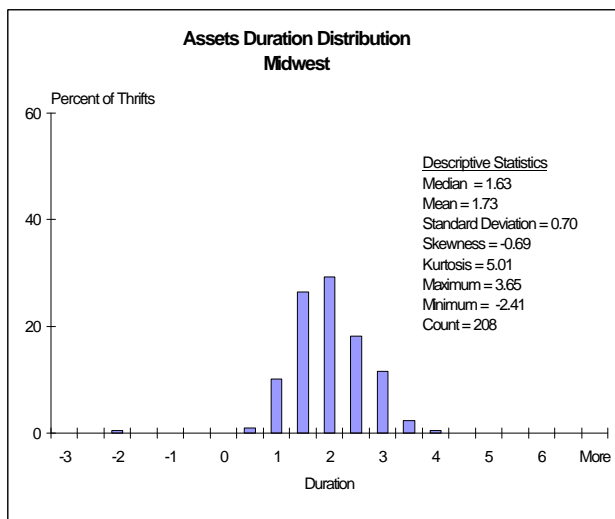
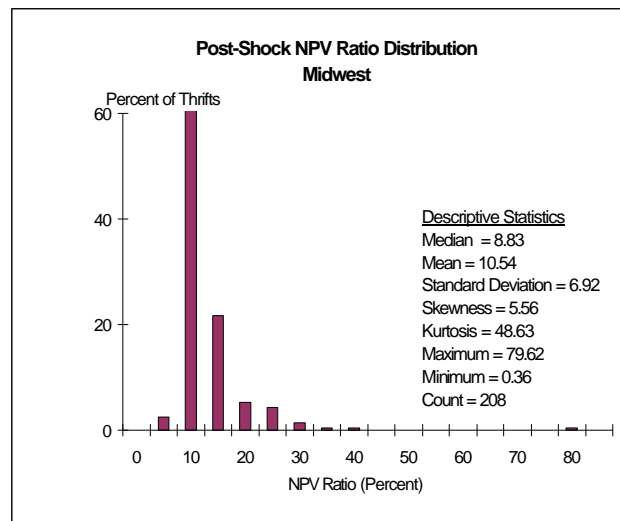
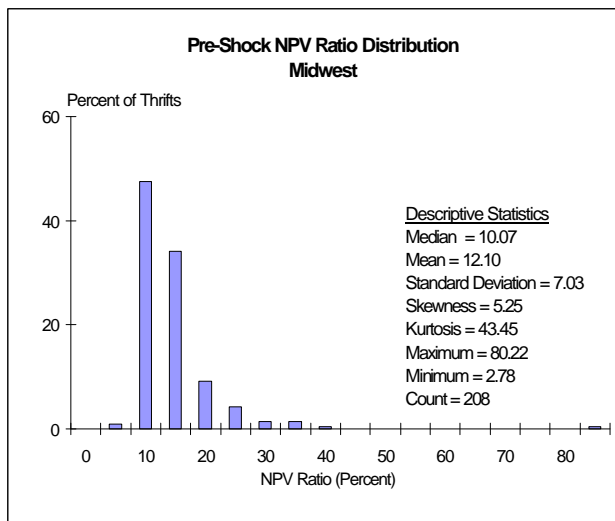
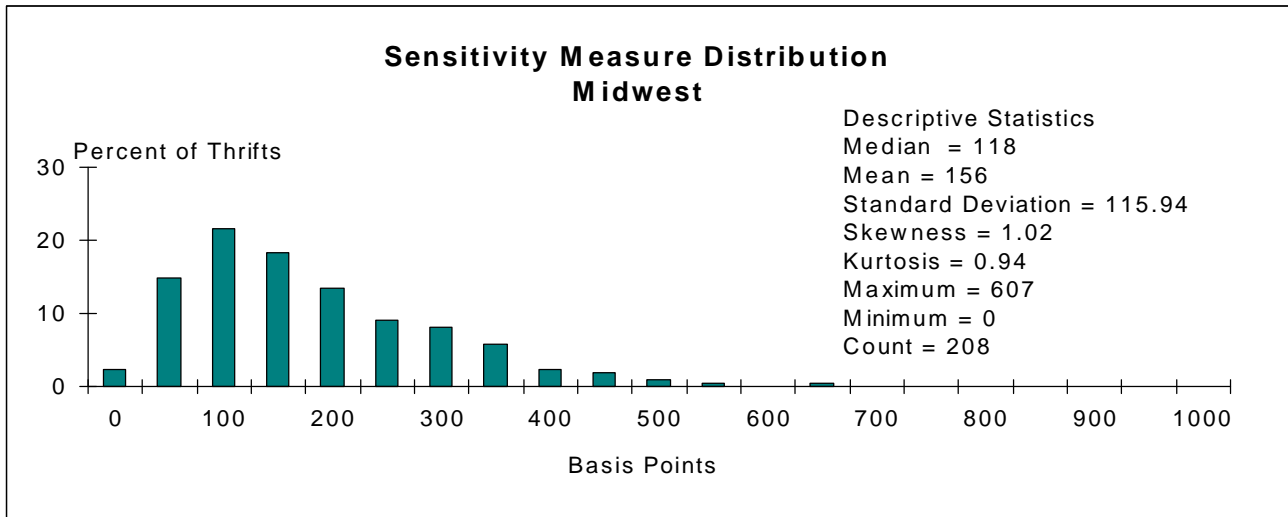
Appendix C – Southeast Region



Appendix D – Central Region



Appendix E – Midwest Region



Appendix F – West Region

