Grading TIPS—An "I" for "Incomplete"

Investors have long recognized the protection that indexed debt contracts offer against unexpected inflation, eliminating the capricious transfers from lenders to borrowers. The inflation-tax problem is a special concern when the government is the borrower; in this setting, inflation is under the debtor's purview. In addition, some economists argue that there is useful information contained in the yields of non-indexed and indexed government bonds. The difference in the two yields is a market-based signal of expected inflation. Central bankers could use the yield spread as an indicator of monetary policy.[1]

In February 1997, the U.S. Treasury began auctioning Treasury Inflation Protection Securities, or TIPS. U.S. Treasury Secretary Robert Rubin explained that TIPS would index both the semiannual coupon payments and the security's face value to movements in the Consumer Price Index (CPI).

To illustrate how indexation works, Table 1 presents a hypothetical example in which a pair of 2-year securities are auctioned: one is a TIPS and the other is a non-indexed security. Both securities sell for $1,000. Suppose the coupon rate on the TIPS is 4 percent.[2] Assume that buyers have perfect foresight, knowing that the inflation rate will be constant and equal to 6 percent for the next two years. The buyer is indifferent between the two securities, provided the coupon rate on the non-indexed Treasury security is 10.03 percent.[3] Note that the coupon rate for the non-indexed security is a combination of the real return and the expected inflation rate. Every six months, the TIPS' face value is recomputed to take into account price-level increases. In Table 1, the face value of the TIPS is updated to take the price increases into account. Formally, the TIPS' face value is calculated as the product of the initial face value and the ratio of the current CPI to the CPI's value when the security was issued. The semiannual coupon payment is then one-half the coupon rate times the most recent face value. In contrast, neither the semiannual coupon payment nor the face value changes for the non-indexed security. As Table 1 shows, the person holding the non-indexed bond receives a larger semiannual coupon payment than the one holding the TIPS, but at the cost of eroding purchasing power.[4]

Table 1
Example of Indexation

Consider two U.S. Treasury securities, each selling for $1,000 at initial auction on January 1, 1998. Suppose Bond A is a non-indexed security and the other a TIPS. Further, suppose the CPI increases at a 6 percent annual rate known with certainty at the time of the auction. Both bonds mature in two years.

	Bond A		TIPS	
	Face value	Coupon payment	Face value	Coupon payment
July 1, 1998	$1,000	$50.15	$1,029.56	$20.59
Jan. 1, 1999	$1,000	$50.15	$1,060.00	$21.20
July 1, 1999	$1,000	$50.15	$1,091.34	$21.83
Jan. 1, 2000 (at redemption)	$1,000	$50.15	$1,123.60	$22.47

NOTE: To compute the coupon payments for the non-indexed bond, the following formula is used: $c/2 * FV$, where c is the coupon rate on the non-indexed bond and FV denotes its face value.

The purpose of this article is to grade TIPS' performance. In 1997 and 1998, the inflation rate has been relatively low. While low inflation is desirable for many reasons, it renders less meaningful the distinction between indexed and non-indexed government debt. Low inflation notwithstanding, TIPS are judged by two criteria. First, do indexed government bonds make people better off? Recent research indicates the answer is yes, but the gain is small. Second, has yield spread served as a useful indicator? The U.S. Treasury has been auctioning a relatively small quantity of TIPS, and these have maturity dates exceeding five years. Arguably, this term is not short enough for the central bank, which focuses on horizons up to two years. In sum, the TIPS' "grade" is "incomplete."

The Economics of Indexation

In the example above, the bondholder ensures against the erosion of purchasing power over time by bidding up the coupon rate on the non-indexed security. The higher coupon payment is necessary to compensate the bondholder for receiving such payments in cheaper dollars. Indeed, the bondholder is indifferent between holding the non-indexed security and the TIPS because the present values of goods and services are equal.[5] Economist Irving Fisher (1911) recognized this, stating the coupon rate on the non-indexed Treasury security will be equal to

$$(1 + \pi)(1 + r) - 1,$$

where π is the inflation rate and r is the real return.

The hypothetical example, however, is unrealistically simple in one impor-

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tant way: The future price level cannot be known with certainty; it can only be estimated. Thus, an unavoidable risk is inherent to the non-indexed security. Consider the example in Table 1, modified so the average inflation rate is 6 percent over the security's two-year life. Suppose the bondholder is risk neutral, caring only about the average return. With a risk-neutral bondholder, the coupon rate on the non-indexed security will be 10.03 percent, same as in the perfect-foresight scenario. Suppose, however, that the bondholder is risk averse, disliking uncertainty. In this case, a coupon rate greater than 10.03 percent is necessary to entice the risk-averse person to hold the non-indexed security. The risk-averse person must be compensated for expected inflation, plus receive a risk premium to compensate for uncertain price-level movements over the next two years. Hence, the coupon rate will consist of three parts: the real return, the expected inflation rate and the risk premium.

