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Abstract: In 1997, the U.S. Treasury introduced Inflation Protection (or "Indexed ") Securities, known as TIPS. Several authors have since described these securities as "tax disadvantaged" relative to conventional securities, leading to substantial debate regarding their appropriateness outside of tax-deferred accounts. In this paper, the authors develop a framework that allows them to demonstrate that the tax treatment of TIPS is trivially different from that of conventional Treasury securities. Utilizing an after-tax valuation approach, they further show that under relatively conservative projections for inflation, TIPS generally have after-tax yields comparable to, if not exceeding, conventional fixed-rate Treasury securities. Moreover, the authors find evidence that since their introduction, TIPS have outperformed matched maturity conventional Treasury securities in terms of after-tax returns.

JEL classification: G0, G1, H2, H6

Key words: Treasury securities, inflation protection, income taxes, interest rates

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Are Treasury Inflation Protected Securities Really Tax Disadvantaged?

In January 1997 the U.S. Treasury followed the lead of several other countries and began auctioning inflation-indexed debt in the form of Treasury Inflation Protection (or "Indexed") Securities, commonly referred to as TIPS. Unlike the Treasury's conventional debt, these indexed debt securities have a fixed *real* coupon rate. Because the principal is adjusted (semi-annually) by the amount of inflation over the period, *nominal* coupon payments, equal to the product of the real coupon rate and the inflation-adjusted principal, grow with inflation. By design, these securities provide a hedge against inflation, and the real yield (equal to the real coupon rate) is essentially constant and established at issuance.

The finance profession has alternated between totally ignoring the tax treatment of these new instruments on the one hand to arguing that the tax treatment of these instruments is so unique and disadvantageous to make these unworthy of taxable investors attention. A number of studies demonstrate that inflation-indexed debt can be a beneficial component of most portfolios (e.g., Bodie [1990], Campbell and Viceira [2002], and Campbell et al. [2003]). Without considering the tax treatment of these instruments these studies imply that TIPS do not have any unique tax considerations. Similarly, Jarrow and Yildirim [2003] use an arbitrage-free term structure model to fit the time series of real and nominal zero-coupon bond prices, without a tax factor. This again suggests that these authors see little in the tax treatment of TIPS to make them different from nominal Treasury securities.

Others, however, emphasize the unique tax treatment placed upon TIPS as critical in interpreting these instruments.[1] Essentially, taxes must be paid annually on accrued increase in principal caused by inflation, even when this is an *unrealized* gain. Therefore, the owner is required to pay taxes on "phantom income" that is not actually received until maturity or upon sale of the bond. This tax treatment has led several leading authorities in the field to characterize TIPS as "tax disadvantaged." See, for example, Fabozzi [2000], Van Horne [2001], and Sundaresan [2002] who all argue that TIPS have serious tax disadvantages.[2]

The conclusion that TIPS are seriously tax disadvantaged has spilled into the popular press as well. For example, in a recent issue of *Money* magazine, Rekenthaler [2003, p.44] writes "[The tax treatment] is annoying . . . therefore, TIPS are best held in a tax-deferred account." Clements [2003], in the Wall Street Journal, quotes an investment advisor, Nelson Lam, as stating, "These things [TIPS] are horribly tax inefficient."

In this paper, we evaluate the notion that TIPS are tax disadvantaged. We argue that the tax treatment of TIPS needs to be compared with the tax treatment of non-inflation indexed securities, rather than in isolation. Our analysis suggests that, under fairly common assumptions, these instruments are not tax disadvantaged relative to conventional Treasury debt. We argue that the annual taxation of accretion of principal is necessary to make the overall taxation of TIPS comparable to conventional debt. We then examine the empirical performance of TIPS from a couple of different perspectives. Consistent with our contention, we find empirical evidence that the *after-tax* yields on TIPS and conventional bonds are close to one another when inflation expectations are taken from the two markets. We also examine the holding period returns for TIPS and compare these to the holding period returns on conventional Treasury

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[1] Parker and Vines [2003] provide details on the tax treatment of TIPS, as specified by the Internal Revenue Service.

securities, both on an after-tax basis. Interestingly, we find that TIPS outperform their conventional counterparts, even assuming investors are in high marginal tax brackets. An important implication of the study is that, contrary to views widely expressed in the academic and practitioner communities, the appeal of TIPS should not be viewed as limited to tax-exempt investors.

