

The hedging and diversification features of inflation-indexed bonds makes this relatively new investment instrument worth considering for public investors.

Inflation-Indexed Bonds: A Primer for Finance Officers

By Margaret Stumpp and Robert Tipp

Inflation remains one of the greatest obstacles to achieving investment goals, despite its dormancy in recent years. Inflation robs fixed interest payments of purchasing power, thereby leading to a decline in the market value of bond portfolios. Inflation also increases the cost of many future liabilities, such as pension benefit payments. Simply put, inflation simultaneously erodes asset values and increases liabilities.

Until recently, only equities and real estate were considered capable of providing a hedge, albeit a crude one, against inflation. Today, however, the U.S. Treasury is one of several countries that issue inflation-indexed bonds. Inflation-linked bonds issued by the U.S. Treasury are commonly known as TIPS, for "Treasury Inflation Protected Securities." Inflation-protected bonds offer investors a high quality investment tool to hedge against inflation. Their outstanding diversification qualities also make them an ideal addition to many portfolios, even when inflation is not a concern.

A Short History of Inflation-Indexed Bonds

History shows that, when faced with rapidly accelerating inflation, investors at times have rejected conventional sovereign debt. Under such circumstances, governments have been forced to consider alternative forms of financing, including inflation-indexed debt, to regain investor confidence. Israel issued inflation-indexed bonds in response to double-digit inflation in 1955, and the United Kingdom did the same in the mid 1970s. Several Latin American governments have issued inflation-indexed bonds in environments when inflation rose to triple digits.

While other nations have been forced to issue inflation-indexed bonds in response to economic upheavals, the U.S. Treasury surprised investors in 1997 by issuing inflation-indexed bonds at a time of economic stability. (Their use, however, actually began much earlier: inflation-indexed debt was used in this country in colonial times.) Although U.S. investors were slow initially to embrace these securities, interest has steadily increased as investors have become aware of their unique advantages. As of this writing there are 10 U.S. Treasury issues outstanding, ranging in maturity from four to 30 years.

Cynics contend that governments have an incentive to create inflation, because it reduces the cost of repaying outstanding national debt. Because inflation cannot erode the value of inflation-indexed bonds, a government issuing such bonds emphasizes its commitment to fighting inflation, with the mere existence of the bonds a positive signal. Both issuers and investors have the potential to benefit from them: investors benefit from their hedging and risk

management capabilities, while governments can reduce the cost of carrying the public debt provided they successfully restrain inflation.

How Do Inflation-Indexed Bonds Work?

The precise provisions of inflation-indexed bonds vary around the world. In the United States, they are government-issued securities for which the outstanding principal is adjusted in response to changes in the consumer price index. Mechanically, this adjustment is made by modifying the face or par value of the bond to reflect changes in the CPI relative to a base level. Once the par value is adjusted, the corresponding semi-annual interest payments automatically change to compensate for the higher CPI. Consider a hypothetical \$1,000-par inflation-indexed bond with a 3 percent coupon rate. This bond would initially pay \$30 per year in interest. If the CPI were to double, the bond's value would increase to \$2,000 and the interest payment would also double to \$60.

Not surprisingly, the precise formula is slightly more complicated. Economists have long known that yields on conventional bonds are comprised of several components, as characterized in the following simplified expression:

$$\text{Conventional Bond Yield} = \text{Real Yield} + \text{Expected Inflation} + \text{Risk Premium}$$

Putting aside the more theoretically thorny (and presumably smaller) component of the "risk premium," real yield and expected inflation represent the two forms of compensation investors require: a real return on the investment and compensation for the purchasing power lost as a result of inflation.

