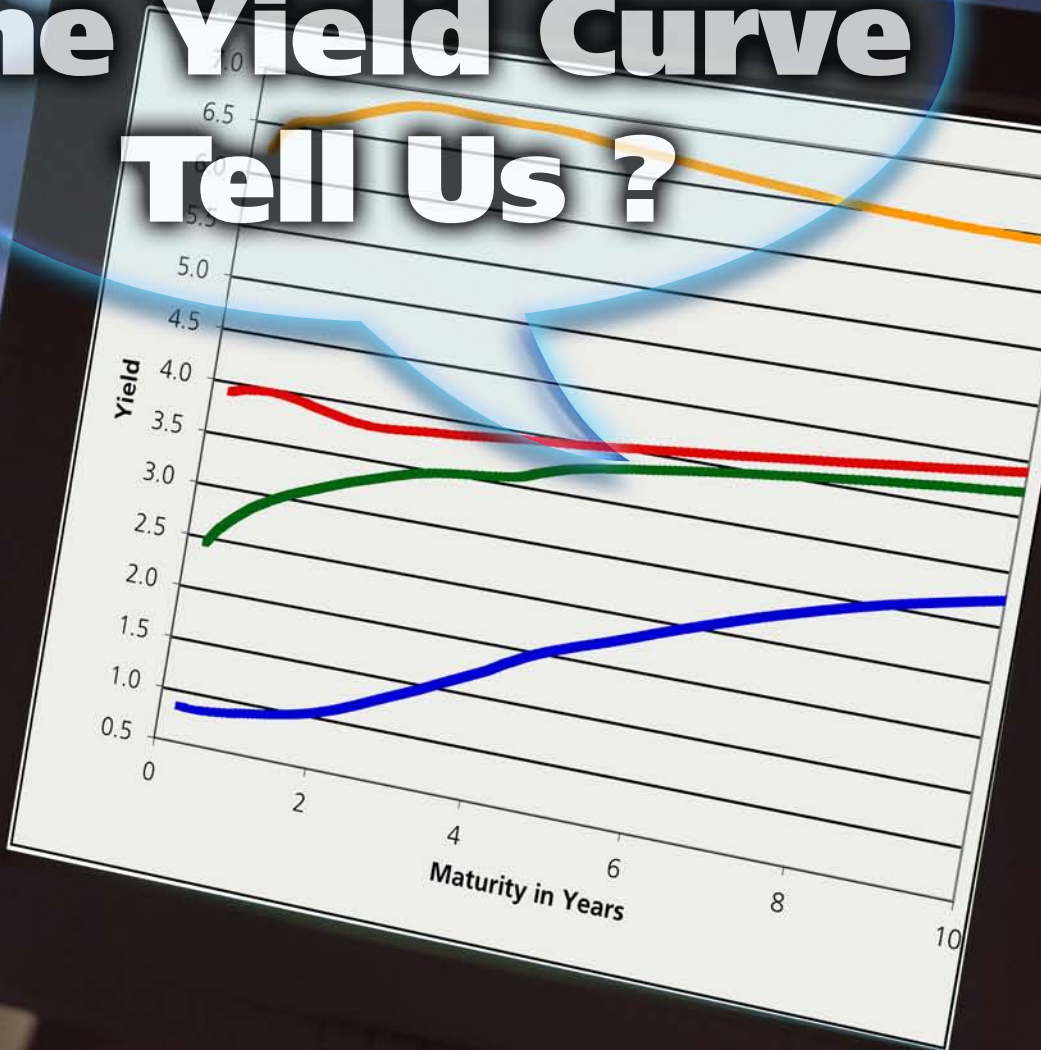


What Does the Yield Curve Tell Us ?



**A combination
of history and
math may reveal
the answer.**

by
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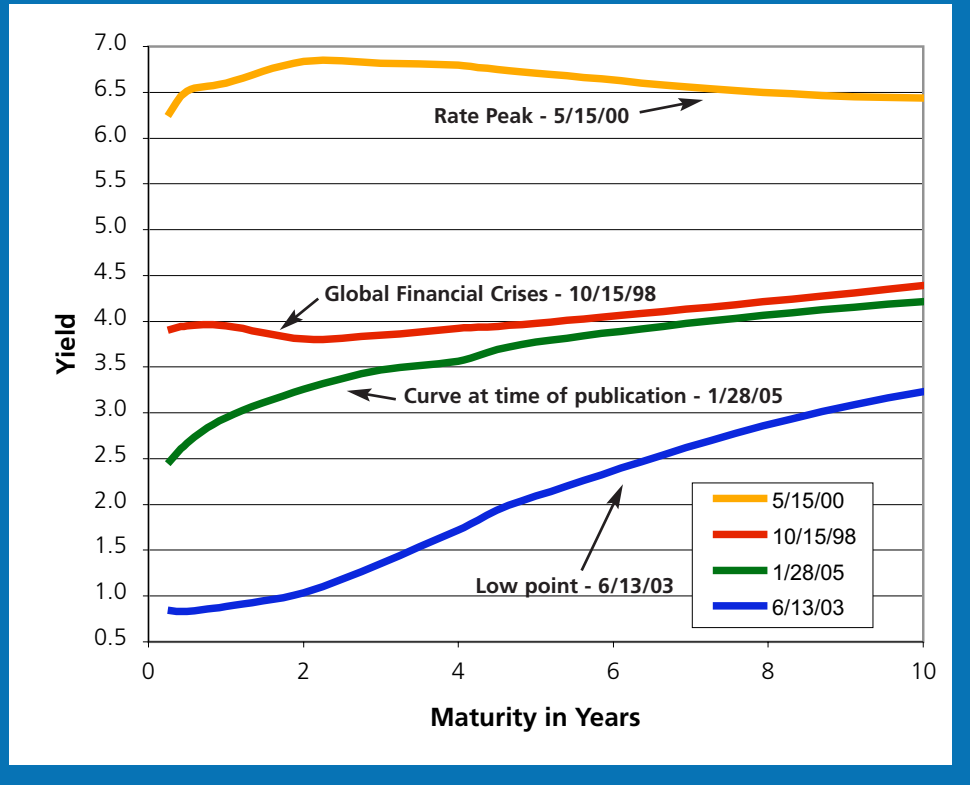
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The yield curve is fascinating, speaking volumes about the market in which banks operate. Not only does it tell the current interest rate level for each maturity but it also speaks volumes about expectations built into the market. It is neither a perfect predictor nor one that can be ignored. Understanding what the yield curve is saying is essential to making sound investment and balance sheet management decisions. An entire book could easily be devoted to analysis, history, and theories about yield curves. This article is designed to provide an overview of the yield curve's messages, its history, its application, and appropriate strategies that result.

