



“ On T h e M o n e y R e p o r t ”

By Steve Pomeranz, CFP

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The following report is a comprehensive and well written essay on the mechanics of laddering bond portfolios.

We do not endorse the authors or Thornburg Investment Management, however I believe this report has strong merit and can be a helpful guide to those who are considering this strategy.

Steve

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“The Investor’s Advocate”
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The Laddered Bond Portfolio

*A Core Bond Strategy for Managing Risk
and Capturing Market Returns*

Investment Solution Series

Thornburg

Investment Management

The stock market crash of October 1987 was highly dramatized in the media, but during that year, more money was lost in long-term bonds and bond funds than in stocks. Interest rates fluctuated widely throughout the year then rose

Looking back, investors historically have not been compensated for the higher risk of long-term bonds.

dramatically by the end of that year; this caused the bond market to lose significant value. *Why?* When interest rates rise, market values of bonds drop because bond interest rates are fixed and the *present value* of a bond's stream of interest payments also fluctuates. These factors caused investors to panic and sell their bond funds, leaving fund managers with no choice but to sell these long-term bonds at depressed prices as a way to generate cash for redemptions.

The higher nominal yield of long-term bond funds has not been enough to compensate the investor for their highly volatile prices. Investors have not, historically speaking, been compensated for the higher risk of long-term bonds.

A HISTORICAL PERSPECTIVE

During the late 1980s and early 1990s, long-term bond investors enjoyed their best decade in history, with gains averaging 12.7% per year. Unfortunately, many investors continue to consider only the most recent positive period when analyzing investment options. Psychologists call this *cognitive bias*, the expectation that historical performance will determine future performance. It is critical to analyze all statistical evidence available in financial decision-making; investors should never dismiss data without good reason.

Consider the decade of the 1950s—the worst decade for long-term bond investors—with an average annual loss of -0.1% (with reinvested interest income; substantially lower if not). This practical example illustrates what can happen when interest rates rise. The volatility of long-term bonds, particularly over long time periods, approaches the volatility of common stocks. Clearly,

long-term bonds do not exhibit the price stability that many fixed-income investors are seeking.

The longer the term to maturity, the longer the expected stream of interest payments to the bondholder. The market price of any bond represents the present value of this stream of payments discounted at current interest rates. As rates fluctuate, the present value of this stream of payments constantly changes. This longer stream of interest payments, as compared to those of short-term bonds, creates higher price volatility for long-term bonds.

The higher risk of long-term bonds might be acceptable were higher rates of interest to compensate for the additional risk assumed. Note that University of Chicago Professor Eugene Fama has studied the rates of return of long-term bonds from 1964 to

1996; Fama's studies demonstrate that long-term bonds have historically exhibited wide variance in their total rates of return without sufficiently compensating investors with higher expected returns. Fama found that bonds with maturities beyond five years have had lower total returns than those with maturities of less than five years. Ibbotson Associates also reached the same conclusion when they compared total returns for the last 40 years, as illustrated in the chart above.

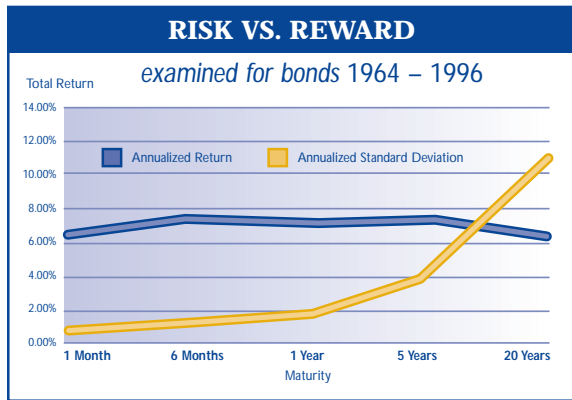
SUMMARY STATISTICS OF ANNUAL RETURNS		
1962-2001	Average Annual Total Return	Standard Deviation of Return
Treasury Bills	5.96%	2.61%
5-Year Gov't Bonds:	7.33%	6.58%
20-Year Gov't Bonds:	7.08%	11.44%

Source: Ibbotson Associates

Note: Intermediate bonds, defined as those with a maturity of five years, had higher total returns with almost half the standard deviation of long-term bonds.

WHY WOULD ANYONE BUY LONG-TERM BONDS?