In contrast to conventional bonds, the yield of inflation-indexed bonds is different, as inflation-indexed bonds include only the "real" component (plus the risk premium):

$$\text{Inflation-Indexed Bond Yield} = \text{Real Yield} + \text{Risk Premium}$$

The yield on inflation-indexed bonds does not include expected inflation because the par value and coupon payments automatically adjust to changes in inflation. Because inflation-indexed bonds automatically compensate the investor for inflation, the only significant variable component of their yield is the "real," post-inflation, return. Though influenced by a host of factors, the real yield is primarily determined by the economy's overall demand and supply for capital, which tends to follow the economy's overall rate of growth. Changes in expected inflation, which heavily influence conventional bond yields, have virtually no impact on the yields of inflation-indexed bonds.

One way to conceptually differentiate between TIPS and nominal Treasuries is to think in terms of what is and is not certain at the time of purchase. With TIPS, the real long-term return is known at the time of purchase, since TIPS provide a fixed real yield supplemented by any change in inflation. The nominal return ultimately realized, though, cannot be known before maturity, since the additional inflation return component experienced over the life of the bond cannot be known in advance.

Conversely, with nominal Treasuries, we know at the time of purchase that the nominal return to be realized over the life of the bond will be approximately equal to the bond's yield to maturity, abstracting from reinvestment risk. The real return, though, will not be known until the bond matures. Only then will we know how much of the nominal return was consumed by inflation.

An additional useful aspect of TIPS is the information they reveal about economic expectations. Since the yield on a nominal bond is equal to both a required real return plus expected inflation, whereas the yield on a TIPS is comprised of just the required real return, the difference between the two represents, in effect, the market's forecast for inflation. Exhibit 1 graphs the real and nominal yield of two Treasuries that mature in 2007, one nominal and one real. The yield difference between the two bonds—the market's expected inflation rate—also is represented.

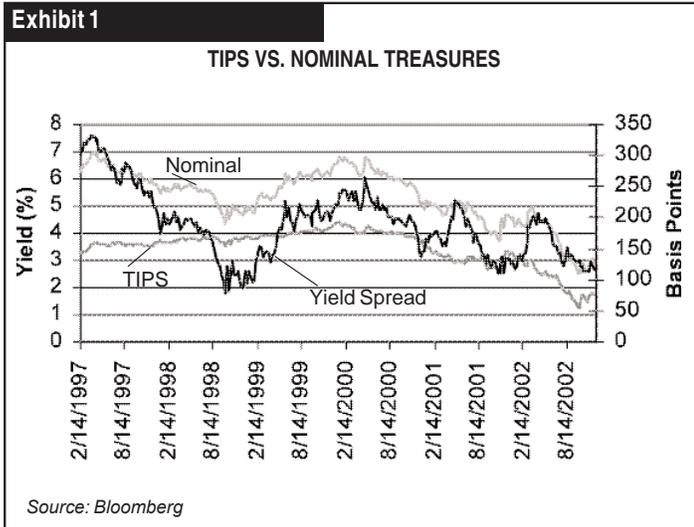
Focusing on the yield, or real yield, of the TIPS, we can see that after remaining fairly placid around 4 percent until early 2000, the yield has declined significantly to just below 2 percent. From an economic perspective, this could be said to reflect the market's implied growth expectation for the economy. This is somewhat intuitive, since until the "new paradigm" cracked in 2000, growth expectations were becoming quite stable—and at a high level at that. Since then, of course, recession, geopolitical uncertainty, and other myriad factors have in fact led to a substantial decline in growth, as well as a corresponding decline in growth expectations.

Looking at the higher yield—that of the nominal Treasury—we can see a comparatively higher level of volatility throughout the period shown. This is because nominal Treasury yield changes must reflect not only changes in real yields, but also changes in expected inflation. The yield spread between the two bonds isolates, albeit roughly, the market's value for expected inflation. This variable has fluctuated over the period from less than 1 percent to more than 3 percent. In this way, TIPS and nominal Treasuries combined provide a unique window into the market's implied expectations for two key economic variables, which before the advent of TIPS in 1997 was unavailable.