Three predominant theories exist about how the slope of the yield curve is influenced. They are the pure expectations theory, the liquidity preference theory, and the market segmentation theory. These theories are described in more detail in the insert below. While the liquidity preference and the market segmentation theories certainly have influence in determining the shape of the curve, the expectations approach appears to be the dominant factor.

According to the expectations theory, the steeper the yield curve, the more the market is expecting rates to rise in the coming months or years. The flatter the curve, the less

Yield Curve Review



Yield Curve Theories

The *pure expectations theory* asserts that the slope of the yield curve represents investor's expectations about future rates. For example, the yield on a ten-year Treasury would equal the expected yield on a one-year Treasury rolled annually for the next ten-years.

The *liquidity preference theory* asserts that while the expectations theory applies, investors demand an additional yield premium above that which would be required by the pure expectations theory alone.

The *market segmentation theory* states that the expectations theory is further limited by the fact that investors have limited maturity spectrums within which they invest. As a result, regardless of expectations, investors will only lengthen or shorten their investments within a particular spectrum rather than across the full curve.

concerned the market is about rising rates. Since liquidity preferences will generally keep short term rates lower than long-term rates, even if the market is expecting rates to remain stable indefinitely, flat curves indicate a market expectation that rates are likely to fall. Inflation is also a consideration as higher inflation would tend to reduce the value of longer-term securities thereby increasing the slope of the curve, while expectations of lower inflation should allow the curve to be flatter.

Using Forward Curves

Assuming that the expectations theory applies, investors should receive the same total return (including both price change and yield) regardless of the maturity selection. For example, an investor in a two-year Treasury bond would expect to receive the same yield over a two-year period as they would have received if they had purchased a one-year Treasury and then reinvested the proceeds into another one-year Treasury.

Math Corner

An investor in a two-year Treasury bond would expect to receive the same yield over a two-year period as they would have received if they had purchased a one-year Treasury and then reinvested the proceeds into another one-year Treasury.

If an investor chooses a one-year Treasury instead of a two-year Treasury, what yield would they need to reinvest at in one year in order to earn the same return as if they had purchased the two-year Treasury?

Assumptions:

1yr Treasury yield 2.95
2yr Treasury yield 3.26
3yr Treasury yield 3.37

Return on Two-Year Treasury:

$(1 + \text{semiannual yield})^4$

Because the two-year Treasury will pay four semi-annual coupons

$(1 + .0326/2)^4$

$(1.0163)^4 = 1.0668 = 6.68\%$

Break-Even Analysis

If the investor buys the one-year Treasury, the return will be:

$(1 + .0295/2)^2$

$(1.0147)^2 = 1.0297 = 2.97\%$

In order to break-even with the two-year, how high will the one-year's return need to be when the first one-year Treasury investment matures?

$(1 + \text{return on two-year}) / (1 + \text{return on one-year})$

$(1.0668)/(1.0297) = 1.0360$

3.60% required return for the second year

To decompound that into a bond-equivalent yield:

$(1.0360)^{(1/2)}$ take the square root of the return for the year (+1)

1.01785 which is the required semiannual yield

1.785×2 to get the bond-equivalent yield

3.57%

Result

An investor choosing a one-year Treasury instead of a two-year would need the yield on the one-year Treasury to rise to 3.57% or higher in one-year in order to equal or beat the return on the two-year Treasury which is available for purchase today.

The same math is used to compute the forward curve.

Using this approach, it is possible to construct a forward curve which represents the market's built-in projection of where rates will be at some future date. The forward curve projects the level of rates that would be necessary in order for investors to have received the same return, regardless of maturity selection.

Historically, the forward curve has not been a good predictor of the level of rates. The forward curve does, however, serve three very valuable purposes.

■ It serves as a reasonable estimate of the market's sentiment and expectations.

■ It is a major factor in the valuation of interest rate caps and variable rate securities and loans by providing an idea of where the market believes rates could go in the future. Consider, for example, that in May of 2004 while Fed Funds were at 1%, forward rates projected three month LIBOR would exceed 6% by the middle of 2008. As a result, the market believed that the possibility of caps coming into play on floating rate securities or loans was high enough to weigh into valuations and more likely than most institutions would have thought.

■ It can establish an "over/under", providing institutions with a means of deciding whether the market yields are higher or lower than their expectations and therefore whether asset or liability duration should be adjusted. If rates end up equal to the forward curve's projection, all bullet securities across the curve will have the same total returns.