The majority of investors in the long-term bond markets are institutions, such as corporate pension plans and life insurance companies. These investors are interested in funding long-term debt obligations such as fixed annuity payments or other fixed corporate responsibilities. They are not concerned with volatility of principal or with the effects of inflation since their obligations are a fixed amount. In terms of variability of total return, long-term bonds bear more similarity to stocks than to shorter-term fixed-income vehicles such as Treasury bills. And yet, over long time periods, their respective total returns have consistently lagged those of equities.



Source: Eugene F. Fama, University of Chicago

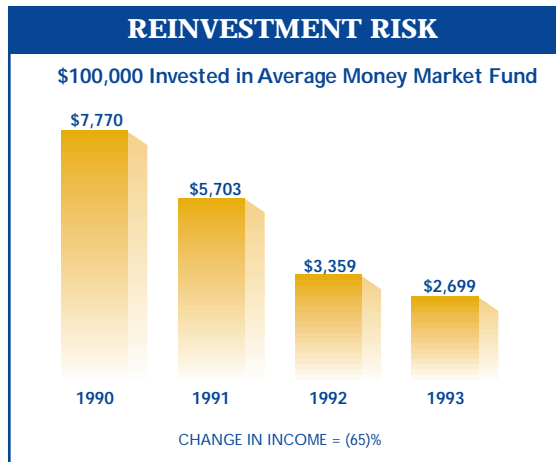
A look at the graph at left will help illustrate the higher standard deviations and lower total returns of bonds with maturities beyond five years.

The Risks

There are four main risks inherent in every bond and bond fund: credit risk, income tax risk, market price risk, and reinvestment risk. It is possible to control credit risk by researching a bond, and income tax risk can be controlled by investing in tax-free bonds or using a tax deferred account, but it is impossible to simultaneously master market price risk and reinvestment risk.

So, while it's true that some investments do control some of the above factors, no single investment can fully control all of them.

Market price risk, for example, can only be controlled by owning a short-term certificate of deposit (CD) or a money market fund, because the market price is always constant. But reinvestment risk is not controlled by investing in a CD or money market fund. Reinvestment risk can



Reinvestment risk as depicted by the declining income stream from a \$100,000 money fund purchase in 1990. Source: iMoneyNet.

be controlled through investing in zero coupon bonds, because reinvestment is fixed until maturity, but a zero coupon does not control market risk. All other bonds are subject to both market and reinvestment risk. At best, then, an investor in a fixed income vehicle other than the above two instruments can hope only for a compromise solution that minimizes and manages market price and reinvestment risk, while achieving acceptable total return.

MARKET PRICE RISK		
1994	High	Low
U.S. Treasury 6.25% Maturity 8/15/23	100.97	78.27
Change in Price = (22.5)%		

RISK CONTROL STRATEGIES	
Risk	Solution
Credit Risk	Careful selection, diversification, ongoing credit review
Income Tax Risk	Municipals and tax-deferred
Market Price Risk Reinvestment Risk	Compromise

THE COMPROMISE — LADDERING THE PORTFOLIO

How do fixed income investors achieve a respectable rate of return without experiencing the higher risk associated with the fluctuation of interest rates?

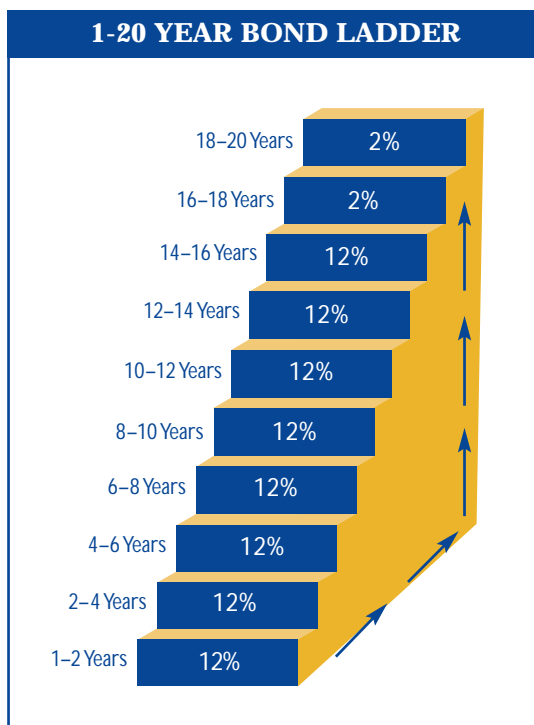
Further, what is an adequate tradeoff of higher risk for higher return?