Uses of Inflation-Indexed Bonds

Turning our attention to application, inflation-indexed bonds are ideal for hedging liabilities that fluctuate with the rate of inflation. For example, the liabilities of many defined benefit and retirement health plans depend on unknown future wages that usually rise with inflation. When these plans are funded with conventional bonds, increases in inflation reduce the value of those fixed income investments at the precise time the liabilities that the bonds are to fund are increasing. This makes traditional fixed income instruments a poor hedge for real, or inflation-sensitive, liabilities. Conversely, to the extent that the rise in liabilities is the result of an increase in the general rate of inflation, the return on the TIPS would increase commensurately. While by no means a perfect offset, the TIPS over the long haul will vary positively with the inflation changes, whereas the nominal bond's return will not.

Just as TIPS can be useful for institutional investors hedging real



liabilities, they can be similarly useful for individuals. When saving for future expenses such as retirement or college tuition, TIPS assure a real rate of return above and beyond that of inflation. In contrast to traditional fixed income instruments whose real returns vary inversely with inflation, TIPS track the cost of inflation-sensitive liabilities.

In addition to their real liability hedging capabilities, inflation-indexed bonds also provide diversification benefits. As Exhibit 2 shows, these instruments exhibit low correlation with other investments, such as stocks and conventional bonds. This means that TIPS tend to fluctuate independently of these markets. As a result, diversifying a portfolio by adding TIPS tends to reduce overall volatility.

Exhibit 3 compares return-related data for TIPS and other investments, showing that TIPS returns were comparable to nominal Treasuries, returning around 8 percent. In fact, it is quite unusual to have such similar returns for the two. Usually, even in an environment of relatively stable inflation, inflation expectations tend to fluctuate. These changes in inflation expectations then drive fluctuations in nominal Treasuries, routinely creating performance differences of several percentage points between the two Treasury asset classes.

In terms of volatility, however, the higher volatility of nominals (6.5 percent) relative to the TIPS (3.9 percent) is quite common. Since the yield of the TIPS doesn't need to adjust to changes in expected inflation—whereas nominal Treasuries do—they are less volatile. This lower yield volatility then drives lower return volatility for TIPS vis-à-vis nominals over most intermediate and long-term holding periods.

Combining these notions of comparable return, yet lower risk, we show the results of an efficient frontier optimization using stocks, nominal, and real Treasuries based on the past five years of market data (Exhibit 4). Specifically, taking into account the asset classes' returns, volatilities, and correlations, we solve for the most efficient portfolios for various levels of risk (i.e., highest return per unit of risk). Along the frontier, the optimal asset allocation among stocks, nominals, and TIPS is shown at discrete points along the curve, indicating which asset allocation provides the highest return for that particular level of volatility.

Over long periods of time, equity returns tend to be positive, driving such frontiers involving equities to usually slope upward

Exhibit 2

CORRELATION COEFFICIENTS March 1997 to March 2002

	Lehman Brothers Aggregate Bond	Merrill Lynch U.S. Treasury Inflation-linked Bond	S&P 500	U.S. 30-Day T-Bill
LB Aggregate Bond	2.0	0.7	0.0	0.3
TIPS	0.7	1.0	-0.1	0.3
S&P 500	0.0	-0.1	1.0	-0.0
U.S. 30-Day T-Bill	0.3	0.3	-0.0	1.0

Source: Prudential Investments using data from Ibbotson Associates.

Note: TIPS are represented by the Merrill Lynch U.S. Treasury Inflation-linked Securities Index.

Exhibit 3

RETURN STATISTICS November 1997 to October 2002

	Annualized Return	Annualized Standard Deviation	Risk to Return Ratio
TIPS	8.1	3.9	2.1
S&P 500	-0.6	18.6	-0.0
Synthetic Treasury	8.4	6.5	1.3

Source: Bloomberg, Merrill Lynch, Lehman Brothers

Note: Reflects the annualized return and standard deviation of monthly returns. TIPS are represented by the Merrill Lynch U.S. Treasury Inflation-linked Securities Index. The Synthetic Treasury index reflects a weighted average of the Lehman Brothers Intermediate and Long Treasury Indices created to match the duration of the TIPS index.

toward the "northeast." In this case, our recent equity bear market has given the frontier an unusual shape, which goes downward toward the "southeast." Nonetheless, looking at the allocations at each point along the curve, we see that TIPS feature prominently in six of the 10 portfolios, indicating that at least over this historical period, TIPS would have been a useful risk reducer from an asset allocation perspective. Given their low correlation and comparable returns versus nominals, this is likely to be a generally consistent finding. In other words, over the long haul, an allocation to TIPS tends to reduce overall portfolio risk for any given level of return.