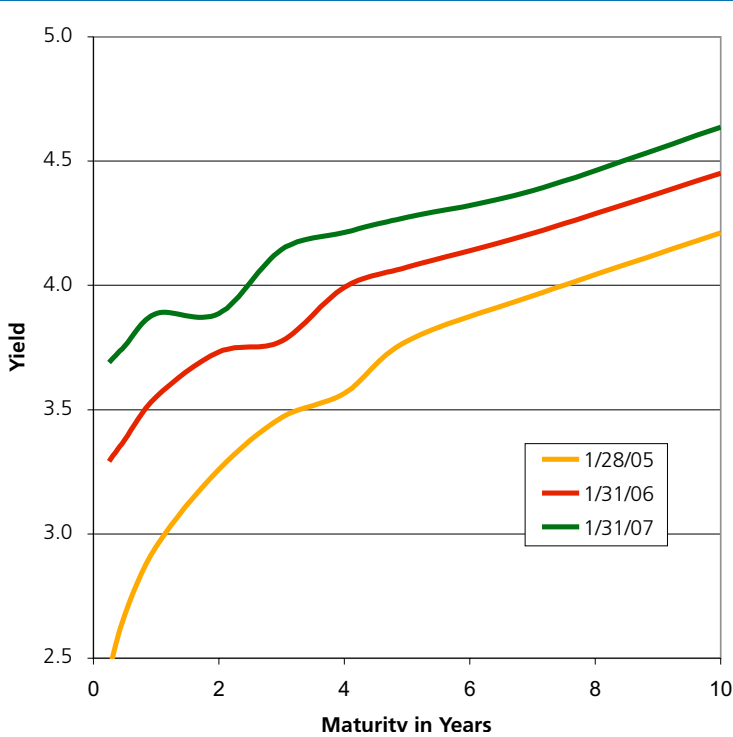
When making decisions about where to invest on the yield curve, the forward curve can serve as a good benchmark to help guide the decision. This is particularly true for deciding between maturities which are not spread too far apart such as comparing three-year and five-year Treasuries. The adjacent illustration provides a more detailed example.

Bonus Quiz

What yield would an investor need on a one-year Treasury to be purchased in two-years in order to make the investment in a two-year Treasury today plus a one-year Treasury two-years from now equal the return available on a three-year Treasury today?

Use the assumptions above.....the answer is at the end of this article.

Forward Curves Current, 1 yr., and 2 yr.



	Current	1yr Forward	2yr Forward	3yr Forward
1 yr	2.95%	3.57%	3.89%	3.87%
2 yr	3.26%	3.73%	3.88%	4.25%
3 yr	3.47%	3.78%	4.13%	4.27%
4 yr	3.57%	3.99%	4.18%	4.33%
5 yr	3.78%	4.05%	4.24%	4.37%
6 yr	3.87%			
7 yr	3.96%			

What would the one-year need to yield on 1/31/2006 in order for an investor to receive the same return on two one-year maturity purchases as they would receive on a two-year Treasury bought today?

Return on two-year $(1 + .0326/2)^4 = (1.0163)^4 = 1.0668 = 6.68\%$

Divided by return on one-year $(1.0147)^2 = 1.0297 = 2.97\%$

Equals 3.60%...decompounded into a bond-equivalent yield:
 $(1.0360)^{(1/2)} = 1.01785$ (semiannual yield)

$1.785 \times 2 = 3.57\%$ bond-equivalent yield

For the most part, if an investor's expectation for rates is higher than the forward curve projects, shorter maturities should be purchased. Conversely, if the investor's expectation for rates is lower than the forward curve projects, longer maturities should be purchased.

Is the Shape of the Yield Curve a Good Predictor?

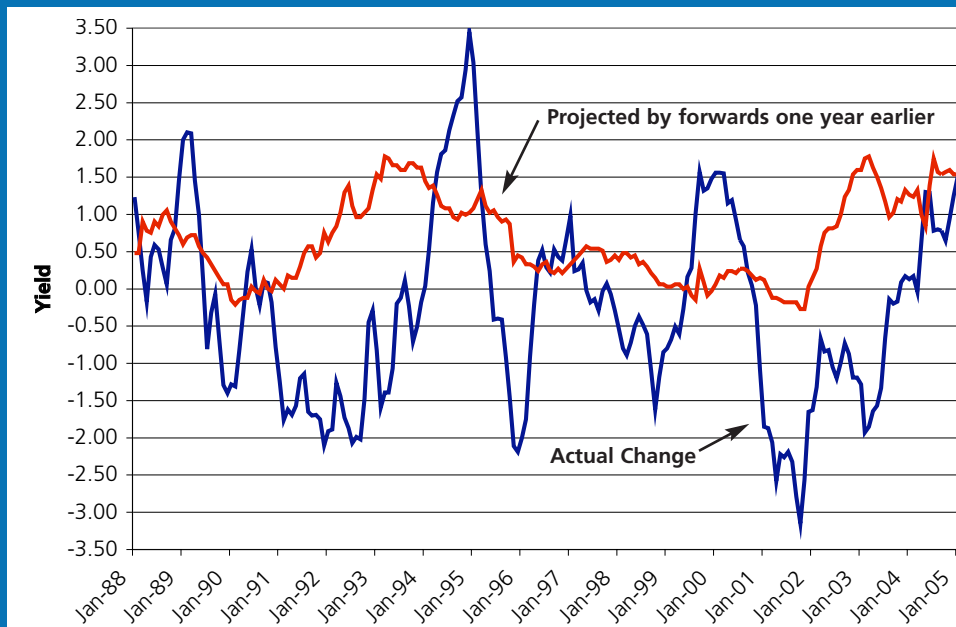
Since the shape of the yield curve and forward curves provide a measure of market expectations and provide a break-even analysis of whether it is better to invest longer or shorter on the yield curve, the next question is: Is the shape of the curve a good predictor of future rates?