Laddering involves building a portfolio of bonds with staggered maturities so that a portion of the portfolio will mature each year.

Laddering involves building a portfolio of bonds with staggered maturities so that a portion of the portfolio will mature each year. To maintain the ladder, money that comes in from currently maturing bonds is typically invested in bonds with longer maturities within the range of the bond ladder.

Laddering tends to outperform other bond strategies because it simultaneously accomplishes two goals:

- Captures price appreciation as the bonds age and their remaining life shortens; and,
- Reinvests principal from maturing short-term bonds (low yielding bonds) into new longer-term bonds (high yielding bonds).



MANAGING MARKET PRICE RISK

The primary goal of a laddered bond portfolio is to achieve a total return over all interest rate cycles that compares favorably to the total return of a long-term bond, but with less market price and reinvestment risk. This is achieved by maintaining an investment of approximately four to 10 percent of a bond portfolio in each year of the selected maturity range.

We find that two durations of ladders provide the best results:

- A short-term ladder in which the average maturity is kept between three and five years; and,
- An intermediate-term ladder with an average maturity of between six and ten years.

A bond's sensitivity to interest rates is measured by its duration. The shorter the duration, the less volatile the bond's price. When interest rates shift, a bond with a one-year maturity barely budges in price, while the price of a 30-year bond moves dramatically. Long-term bond funds pay a heavy price for their marginally higher yields. As short- and intermediate-term bonds age, their durations shorten at an increasing rate, in a telescoping effect. A single year of aging will shorten the duration of a five-year bond more than it does a 10-year bond; and will benefit a 10-year bond more than a 20-year bond. A 30-year bond's duration, on the other hand, hardly responds to a single year's passing.

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MORE PROOF

Compare three identical bonds with six percent coupons. The first bond has 30 years to maturity, the second 20 years, and the third 10 years. Observe the effect on duration (the bond's sensitivity to interest rates) after five years of aging.

Length of Bond	Initial Duration	Duration After Five Years	Change in Duration	Change in Duration
30-year	13.8	12.9	0.9	6%
20-year	11.6	9.8	1.8	15%
10-year	7.4	4.3	3.1	42%

The shorter-duration bond carries less risk, so a potential buyer will demand less yield. If interest rates remain constant, the bond will rise in value over most of its life, as its duration shortens. If interest rates rise, the bond will recover much (if not all) of its lost value as duration shortens, and is priced to the lower yield of a shortened bond.

The chart at bottom right shows the price of an intermediate municipal bond

A bond's sensitivity to interest rates is measured by its duration. The shorter the duration, the less volatile the bond's price.

as it ages—from its issuance until maturity. Note how the price rises over most of its life. This scenario, when applied to a laddered-maturity portfolio, reduces market price risk because there are generally more bonds rising in price than falling in price. Since the total return is derived from the average of *all* the various maturities in the portfolio, volatility is greatly reduced.

PRICING A MUNICIPAL BOND AS IT MOVES DOWN THE YIELD CURVE

Yield Scale Through Seven Years



Illustration of a 4.55% Bond Due in Seven Years Priced at Various Intervals Over its Term

Pricing Date	Coupon	Yield to Maturity	Dollar Price
Issue Date	4.55%	4.55%	100.000
2000	4.55	4.45	100.521
2001	4.55	4.35	100.890
2002	4.55	4.25	101.092
2003	4.55	4.10	101.258
2004	4.55	3.88	101.277
2005	4.55	3.50	101.023
2006	4.55	Matures	100.000

In this illustration, note that four years after issuance, the 4.55% bond due in 2006 has approximately three years to maturity. Assuming constant interest rates, we price the 4.55% bond using a 4.10% yield to maturity to obtain a dollar price of 101.258, when three years remain to maturity.

MANAGING REINVESTMENT RISK

In a laddered portfolio, bonds mature every year. As this occurs, the principal proceeds are reinvested at the longer end of the ladder, often at higher interest rates. The income stream will stay relatively constant because only a small portion of the portfolio will mature and be replaced each year. Over time, the portfolio will include bonds purchased in periods of both high and low interest rates. The following illustrations demonstrate how a ladder can be expected to react to three interest rate scenarios:

■ UNCHANGED INTEREST RATES

(The centerline in the graph at right represents unchanging interest rates.)