Risk

Although inflation-indexed bonds have many desirable attributes, they are not without risk. Although generally less volatile than nominal Treasuries, they do fluctuate as a function of changes in real interest rates: when real rates rise, the price falls. As the standard deviation figures in Exhibit 3 imply, TIPS prices and returns over the past five years have regularly fluctuated a number of percentage points, both up and down. While TIPS are inflation protected, they are not immune to price volatility by any stretch, and therefore should not be confused with money market securities.

Another point worth emphasizing is that the returns of inflation-indexed bonds usually lag those of conventional bonds during periods in which expected or realized inflation declines. So while overall risk may be mitigated for investors hedging inflation-sensitive liabilities, in absolute terms disinflation can lead to substantially lower returns for TIPS than for nominals.

There is one remote feature of TIPS that mitigates the potential

for underperformance in the event of extreme deflation. The U.S. Treasury has stipulated that the redemption value of an inflation-linked bond cannot fall below a \$1,000 par value, regardless of the extent of any deflation that occurs over the life of the bond. In addition to the protection against an extreme bout of deflation, this characteristic also creates an interesting valuation differential. All other factors being equal, higher priced TIPS are riskier than lower priced TIPS, since the former have more room to fall in a deflationary environment.

Other Considerations

It is worth noting that while TIPS may be expected to produce returns similar to nominal Treasuries over the long haul, they nonetheless create less cash flow than their nominal counterparts. Since TIPS receive consideration for inflation largely in the form of principal accretion, they generally have considerably lower coupons than nominal Treasuries. As a result, regardless of whether their total return for a given period (i.e., coupon plus price change plus return from inflation) is higher or lower than nominal Treasuries, they will nonetheless generally create less cash flow per period than a comparable nominal Treasury.

This cash flow creation difference is magnified for taxable investors. Taxable investors are generally taxed not only on the cash income received from TIPS, but also on the bond's principal accretion. This is analogous to the treatment of zero-coupon bonds, where the investor must pay tax on the bond's implied accretion, even though no cash is received prior to sale or maturity.