The answer is a definite maybe. Taken by themselves, forward curves and the curve shape do not tend to be very reliable predictors of future rates for a couple of reasons. As already mentioned, the liquidity preference builds in additional yield for longer maturities. As a result, the curve tends to be upward sloping, forecasting higher future interest rates, even if the market expects rates to remain unchanged or fall modestly. Also, economic data and market sentiment changes (often quite dramatically) as time passes, thereby negating past forecasts.

History has shown that the market's forecast contained in the yield curve's shape is often (but not always) too early in predicting a turn in rates – especially a rise in rates. In addition, the market often gets faked out – projecting a turn in rates, and then reversing that projection before ultimately getting it right.

Note the graph on the top of page A6 showing the forward curve's projected changes in yield versus the actual changes. The graph compares actual changes in the two-year Treasury's yield over a one-year time period to the forward curve's projections. The forward curve's projections are generally for a larger and quicker rise in rates than actually occurs. Sometimes, however, the forward curve is an accurate predictor. Coincidentally, the forward curve projection made in January 2004 for the level of the two-year Treasury in January 2005 proved to be quite accurate. While certainly too harsh of a criticism, that coincidence serves as a reminder of the old adage that even a broken clock is right twice a day. While almost never a perfect indicator, the forward curve still provides enormous analytic benefit to investors.

Actual and Projected Yield Changes Two-Year Treasury



Two curve shape extremes which exist merit additional review – extremely steep curves and very flat or inverted curves. When the curve attains one of these very rare and anomalistic shapes, how good of a predictor is it? Read on for the answer.

Reading the History of Extremes

Over the years, the slope of the yield curve has undergone many cycles, steepening and flattening along the way. Sometimes, the curve even inverts, placing short-term yields higher than long-term yields. Both periods of inversions and periods of extreme curve steepness have been turning points. Sometimes periods of extreme steepness and flatness have lasted for years while other such occurrences have been fairly brief. In general, periods of curve steepness last longer than periods of inversion or extreme flatness.

Inversions have often been cited as extremes or anomalies. Although looking for yield curve inversions is rather simple since it just involves negative rather than positive curve slopes, it is probably not the best definition of an extremely flat curve since the liquidity preference builds in a normal upward slope to the curve. In addition, there are not such obvious benchmarks for extremely steep curves.

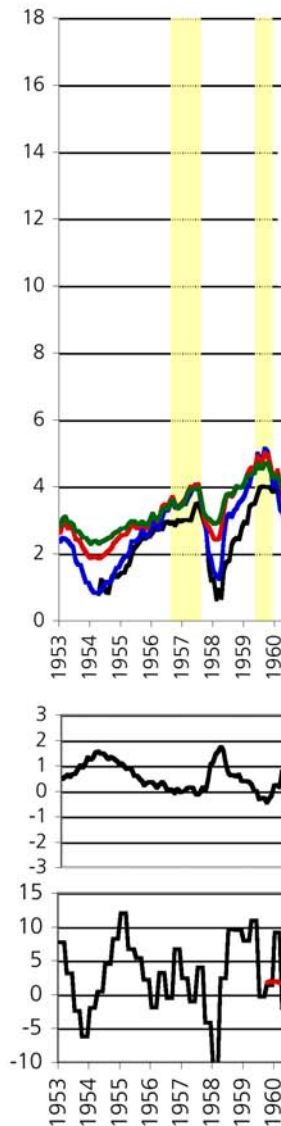
For the purposes of this research, periods of yield curve shape extremes will be assessed based on how distant the spread between the one-year Treasury and the ten-year Treasury is from historic averages. The one-year Treasury and the ten-year Treasury yields (actually the

Constant Maturity Treasury yields) are published by the Federal Reserve with history available back to 1953. The periods of extreme shape will be defined as follows:

- A curve will be considered Extremely Steep when the spread between the one-year and the ten-year Treasury is more than double its ten-year average.

- A curve will be considered Extremely Flat when the spread between the one-year and the ten-year Treasury is less than 25% of its ten-year average.

Because the wild interest rate swings which occurred from 1978 through 1982 are readily accepted as an anomaly due to an experiment by the Federal Reserve in Money Supply focus, that time period has been excluded from our analysis. For much of that time period, the Federal Reserve targeted Money Supply growth and



allowed changes in the Money Supply to dictate Fed interest rate policy. Also, credit controls imposed by the Carter Administration in 1980 caused dramatic and instantaneous changes in the Money Supply and, as a consequence, interest rates.