TAX COMPARISONS FOR ONE-PERIOD SECURITIES SELLING AT PAR

It is relatively straightforward to compare the ex post performance of TIPS with conventional Treasury debt on a before-tax basis. The Fisher hypothesis suggests that the nominal yield on conventional debt will compensate for anticipated inflation, thereby providing an acceptable real yield. Assuming that the expected real yield on TIPS equals the expected real yield on (otherwise-similar) conventional debt, the difference between the two quoted yields will reflect expected inflation. If the debt is purchased at par, expected inflation will also be reflected by the difference in the coupon rates. In fact, this was one of the arguments put forward as to why these instruments will be beneficial; they will provide indirect evidence on expected inflation. Now, when realized inflation exceeds (is below) expected inflation, the realized real return on fixed-rate debt will be below (above) the expected real yield. Since the real yield on TIPS is established at issuance, unanticipated inflation causes TIPS to outperform their nominal counterparts on a real before-tax basis. Just the opposite occurs when there is unanticipated disinflation or deflation.

To simplify the after-tax comparison of the ex post performance of TIPS and conventional securities, we begin by assuming that a one-period bond is purchased at par. The real after-tax return on fixed-rate (FR) debt can then be represented as:

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[2] Kopeke and Kimball [1999] suggest TIPS might be attractive for high-income individuals, contrary to these authors.

$$r_{FR} = C_{FR}\,(1 - T) - \pi, \tag{1}$$

where

r_{FR} is the real after-tax return on fixed-rate debt,

C_{FR} is the nominal coupon rate,

T is the ordinary income tax rate, and

π is the realized inflation rate.

In a similar manner, the real after-tax return on one-period TIPS can be represented as:

$$r_{TIPS} = C_{N,\,TIPS}\,(1 - T) - (\pi)(T), \tag{2}$$

where

r_{TIPS} is the real after-tax return on TIPS,

$C_{N,\,TIPS}$ is the *nominal* coupon rate = $(C_0)(1 + \pi)$, and C_0 is the constant real coupon rate

T the ordinary income tax rate,

π is the realized inflation rate, and

$(\pi)(T)$ is the tax per \$1 par value due to inflation.

An important implication of this simple comparison is that there is no difference in the tax treatment of the two bonds under zero inflation, if the two instruments have the same coupon rates. This suggests that at least in this environment TIPS are most tax-disadvantaged.

What about the case of positive expected inflation? If we again invoke the Fisher relationship, and assume that inflation is perfectly forecastable, then the difference in the conventional coupon rate and the TIPS coupon rate perfectly reflects future inflation (ignoring the cross-product term):

$$C_{FR} - C_0 = \pi. \tag{3}$$

Under this scenario, equations (1) and (2) can be used to show that $r_{FR} = r_{TIPS}$. That is, again, the real after-tax yields on the two securities should be identical. Thus, the difference in tax treatment does not (in this simple one-period example) lead to a perverse or altered relationship between the two bonds' yields when inflation is correctly reflected by the difference in the coupon rates. This analysis suggests that the difference in before-tax yields reflects the inflation expectations *and the taxation of the inflation component* when the real after-tax yields are equal. This analysis further illustrates that the tax treatment of TIPS is not different from that of conventional Treasury securities, even in the face of inflation.

An alternative view of the relationship between the tax treatments and the after-tax real yields across the two bonds is provided by rewriting equation (1) to explicitly allow for expectations in the Fisher hypothesis (again ignoring the cross-product term). For fixed rate bonds, we have:

$$r_{FR} = [E(C_{R,FR}) + E(\pi)]\,(1 - T) - \pi, \qquad (4)$$

where E( ) is the expectation operator, $C_{R,FR}$ is the real coupon rate on the fixed-rate bond, and all other variables are as previously defined. By setting the after-tax real return on TIPS equal to the after-tax real return on fixed-rate debt (i.e., by setting equation (2) equal to equation (4)), the following relationship results:

$$C_{N,\,TIPS} + \pi = E(C_{R,FR}) + E(\pi). \qquad (5)$$

Equation (5) again demonstrates that the different tax treatment across the two bonds does not influence the equilibration of their real, after-tax yields. Instead, the after-tax real yields will be equal when the sum of the TIPS coupon and actual inflation equals the sum of the expected real fixed-rate coupon and expected inflation. Thus, a taxable investment account would receive no less benefit from holding TIPS as opposed to a fixed-rate debt.