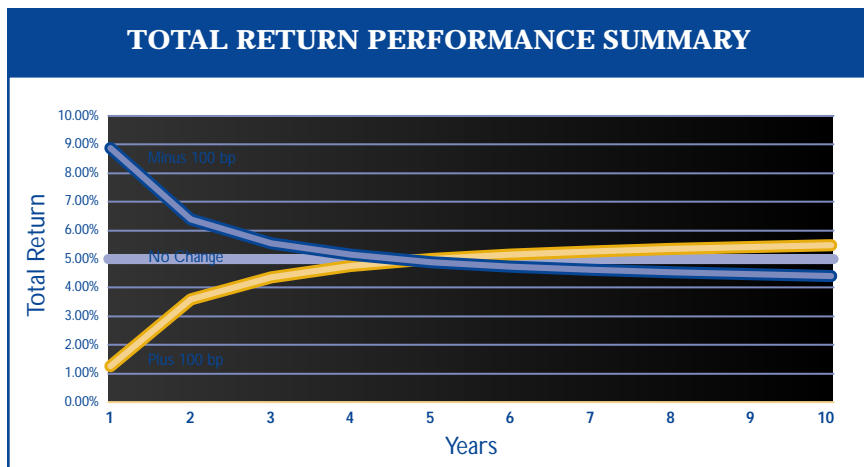
In this scenario, a very steady return is generated each year in the laddered portfolio. The return will be fairly close to the highest yielding bond in the portfolio.

■ RISING INTEREST RATES

(scenario represented by the bottom line)

Bond values initially drop, but only temporarily. Unlike owning an individual bond, the ladder has maturing bonds each year, which gives the portfolio a stream of cash flow to reinvest in new, cheaper, high yielding bonds. This creates a consistent pattern of investment, much as dollar cost averaging does for the equity market. Without maturing bonds, the fund manager would be forced to sell bonds at depressed prices as a way of generating cash for reinvestment. As proceeds from maturing bonds are reinvested in higher-yielding bonds at the far end of the ladder, the portfolio's yield gradually increases.

This built-in reinvestment feature works to offset some of the price depreciation that occurred throughout the ladder when interest rates rose. It also results in a rising income stream. As can be seen, after a few years, the portfolio's total return first equals its original return — then surpasses it.



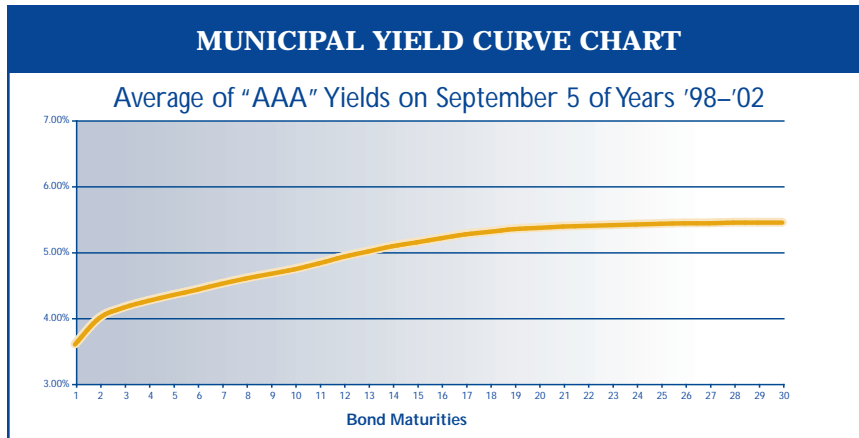
■ WHAT IF INTEREST RATES FALL?

(scenario represented by the top line)

In this scenario, the portfolio's return rises as bond prices are marked up. Ultimately, as those bonds mature and proceeds are reinvested in lower-yielding bonds, the portfolio's long-term return is lower than it would have been under the first two scenarios. The income stream also decreases, but only gradually, because the longer-term higher yielding bonds continue to be held in the portfolio and the income generated continues to be the *average* of all the bonds.

WHY DOES THIS TACTIC WORK?

Let's look at an average municipal bond yield curve (shown in the chart below) for five years from 1998-2002. The horizontal axis represents years to maturity and the vertical axis the expected yield. A normal (positively sloped) yield



Over time, a laddered portfolio of bonds tends to produce a portfolio with the income of the longer maturity bonds but with the price stability of the middle maturity bonds in the ladder.

curve means that the shortest investments generate the lowest yields. As years to maturity increase, yield levels rise. Yields rise substantially every year for the first 10 years of the curve in the municipal market.