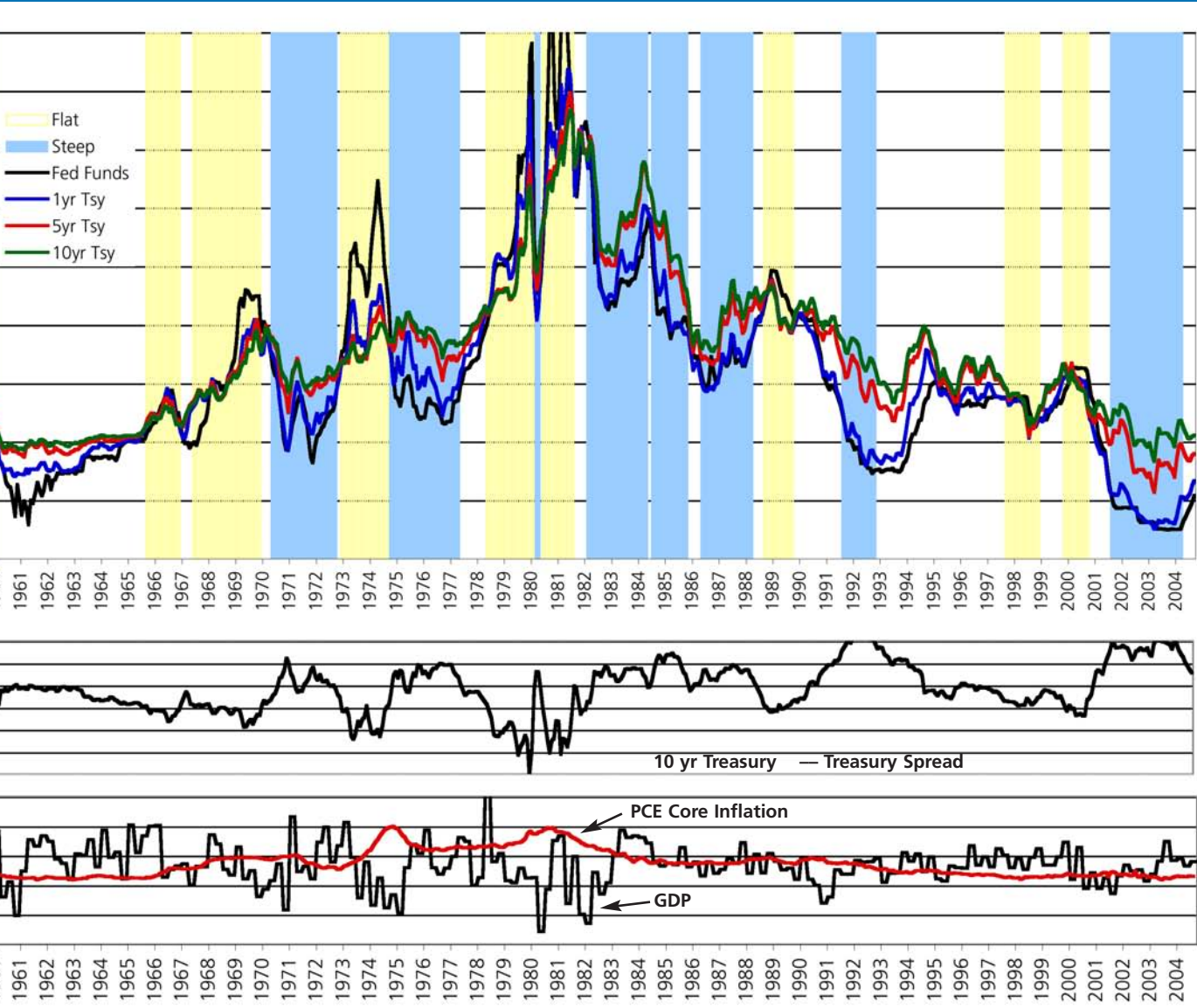
■ In addition, the period of an extremely steep curve (1982-1986) which followed the 1978-82 anomaly was also excluded from this analysis. That time period was marked by an enormous decline in interest rates as the hyperinflation premium of the late 70's was slowly removed from the market. Had that time period been included, it would not have changed the conclusions but would have complicated and skewed the results, making it appear far more lucrative to invest longer and remain invested longer than other periods suggest.

Periods of Extreme Curve Flatness

Although there is no guarantee that an extremely flat curve will foreshadow a peak in rates, history indicates that periods of extreme flatness often accompany rate peaks. Excluding the 1978-86 period, there have been eight significant interest rate peaks since 1953 and only once did the yield curve fail to attain an extremely flat shape. It is also interesting that each time the extremely flat curve occurred, an inversion also occurred although some of the inversions were very minor and not long lasting.

The graph and table on the following page depict the “average” path of interest rates from the first month of yield curve flattening through the eighteenth month following the cyclical interest rate peak. This path is an average of the six extremely flat periods since 1953 and

Historic Review of Step & Flat Curves



excludes the inversions from 1978-86 for reasons discussed previously.

Note that while rates, on average, continued rising following the curve attaining its extremely flat slope (spread between one and ten-year Treasury less than 25% of its ten-year average), the rise in

approaching a recession. In each case where the yield curve actually inverted, the last tightening by the Fed occurred after the curve flattened and the first easing occurred before or coincided with a return to a more normal change. There have been instances when the yield curve

assumed a normal positive shape for a short period of time during an “inversion period” only to later reinvert for a few more months. For this reason, it is impossible to know when a cycle is definitely over. Therefore, investment strategies should consider purchasing intermediate to long-term securities and begin averaging into more bullish strategies as the curve inverts or shortly thereafter in order to complete the implementation of these strategies by the end of an inversion cycle. Of the eight periods of extremely flat curves, the shortest time to the peak in rates was 0 months in 1997 and the longest was 27 months in 1967. All of the cycles since the 1978-86 period saw a peak in rates within three months of the beginning of the extreme flatness.

In addition to reviewing the average of the cycles, it is important to review the most recent cycles which occurred in

rates was not especially sharp, especially on the long-end of the curve. On average, the ten-year Treasury rose 64bp from the beginning of the flatness to the end.

On average, yields ended the period of extreme flatness near where they started and then proceeded downward after the flatness ended. As one would expect, the short-end of the curve experienced the greatest swings.