The Gains from TIPS

To see why economists believe that the existence of TIPS will make people better off, it is necessary to take the government's income and expense statement into account. Indeed, the risk premium plays an important role in government finance and, hence, in identifying the gains from introducing indexed government bonds.

In a simple view, the U.S. Treasury's expenses consist of goods and services and debt payments, both paying interest and redeeming securities that have matured. Income is earned from taxes, new bond sales and money creation. The argument hinges on the interest payments with TIPS versus non-indexed government debt. The U.S. Treasury's interest payments, on average, will be lower with a TIPS than with a non-indexed Treasury security.[6] Provided these savings are passed on in the form of lower taxes, the typical person will be better off.

For instance, suppose the U.S. Treasury auctions one TIPS and one non-indexed security, both maturing in one year. Following the hypothetical example, suppose the TIPS offers a 4 percent coupon rate while the non-indexed Treasury security offers a 12 percent coupon rate. Further, suppose that the realized inflation rate is 6 percent, equal to what people expected when the security was sold. Note that a risk-neutral bondholder would accept a coupon rate of 10.03 percent. Hence, the risk premium is 1.97 percent. (The sole difference in government's real interest expenses is due to risk aversion.) Compare real interest expenses with TIPS and with the non-indexed security. Because the coupon rate on the non-indexed bond is greater than the sum of the coupon payment and the actual inflation rate, the government's real interest expenses are lower with the TIPS than with the non-indexed security. Next, suppose that the lower real interest expenses translate to a cut in taxes. For a given level of income, the typical risk-averse citizen will be better off because the tax cut means the person can acquire either more consumer goods or more capital.

The bottom line is that an inflation-indexed security creates a market for inflation insurance. Without the presence of TIPS, for example, inflation insurance works if the person accurately forecasted inflation. With TIPS, forecast accuracy is no longer needed. The additional market means that another good can be traded, improving consumer satisfaction.[7]

A government offering TIPS would have less incentive to use the inflation tax. Note that all non-indexed government paper is subject to the inflation tax. At the end of 1997, the United States had nearly $6 trillion of non-indexed government paper—U.S. Treasury securities plus base money—outstanding. U.S. Treasury securities accounted for more than 90 percent—$5.5 trillion—of that quantity. Suppose the U.S. Treasury replaced all the non-indexed government securities with TIPS. The tax base would shrink to about $500 billion. Correspondingly, the amount of money raised by a given increase in the inflation rate would decline. After taking into account the costs associated with higher inflation, the smaller payoff means there is less incentive to use inflation to raise government revenue.

TIPS Role as Expected Inflation Indicator

Should the U.S. substitute TIPS for all the non-indexed government securities outstanding? Although there is practically no threat of this happening, the answer is no. The coexistence of TIPS and non-indexed Treasury securities creates a potential indicator for central bankers.

The value of the potential indicator stems from the difference in yields on non-indexed securities and TIPS. Recall that the difference between the rates on these two securities is the expected inflation rate and the risk premium. Hetzel (1991) argued that central bankers would like an indicator of the inflation expectations. Subtract the yield on TIPS from the yield on a non-indexed Treasury security, controlling for maturity, to obtain a market-based signal of expected inflation rate. Unfortunately, the yield differential is a noisy signal; there is no definitive way to identify what part of the yield differential is the expected inflation rate and what part is the risk premium. Still, movements in the yield differential represent an improvement compared with what policymakers currently have—survey data that are not subject to any market-performance criterion. Hence, economists recommend that indexed and non-indexed securities coexist.

It is time to look at how TIPS have performed.

TABLE 2
TREASURY NOTES AUCTIONED SINCE JANUARY 1997

	Auction date	Quantity auctioned (par value)
5-year	1-31-97	12,503
	2-28-97	12,518
	3-31-97	12,516
	4-30-97	12,554
	6-02-97	12,029
	6-30-97	11,520
	7-15-97	8,004(I)
	7-31-97	11,526
	9-02-97	11,527
	10-15-97	8,012(I)
	10-31-97	11,021
	12-01-97	11,021
	12-31-97	11,018
	2-28-98	11,043
	3-31-98	11,012
	4-30-98	11,495
	5-31-98	11,216
	6-30-98	11,157
	8-15-98	16,001
10-year	2-06-97	7,003(I)
	2-18-97	12,014
	4-15-97	8,005(I)
	5-15-97	12,008
	8-15-97	12,006
	11-17-97	11,003
	1-15-98	8,009(I)
	2-15-98	13,554
	5-15-98	12,414
30-year	11-17-97	11,331
	2-17-98	11,182
	4-15-98	8,002(I)
	8-15-98	10,003

NOTE: (I) denotes an auction of TIPS.