From equations (1) and (2), we also know that an unanticipated increase in inflation will lead to a reduction in the real after-tax return on TIPS by $(\pi)(T)$, which is less than the reduction in the real after-tax return on fixed-rate debt, equal to π. Thus, like the before-tax scenario, TIPS will outperform fixed-rate debt on a real after-tax basis if actual inflation is higher than expected inflation.

Having established under the Fisherian framework that the tax treatment of TIPS does not cause them to be "disadvantaged" relative to conventional securities for a taxable investor, we next examine the logic that has been used to establish the view that TIPS are tax disadvantaged. A good point of departure is Clements' [2003] simple analysis. He establishes the claimed tax difficulties with an example: "Suppose you are in the 35% income tax bracket and you buy 10-year inflation bonds with a 2.3% real yield. If inflation runs at 4.7% over the next decade, you will clock a nominal gain of 7%. But after you surrender 35% of that gain to the taxman, you will be left with less than 4.6%, below the 4.7% inflation rate."

At one level Clements is exactly correct in his calculations. The TIPS would indeed have a negative after-tax real return in this setting; however, Clements does not consider any other alternatives. Suppose the above investor chooses the conventional security, as opposed to the TIPS. If we assume that the expectations of inflation are realistic, then the nominal yield on the conventional security should be 7% under our Fisherian assumptions (2.3% real return plus 4.7% compensation for expected inflation, ignoring any cross-product term). Our hypothetical conventional security investor would be required to surrender 35% of the annual nominal yield for tax purposes, so he/she would again be left with the same after-tax yield of 4.55%. In other words, as just shown above, the TIPS would be no more tax disadvantaged in this situation than the nominal Treasury securities, as the conventional level would also have negative real after tax returns.

It is indeed the case that as inflation rises, along with expectations for future inflation, our tax code makes debt holders worse off, if nominal rates rise one for one with expected inflation. Indeed, Darby [1975] and Feldstein's [1976] main point was that investors understand the taxation on inflation and therefore cause nominal rates to rise faster (by 1/(1-T)) than increases in expected inflation. But our central point is that as long as we can assume that nominal yields reflect future expected inflation one for one, as the Fisherian framework requires, TIPS are no more disadvantaged than conventional securities. If TIPS' unrealized capital gains were not taxed then they would, in a tax sense, entirely dominate conventional Treasury securities, since the latter would still have nominal capital gains taxed. The IRS ruling on TIPS assures that TIPS and conventional Treasury securities are essentially taxed similarly.

NEGATIVE NET CASH FLOWS WITH TIPS

In this section we address the possible "disadvantage" that occurs when the annual tax obligation on phantom income from the inflation-adjusted principal on TIPS is greater than the after-tax cash flow from the coupons received in that year. Some have suggested that the possibility of a negative net cash flow in any particular year represents an important piece of the tax disadvantage argument (e.g., see Sundaresan [2002]). We can easily model the after-tax coupon payment on TIPS, and the tax obligation on the increase in inflation-adjusted principal on TIPS, as

$$C_{AT} = C(1 - T), \tag{6}$$

$$TOB = (\pi)(T), \tag{7}$$

where

C_{AT} is the after-tax *nominal* coupon payment,

C is the before-tax *nominal* coupon payment,

T is the ordinary income tax rate,

π is the inflation rate, and

TOB is the tax obligation per dollar increase in principal due to inflation.