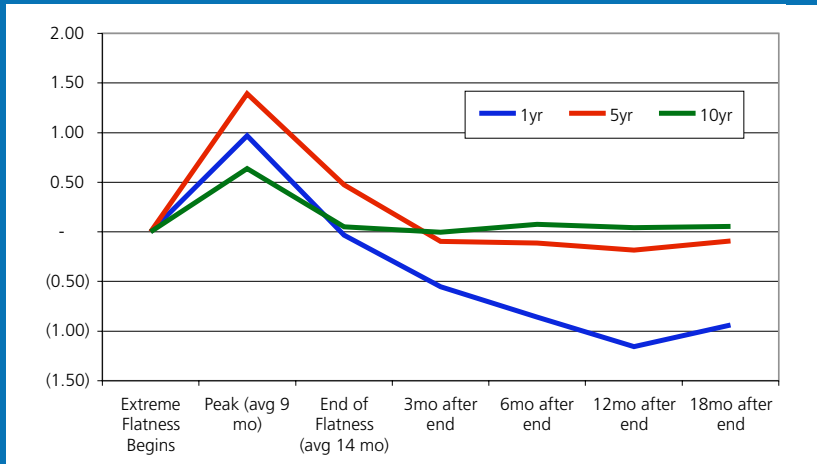
As the graph indicates, the descent in interest rates has typically begun during the time period when the curve was still very flat. By the time the curve returned to its “normal” positive shape, the economy had already slowed and frequently was

1988, 1997, and 2000 as these cycles may be more indicative of future inversions for the following reasons:

- They are the most recent experiences;
- They all occurred under Alan Greenspan as Chairman of the Fed;
- Curve flattening and steepening trades were much more heavily employed; and,
- Derivative usage, technological advances, the increased linking of global economics and the growth in Mutual Funds are more recent occurrences.

As you can see above, the data is compelling to extend when an inversion occurs. Given that

Average Rate Path - Flat Curves

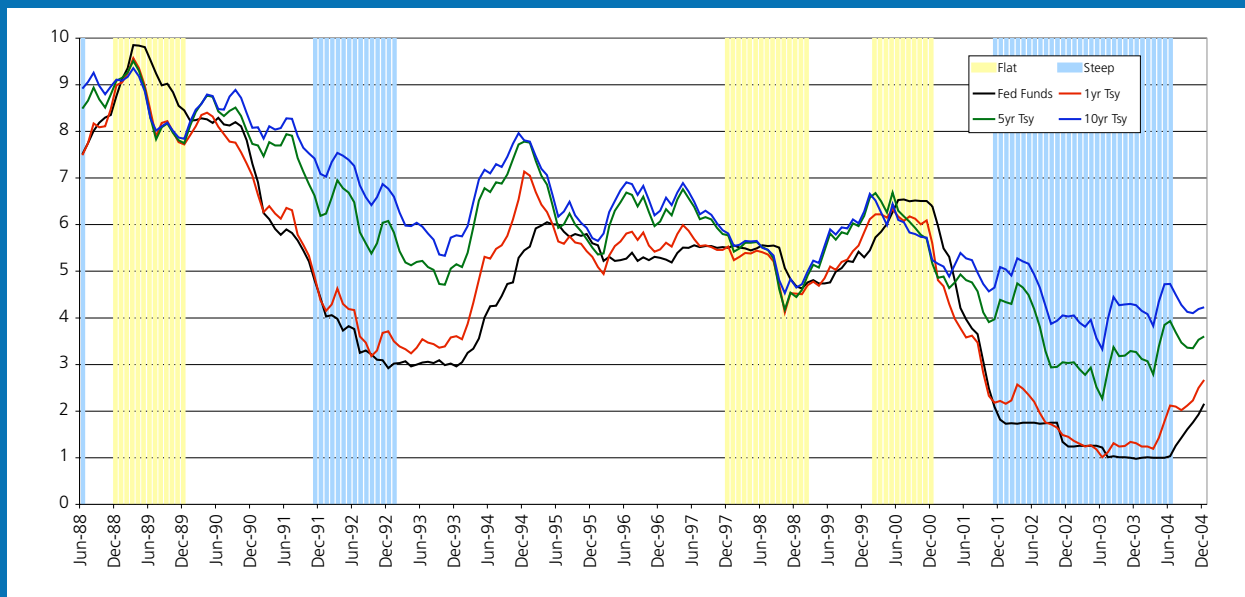


Periods of Extreme Flatness

Beginning	Ending	Mos	1yr		5yr		10yr			
			Peak mo	Change	End Chg	Change	End Chg	Peak mo	Change	End Chg
12/1/56	10/1/57	10	9	0.39	0.33	0.38	0.38	10	0.38	0.38
9/1/59	2/1/60	5	3	0.14	(0.34)	0.11	(0.21)	4	0.04	(0.19)
12/1/65	2/1/67	14	9	1.10	(0.01)	0.78	0.02	8	0.60	0.01
9/1/67	2/1/70	29	27	2.93	2.35	2.77	2.42	28	2.49	1.94
3/1/73	11/1/74	20	17	2.51	0.81	1.83	0.88	18	1.33	0.97
8/1/78	4/1/80	20	19	7.51	4.99	5.14	3.51	19	4.34	3.06
9/1/80	10/1/81	13	11	5.20	3.86	4.31	3.79	12	3.81	3.64
12/1/88	12/1/89	12	3	0.58	(1.27)	0.42	(1.34)	3	0.25	(1.27)
12/1/97	2/1/99	14	-	-	(0.83)	-	(0.86)	-	-	(0.81)
2/1/00	12/1/00	10	3	0.11	(0.62)	0.01	(1.51)	-	-	(1.28)
	Median	13	6	0.49	(0.18)	0.40	(0.09)	6	0.32	(0.09)
	Average	14	9	0.97	0.05	1.39	0.47	9	0.64	(0.03)

Medians and averages exclude 1978-86 time periods

Recent Cycles



most institutions do not have the luxury of being able to sell and buy entire portfolios instantly, an “averaging” approach should be employed. The key is to invest as much as possible during the early months of the inversion period when history tells us that rates are at their highest point.