TIPS: A Brief History

On February 6, 1997, the U.S. Treasury introduced 10-year TIPS notes.[8] In July 1997, the Treasury auctioned 5-year TIPS notes for the first time, followed by an auction of 30-year TIPS bonds in April 1998. Plans have been announced to auction 2-year TIPS notes and inflation-protected savings bonds. Overall, the Treasury has offered TIPS at six separate auctions, including two dates in 1998.

Table 2 displays the dates on which 5-, 10- and 30-year securities were auctioned and the value of securities auctioned on those dates. Since 1997, the Treasury has auctioned 5- or 10-year notes on 28 occasions. TIPS were auctioned on five of those dates: 5-year notes twice and 10-year notes on three occasions. Of the past four auctions at which 30-year bonds were sold, indexed bonds were sold only once.[9]

Not only are the TIPS auctions relatively infrequent, but, on a maturity-by-maturity basis, the Treasury sells fewer TIPS at auction than it does non-indexed securities. Cumulatively, in 1997 the Treasury auctioned slightly more than $16 billion worth of 5-year indexed notes, slightly more than $15 billion worth of 10-year indexed notes and $8 billion worth of 30-year indexed bonds. Over the same period, the Treasury auctioned more than $201 billion worth of 5-year non-indexed notes, more than $63 billion worth of 10-year non-indexed notes and more than $22 billion worth of 30-year non-indexed Treasury bonds. The size of a TIPS auction was roughly 75 percent the size of auctions for non-indexed Treasury securities. On a cumulative basis, TIPS accounted for less than 14 percent of the total amount of 5-, 10- and 30-year securities auctioned during the past 18 months.

Based on Table 2, three facts stand out. First, TIPS auctions are held less frequently than auctions at which non-indexed securities are sold. Second, the quantity of TIPS auctioned is smaller than the quantity of non-indexed government securities being auctioned. Third, and perhaps most telling, TIPS were never auctioned on the same day as non-indexed securities.

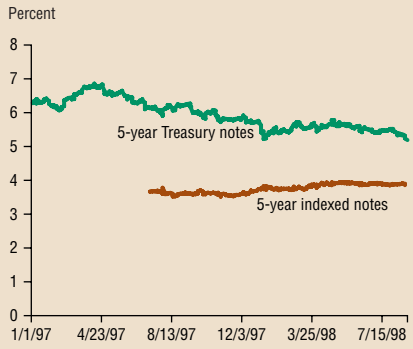
Together, these facts suggest something about the economic value of indexation. The evidence intimates that the U.S. Treasury was attempting to protect TIPS in their infancy. This claim begs the following question: Why would the TIPS market need protection?

One answer is that the gains from TIPS are quantitatively small, as Viard (1993) found. If the gains are small, a typical bondholder is virtually indifferent between the two securities. Such an attitude could inhibit the development of a market for TIPS, potentially leading to undersubscribed auctions for TIPS. Such indifference is observationally equivalent to the notion that the Treasury was protecting TIPS. Small gains may also account for why only five countries—Australia, Canada, New Zealand, Great Britain and the United States—issue indexed bonds.

Assessing the Information Value of TIPS

The other criterion for grading TIPS is the value of the information present in the yield spread between indexed and non-indexed securities. The yields for 5-year and 10-year U.S. Treasury securities are plotted in Charts 1 and 2, re-

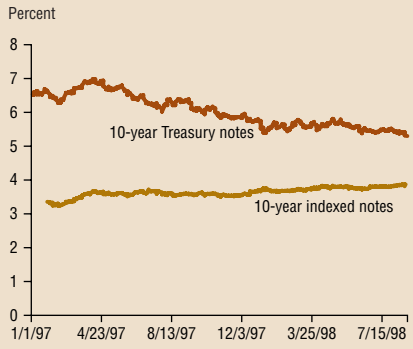
CHART 1
5-YEAR TREASURY NOTES AND 5-YEAR INFLATION-INDEXED TREASURY NOTES



spectively.[10] In each chart, the yield is plotted for both a non-indexed security and a TIPS. Note that the spread between the two alternative securities has narrowed slightly since the inception of TIPS. More precisely, the spread on 10-year notes declined slightly more than 100 basis points, while the spread on 5-year notes fell about 70 basis points.