It is clear from equations (6) and (7) that the net cash flow, $C_{A\text{-}T}$ – TOB, is smaller: 1) the higher the inflation rate, 2) the higher the tax rate, or 3) the lower the coupon rate. Tables 1 and 2 present the net cash flow at varying levels of the tax rate (20%, 30%, and 40%), and varying levels of nominal coupon rates (1% and 3%), for 3% and 5% inflation, respectively. The entries show that small negative cash flows occur at the low nominal coupon rate of 1% for tax rates of 30% and 40%. However, at the more reasonable coupon rate of 3%, no tax rates lead to negative cash flows when inflation is 3%, and only small negative flows occur at T = 40% when inflation is 5%. These data suggest that the likelihood of negative net cash flows, at reasonable parameters for today's environment, is relatively low. Furthermore, for those parameter values with a negative net cash flow, the amounts are relatively small.

When considering the role of negative net cash flows in the tax disadvantage argument, it is important to recognize that nominal coupon rates on fixed-rate debt are directly related to expected inflation (i.e., issuers typically issue debt near par value) if, as we presume, the Fisher effect holds. Therefore, since nominal coupons on fixed-rate debt are taxed, higher inflation leads to an increase in "inflation taxation." Furthermore, fixed-rate debt holders face the potential of a capital loss if an increase in inflation is unanticipated. Both of these factors will reduce the after-tax return for fixed-rate debt holders. These can be taken as additional factors that abate any perceived tax disadvantage.

TAX COMPARISONS FOR MULTI-PERIOD SECURITIES

In this section we show how one can directly compare TIPS and conventional Treasury securities on an after-tax basis in a multi-period setting. We use an after-tax nominal yield comparison because these are easily calculated and directly observable for conventional securities. Van Horne [2001] carefully details the manner in which taxes affect yields of conventional fixed rate instruments. To find after-tax nominal yields, Van Horne solves for the discount rate that will equate today's security price with the present value of all nominal, *after-tax* cash flows. For a conventional fixed-rate bond that is held to maturity, Van Horne provides the following:

$$P_{FR} = \sum_{t=1}^{N} \frac{C(1-T)}{(1+R_{FR})^t} + \frac{(100-P_0)(1-G)}{(1+R_{FR})^N} + \frac{P_{FR}}{(1+R_{FR})^N}, \tag{8}$$

where

C is the annual (nominal) coupon payment,

T is the ordinary income tax rate,

G is the capital gains tax rate,

N is the number of years to maturity,

P_{FR} is today’s price ($1 par value),

P_0 is the original purchase price ($1 par value), and

R_{FR} is the nominal, after-tax yield that equates the above relationship.

Equation (8) illustrates the calculation of after-tax nominal yields for conventional securities. The right-hand side of the equation can be interpreted as the present value of all after-tax nominal cash flows discounted by the after-tax nominal yield that provides the bond's price. The first term represents the present value of all after-tax coupon payments. The second term represents the present value of the after-tax capital gain (loss). The last term represents the present value of the purchase price, which bears no tax obligation.

Now consider Treasury Inflation Protected Securities, TIPS. Define $p_{A,t}$ to be the inflation-adjusted principal on a TIPS at time t. This can be written as $p_{A,t} = p_{A,t-1}\,(1 + \pi_t)$, where π_t = the inflation rate (i.e., $\pi_t = CPI_t/CPI_{t-1} - 1$),[3] and $p_{A,0}$ is par at issuance. As long as one knows the CPI index for different points in time, the new accrued principal can be found. For the sake of simplifying the discussion at this point, we ignore the complication that going forward one does not know with certainty the future course of the CPI, and instead assume that future inflation equals anticipated inflation. This is highly unrealistic, but investors must ask themselves what future inflation will bring when they are estimating nominal yields on TIPS.

Following Van Horne's [2001] development, we can solve for the nominal, after-tax yield for TIPS by equating today's TIPS price, P_{TIPS}, with the present value of all nominal after-tax cash flows:

$$P_{TIPS} = \sum_{t=1}^{N} \frac{C_t(1-T)}{(1+R_{TIPS})^t} - \sum_{t=1}^{N} \frac{(p_{A,t} - p_{A,t-1})(T)}{(1+R_{TIPS})^t} + \frac{p_{A,N}}{(1+R_{TIPS})^N} \tag{9}$$

where

C_t is the time t *nominal* coupon payment; $C_t = (C_0)p_{A,t}$; C_0 is the constant real coupon rate,

T is the ordinary income tax rate,

N is the number of years to maturity,

P_{TIPS} is today's price,

$p_{A,t}$ is the inflation-adjusted principal on a TIPS at time t, $p_{A,t} = p_{A,t-1}(1 + \pi_t)$ as defined above, and

R_{TIPS} is the nominal, after-tax yield that equates the above relationship.