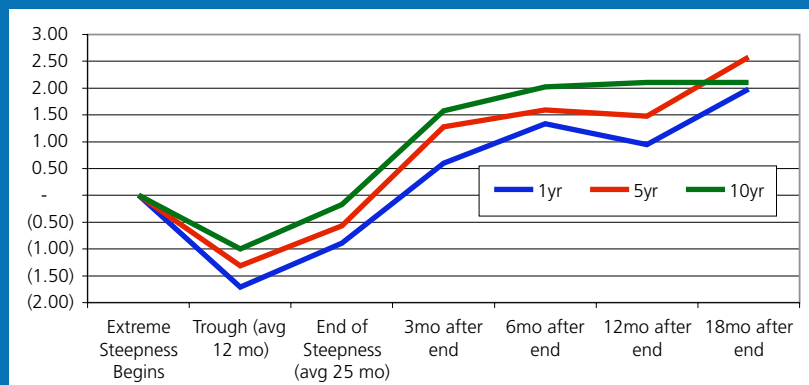
Steep Curves

Similar to flat curves, no guarantees accompany an extremely steep curve. Steep curves tend to last much longer than flat curves and often begin well before rates hit their lows. Nevertheless, steep curves usually remain until rates begin moving upward.

As the table and graphs at the right depict, rates usually fall sharply after the curve attains an extremely steep shape (defined herein as the spread between the one-year Treasury and the ten-year Treasury exceeding 200% of its ten-year average).

Unlike the extremely flat curves which appear to beg quick action by investors, extremely steep curves have not required such a reaction. In fact, history suggests that investors are well served by holding onto longer maturity holdings or even

Average Rate Path - Steep Curves



Periods of Extreme Steepness

				1yr	5yr	10yr				
Beginning	Ending	Mos	Trough mo	Change	End Chg	Change	End Chg	Trough mo	Change	End Chg
8/1/1970	12/1/1972	28	7	(3.29)	(1.46)	(2.57)	(1.41)	7	(1.83)	(1.17)
1/1/1975	7/1/1977	30	23	(1.94)	(0.89)	(1.31)	(0.57)	23	(0.63)	(0.17)
6/1/1980	7/1/1980	1	-	-	0.49	-	0.32	-	-	0.47
5/1/1982	7/1/1984	26	8	(4.72)	(1.31)	(3.73)	(0.48)	12	(3.24)	(0.26)
10/1/1984	1/1/1986	15	14	(3.23)	(3.17)	(3.38)	(3.38)	15	(2.97)	(2.97)
8/1/1986	6/1/1988	22	2	(0.21)	1.56	(0.16)	1.69	5	(0.09)	1.75
11/1/1991	1/1/1993	14	10	(1.71)	(1.39)	(1.24)	(0.79)	10	(1.00)	(0.82)
11/1/2001	6/1/2004	31	19	(1.17)	(0.06)	(1.70)	(0.04)	19	(1.32)	0.08
	Median	28	10	(1.71)	(0.89)	(1.31)	(0.57)	10	(1.00)	(0.17)
	Average	25	12	(1.66)	(0.45)	(1.40)	(0.22)	13	(0.97)	(0.07)

Medians and averages exclude 1978-86 time periods

extend as the curve attains its extremely steep posture. Unfortunately, the optimal time to shorten is not clearly signaled by the yield curve. Steep curves have proven less reliable in telling investors when higher rates are imminent.

Strategies

Having worked diligently to listen to what the curve is telling about expectations for the future, the next task is to apply investment strategies designed to benefit from the curve's posture. Not surprisingly, different curves call for different strategies, all of which are well within the bands of what would be considered prudent and normal portfolio management for community banks with traditional balance sheet mixes.

Flat Yield Curves

As illogical as it may seem, a flat yield curve, which rewards the investor very little for extension *today*, is historically the precise time to extend. As stated earlier, periods of extremely flat curves tend to last for varying lengths of time (average cycle over the last 50 years is 14 months), but have usually immediately been followed by a drop in rates. In addition, remember that recent cycles have seen rate peaks near the beginning of the period of extreme flatness.

If an investor decides that flatness will precede a drop in rates, or at least short-term rates, short duration securities should be replaced with longer duration securities. In addition, investors should seek a portfolio structure with as few imbedded call options as possible. For example, a ten-year callable agency with a call date in less than a year will have very little appreciation if purchased near the beginning of a bull market, especially compared to "locked-out" bonds like PAC CMOs or bullets. Following are other examples of securities that should perform well if purchased when the curve is flat:

- Bullet securities
- Municipal bonds
- Callable agencies at discounts or lock-out
- Discount CMOs or MBSs
- Discount or par-ish "Bullish" ARMs
- Discount or par-ish Hybrid ARMs

Steep Yield Curves

Since a steep yield curve creates expectations of a rising rate environment, most strategies for such an environment employ investments which perform well "later" rather than "sooner". In many cases, financial institutions have the ability to forfeit some current income in a steep curve environment, because as the steepening occurs, book yields exceed market yields, and portfolios produce wide spreads to institutions' cost of funds. This does assume that the

portfolio's duration has been somewhat maintained, which is another way of saying that it has call protection. Consequently, to allow for a rise in rates, and a flattening of the curve, any of the following securities should have a reasonable chance for above-average performance:

- Premium callable agencies
- "Bearish" ARMs or SBA loans or pools
- Premium CMOs or MBSs
- Cushion or shorter maturity muni bonds
- Prime-based and LIBOR-based floaters

Normal Yield Curves

Normally-sloped yield curves, which are more hypothetical than real, would tend to favor securities that "roll down the yield curve." With the average spread between the one-year and the ten-year being 141 basis points since 1985, a five-year security would appreciate about 3/4 points in a year, assuming no change in rates. The dollar appreciation will be greater the further out on the curve a security sits.