Before it can be claimed that expected inflation has fallen about 0.75 percentage point, two problems emerge. One is the basic identification issue. There is no way of knowing how much of the decline in the yield spread is due to falling expected inflation rate and how much to falling risk premium. A much more accurate, but far weaker, statement is that 1998 data are consistent with some decline in the expected inflation rate compared with early 1997.

CHART 2
10-YEAR TREASURY NOTES AND 10-YEAR INFLATION-INDEXED TREASURY NOTES



The second problem is that the U.S. Treasury auctioned 5- and 10-year notes. Even if the identification problem were eliminated, the data relate to the average expected inflation rate over the next five years, which may not be that useful for central bankers. If the planning horizon is two years, movement in the average expected inflation rate over the next five years is not the most useful indicator to the central banker. Until TIPS with shorter maturities are sold, the central banker is left waiting until the time left on outstanding TIPS matches with the central bankers' planning horizon.

Concluding Remarks

So what grade does TIPS deserve? An "incomplete" seems appropriate at this stage. The early evidence supports the claim that people do benefit, albeit not greatly, from indexed bonds. This is especially true in a low-inflation environment, like the one the United States has enjoyed over the past couple of years. Unfortunately, the expected inflation rate that could possibly be inferred from TIPS and non-indexed securities does not provide the information most useful to the Federal Reserve. It is noteworthy that the "Monetary Policy Report to the Congress" (Federal Reserve Board, 1998) did not refer to the yield differential between TIPS and non-indexed Treasury securities when it discussed the inflation outlook for 1998 and 1999. When shorter maturities, such as the 2-year TIPS, are offered, it will be easier to judge whether Federal Reserve officials find the market-based signal of expected inflation useful.

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Notes

[1] This argument is articulated in a *Wall Street Journal* op-ed article by Robert Hetzel (1991).

[2] The coupon rate is computed as a year's worth of interest payments divided by the bond's face value. At auctions, bids are ranked from the lowest coupon rate to the highest. Those offering the lowest coupon rates are awarded the securities. The Treasury accepts bids so that the security's price ranges from 99.875 percent to 100.125 percent of its face value.

[3] Here, indifference requires that the inflation-adjusted present values of the two streams of dollar payments are identical. The arbitrage condition is formally represented as

$$FV\left[c^{T}\left(\sum_{i=1}^{4} d^{i/2}\right)+d^{2}\right]=FV\left\{c\left[\sum_{i=1}^{4}\left(\frac{d}{1+\pi}\right)^{i/2}\right]+\left[\frac{d}{1+\pi}\right]^{2}\right\}$$

where FV denotes the face value of the security, c^T is the coupon rate on the TIPS, d is the discount rate applied against future payments, c is the coupon rate on the non-indexed security and π is the inflation rate. The left side of the expression is the real present value of payments from the TIPS, and the right side is the real present value of payments from the non-indexed bond. Note that payments from the TIPS security are indexed by $(1+\pi)$. Hence, deflating by $(1+\pi)$ and indexing by $(1+\pi)$ result in this term canceling out on the left side of the arbitrage condition.

[4] In practice, the CPI value used is called the reference value. The Bureau of Labor Statistics does not publish CPI values each day. To get around this, the Treasury chooses a reference value that lags the issue date by 2.5 months. The Treasury computes the reference value as a weighted sum, where the weight corresponds to the time of the month when the security is issued. For example, a note issued on January 15 will have reference date CPI equal to 16/31 times April's CPI value plus 15/31 times May's CPI. The first coupon payment is due July 15. The reference value for that date is 16/31 times October's CPI plus 15/31 times November's CPI. Then, $1+\pi$ in footnote 3 is calculated as the ratio of July 15's reference value to January 15's reference value.

[5] With coupon payments and with inflation that varies over time, it is more difficult to ensure against inflation.

[6] Note here that the par value of government securities is held fixed.

[7] This article ignores the risk associated with holding periods that differ from the securities' time to maturity. See Shen (1998) for a discussion of market risk as it applies to the TIPS and non-indexed Treasury securities.

[8] This is not to say that the February 1997 auction was the first time that indexed bonds were auctioned in the United States. See Viard (1993) for a complete history of indexed bonds in the United States.

[9] Some of the TIPS auctions were reopened. The U.S. Treasury often reopens some issues when bids are insufficient to sell all the notes or bonds.

[10] There is not enough data on the yields for the 30-year securities to merit a separate figure.

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