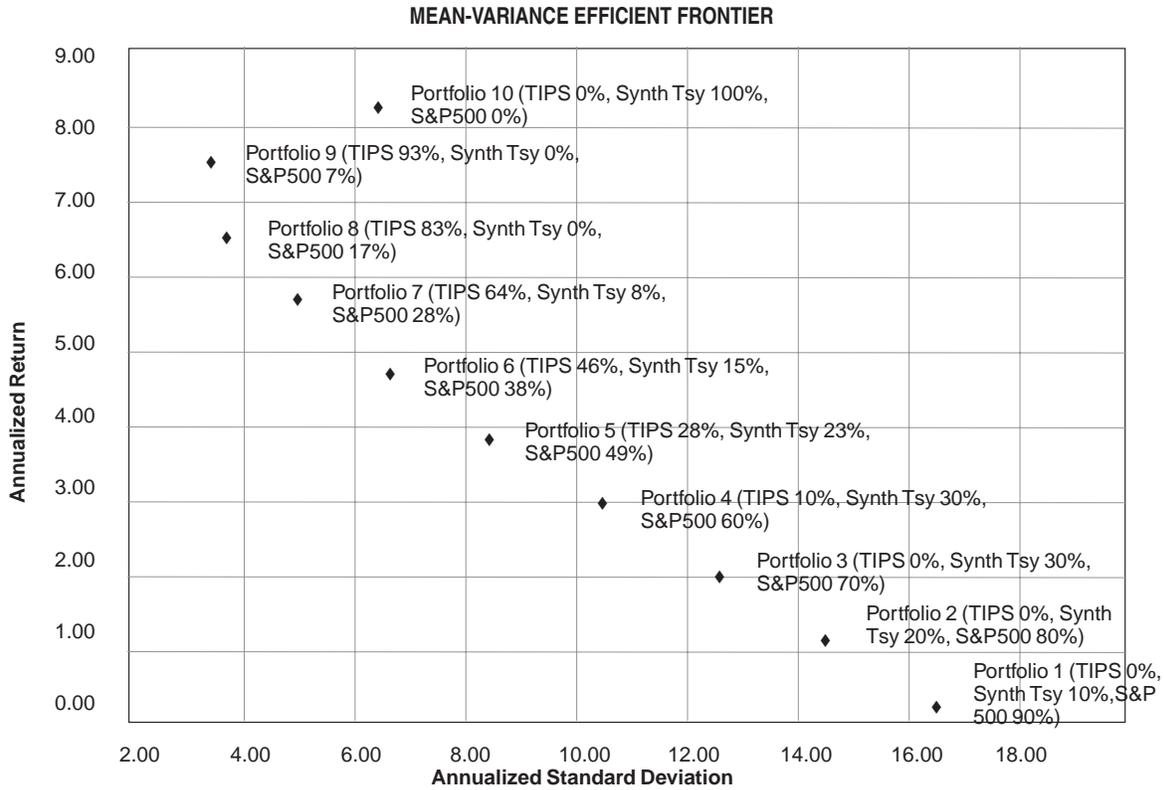
Additional considerations relate to the accounting and operational aspects of TIPS. The fact that the principal balance of TIPS fluctuates to protect the investor from inflation creates complications. When trading TIPS issues, investors must take into account the fact that the bonds have both an original face amount, as well as a current inflation-adjusted face amount. For example, if inflation has risen 5 percent since the issue of a given TIPS bond, the bond's original par amount of \$1,000 would now have a current face amount of \$1,050. Thus, buyers, sellers, accountants, and others must be aware of a given bond's current and original face amounts, and act accordingly. Also, TIPS coupon payments are based on the bond's current face amount, which is recalculated each month. While the income and principal of TIPS is protected from inflation, this protection does not come without some complexities.

The Market

For institutional investors, inflation-indexed bonds can be purchased in periodic Treasury auctions, or on the secondary market. They are traded in institutional volumes, although the market is small and immature compared to that for conventional government debt. As of this writing, trading volume was a respectable \$2 billion per day.

For individuals interested in inflation-protected investing, the U.S. Treasury offers Series I Savings Bonds. While Series I bonds have many similarities to their marketable counterpart, significant differences exist. For example, Series I bonds cannot be traded in the secondary market. Instead, investors can "put" the bonds back to the U.S. Treasury prior to maturity. In this event, the Treasury

Exhibit 4



Source; Bloomberg, Merrill Lynch, and Lehman Brothers.

will pay par for the bonds, subject to some limitations and penalties. So whereas the marketable TIPS can be traded in the secondary market at a price that could be either higher or lower than par, Series I bonds can only be put to the government at par. The effective value of the bond, therefore, is subject to little upside or downside risk compared to its tradable TIPS counterpart.

The Future

TIPS have unique investment characteristics for investors, and serve as a valuable tool for economic forecasters. They have garnered substantial sponsorship over a relatively short period of time, and look poised to increase in popularity. Indeed, public awareness of TIPS securities is increasing, evidenced by a growing number of mutual funds and commingled institutional portfolios specializing in these securities. What's more, the U.S. Treasury appears committed to the market. One strong indication of this fact is that the Treasury did not eliminate TIPS during times of budget surplus, whereas other issuance programs—apparently of lower priority—were cut. ■

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