The next most logical strategy would be a barbell approach. In this case, roughly equal amounts are invested on the short end and the long end of the curve. A common example of this would be equal amounts of ARMs and

The 2000 Experience

In evaluating the merits of adjusting investment portfolios when the curve is especially flat, it is worth revisiting the year 2000. In that year, interest rates peaked in May and the curve was extremely flat from May through December. Institutions who took advantage of the high level of interest rates and the flat curve benefited in the years that followed. The benefit came from both higher portfolio yields and from improved portfolio structure that had less optionality. Note the following results:

	Banks that took losses in 2000	Banks that did not take losses in 2000	Difference
2000 Securities gains/ (losses)	(0.42)	0.08	(0.50)
2001 Investment Yield	6.72	6.29	0.43
2002 Investment Yield	5.55	5.29	0.26
		Net pick-up	0.20

Investment Alternatives Matrix

Each month, our Investment Alternatives Matrix provides a snapshot of products currently available in the market. In addition to traditional yield and price volatility measures, the matrix provides total return analyses for steeper and flatter curves as well as parallel shifts. The steepening/flattening curve shifts are updated regularly based on the current and probable future curve postures.

Investment Alternatives Matrix																									
Security	Cpn	Yield					Price Volatility			Eff Dur		12mo Total Return					12mo Total Return		LIBOR OAS						
		-100	Base	+100	+200	+300	+100	+200	+300	Base	+200	-100	-50	Base	+100	+200	Twist1	Twist2		5/00	5/00-2%				
Agency Callables																									
5.0nc1.00yrC	4.33	4.33	4.33	4.33	4.33	4.33	-3.1	-6.6	-10.3	2.6	4.1	4.31	4.31	4.16	2.17	-0.65	see below for description of twists				3.26	2.03	-4.05	1.73	-0.37
5.0nc1.00yrOTC	4.20	4.20	4.20	4.20	4.20	4.20	-3.1	-6.9	-10.8	2.6	4.3	4.18	4.18	4.19	2.58	-0.90	4.19	2.66	-4.50	2.38	-0.30				
5.0nc2.00yrC	4.20	4.20	4.20	4.20	4.20	4.20	-3.6	-7.3	-11.1	3.4	4.2	6.05	5.22	4.20	1.64	-1.35	2.90	1.51	-4.79	1.19	-0.30				
Agy Bullet 01/08	3.25	3.61	3.61	3.61	3.61	3.61	-2.7	-5.3	-7.9	2.7	2.7	5.79	4.87	3.97	2.18	0.41	2.80	1.65	-2.29	1.19	-0.19				
MBS																									
7yr Bln average life	5.00	3.36	4.14	4.38	4.40	4.42	-2.6	-5.9	-9.4	1.8	3.8	3.61	4.34	4.12	2.55	0.07	3.25	2.35	-2.78	1.88	-0.17				
10yr average life	4.00	4.02	4.02	4.02	4.02	4.02	-3.7	-7.3	-10.7	3.6	3.8	6.81	5.57	4.20	1.32	-1.54	3.03	1.86	-4.20	1.41	-0.17				
15yr average life	4.00	4.52	4.44	4.41	4.40	4.40	-4.6	-9.2	-13.5	4.4	4.9	7.49	6.19	4.57	0.81	-3.14	3.43	2.26	-5.54	1.86	-0.07				
SBA & ARM																									
SBA 7.5 PREMIUM average life	4.63	1.66	2.56	3.44	4.32	5.19	0.0	-0.1	-0.2	0.0	0.0	2.07	2.33	2.60	3.12	3.64	3.00	3.40	3.93	3.12	-0.01				
FN SEAS 5/1 4.41 H average life	4.41	3.62	4.08	4.42	4.62	4.79	-2.3	-5.1	-7.9	1.9	3.1	4.44	4.62	4.30	2.94	1.05	3.57	2.79	-1.15	2.38	0.20				

intermediate-term (seven to ten year) municipals. A flattening would benefit the yield on the ARMs, and a steepening would benefit the municipals. Overall, the duration should remain fairly stable.

Summary

The preceding documentation should equip a market-watcher or a portfolio manager with valuable guidance about the change in, and the rates of change in, the yield curve. It is clear that a certain condition (e.g., an inverted yield curve) has usually resulted in a consistent reaction (e.g., a drop in short-term rates). And, since the time period examined herein now extends to fifty years, a manager may want to use this research to pursue a portfolio restructuring. Contact your Account Representative in order to have your portfolio reviewed for potential earnings improvement swaps that are customized to your institution's unique needs.

About the Authors

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Bonus Question Answers

What yield would an investor need on a one-year Treasury to be purchased in two-years in order to make the investment in a two-year Treasury today plus a one-year Treasury two-years from now equal the return available on a three-year Treasury today?

Return on three-year

$$(1 + .0337/2)^6 = (1.01685)^6 = 1.105456 = 10.5456\%$$

Minus return on two-year

$$(1 + .0326/2)^4 = (1.0163)^4 = 1.0668 = 6.68\%$$

Equals 3.8656%

Decompounded into a bond-equivalent yield:

$$(1.038656)^{(1/2)} =$$

$$1.019145 \text{ (semiannual yield)}$$

$$1.19145 \times 2 = 3.829\% \text{ bond-equivalent yield}$$