As can be seen, the first five to 10 years of the curve is the steepest segment; a steep curve is good for bond investors, because yields will increase rapidly over a short time frame. Beyond 10 years, and more noticeably beyond 15 years, the yield curve becomes virtually flat, and little or no increase in yield results even as maturities extend and more risk is assumed.

As maturing proceeds are reinvested at the end of the ladder, the yield of the portfolio is greater than what would be expected by the average maturity of the bonds, because of the positive slope of the yield curve. As a result, over time, a laddered portfolio of bonds over 15 years tends to produce a portfolio with the income of the longer maturity bonds but with the price stability of the middle maturity bonds in the ladder.

Both price volatility and reinvestment rates are managed as a result of these strategies: laddering the portfolio, focusing on short and intermediate bonds, reinvesting proceeds at the end of the ladder rather than the front, and allowing bonds to naturally age down the yield curve. The practice of laddering the portfolio throughout all market environments provides the most attractive means of controlling both market price and reinvestment risk.

OTHER THINGS YOU SHOULD KNOW

Most bonds have a call provision, which means that the issuer of that bond can repay the bond early. Advisors frequently don't understand the issue of callability and how it can affect their clients' portfolios. A goal of a properly structured laddered bond portfolio should be to buy only non-callable bonds, or bonds that are only callable within a few years of maturity (as opposed to having 10, 15 or 20 years between the call date and the maturity of the bond).

For example, consider a New York City bond with a call provision and assume New York City decides to pay off that bond prior to

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actual maturity. In this case the city will call the bond and issue new bonds at a lower interest rate. Obviously, if the new bonds were issued with a five percent coupon it would be more desirable to retain the old bonds that are paying seven percent, but if the city has a call provision, the higher rate bonds are surrendered.

More than 90 percent of the municipal bonds issued have a 10-year call provision. Therefore, a 20- or 30-year bond paying an above-market yield will probably be called within 10 years. As such, the investor would not be compensated for assuming the greater risk, since the higher yield would have been withheld early. Worse, if interest rates rise and the bond's yield is below market, the issuer is not likely to call the bonds. With a laddering strategy,

which uses only short- or intermediate-range bonds, call risk is reduced. This presents yet another reason to avoid the use of long-term bonds, especially in the municipal market.

It really doesn't matter which way interest rates move; with a laddering strategy, it's possible to get above-market returns.

SUMMARY

The laddering strategy can reduce interest rate risk because it shortens the average maturity of a portfolio, resulting in less price sensitivity to changing interest rates. The strategy also smoothes out reinvestment risk since money is

being reinvested incrementally throughout a full interest rate cycle. The end result is a portfolio with returns close to those of long term bonds but with substantially less risk. As demonstrated, it really doesn't matter which way interest rates move; with a laddering strategy, it's possible to get excellent returns. This gives laddering investors a competitive advantage, knowing any time is a good time to build or buy into a ladder portfolio. It's the smart way to increase a portfolio's return while minimizing both market and reinvestment risk.

AUTHORS



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Steven Bohlin, a graduate of St. John's College in Santa Fe, New Mexico, joined Thornburg Investment Management in 1984 as an associate. He was later promoted to assistant portfolio manager, then vice president and finally managing director. Steve is directly responsible for the Thornburg Limited Term Income

Fund and the Thornburg Limited Term U.S. Government Fund, and has managed each since inception. Both of these portfolios utilize the laddered maturity strategy exclusively.



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George Strickland joined Thornburg Investment Management in 1991 as an assistant portfolio manager and was elected managing director in 1996. He served as co-manager of the company's municipal bond portfolios until December 2000, when he was appointed sole portfolio manager.

The Thornburg municipal bond portfolio consists of two national funds and four single-state funds. George began his financial career with the Calvert Group, and is a graduate of Davidson College (BA, Economics) and the University of Maryland (MBA, Finance). Each of the municipal funds utilizes the laddered maturity strategy exclusively.

Headquartered in Santa Fe, New Mexico, Thornburg Investment Management advises over \$5.0 billion in assets in eight bond funds, three equity funds, and separate portfolios for institutions and individuals. Thornburg has managed laddered maturity bond portfolios for two decades, the discipline having been consistently applied in all market environments, to each of our funds.

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