The right-hand side of equation (9) can be interpreted as the present value of all after-tax cash flows discounted by the after-tax nominal yield that provides the bond's price, assuming some pattern of future inflation. The first term on the right-hand-side is simply the present value of the after-tax nominal coupon payments. The second term represents tax obligations on phantom income due to the inflation adjustment on the principal, and therefore carries a negative sign.[4] Finally, the third term is the present value of the inflation-adjusted principal at maturity. Since the increase in the principal is taxed annually, there is no additional tax obligation associated with this last payment.

As discussed above, it is the taxation of the phantom income that leads some to suggest that TIPS are tax disadvantaged. Equations (8) and (9), however, allow us to make two important points about this contention. First, the coupon payment for the conventional Treasury security, C, in the first term of equation (8), is a nominal cash flow that investors expect will compensate them for inflation via the Fisher hypothesis (and potentially for the taxation of inflation under the Darby and Feldstein framework). Therefore, if participants anticipate higher future inflation, C contains a greater inflation "mark-up," which also results in higher nominal taxes. Since taxes on C must be paid annually, the tax treatment of fixed-rate debt securities also requires that taxes be paid annually on an "inflation component." Since the coupon rate on

[3] Here we ignore a slight two-month lag in the inflation adjustment calculation that TIPS require.
[4] To the extent that there is no capital gains tax rate applied to increases in inflation-adjusted principal for TIPS, equation (9) might suggest a slight tax disadvantage in comparison to the after-tax yield of fixed-rate Treasury securities as described in equation (8). We provide empirical evidence below that this difference is minimal.

conventional, fixed-rate debt should be greater than the coupon rate on TIPS (by approximately $E(\pi)$ under the Fisher hypothesis, and by approximately $E(\pi)/(1-T)$ under the Darby and Feldstein framework), the taxes paid every year on coupons over the life of the securities are, at a minimum, greater by $E(\pi)(T)$ on fixed-rate debt than the annual taxes on TIPS. This again suggests no tax disadvantage on TIPS. The inference in the single period analysis generalizes to the multi-period setting.

The second important point to consider for TIPS is that the annual taxation of phantom cash flows is offset by the inflation-induced gain in principal that is *not* taxed at maturity. Thus, there is no new net increase in tax obligations due to inflation for TIPS versus fixed-rate debt. It is simply that the tax obligation of the inflation "mark-up" comes annually, as opposed to at maturity, as bondholders would naturally prefer. This treatment (as shown above), however, is not different from the annual taxation of the mark-up in the coupon for fixed-rate debt.

EMPIRICAL RESULTS: AFTER-TAX YIELD COMPARISONS

The inferences in the multi-period setting are predicated on the well-known Fisher hypothesis, in which nominal rates will move one-for-one with changes in expected inflation. However, the literature contains substantial controversy about the hypothesis, stemming largely from empirical investigations. Indeed, the theoretical frameworks of Mundell and Tobin, and Darby and Feldstein-Feldstein, also find support. Therefore, we believe investigating whether market data for Treasury securities supports the notions laid out earlier provides an important contribution.

In our effort to more explicitly quantify the tax difference between TIPS and conventional securities, we use equations (8) and (9) to calculate after-tax nominal yields for a matched sample of conventional Treasury securities and TIPS, respectively. We began with all TIPS in existence at the end of 2002. At this time, ten TIPS issues existed, with different maturities. For each TIPS security, we then selected a maturity-date-matched/issuance-date-matched conventional Treasury security. Prices, coupon rates, and accrued principal on November 26, 2002 were taken from the Wall Street Journal (WSJ). Table 3 provides information on each of these securities (ordered by issuance date).

Consider the matched pair at the bottom of Table 3 maturing in July and August of 2012. Both securities had been recently issued and were selling reasonably close to par. The July 2012 TIPS has a stated coupon rate of 3.00% and the WSJ listed the yield to maturity as 2.53% with accrued principal 1008 ($1000 face). The August 2012 conventional Treasury note had a coupon rate of 4.375% and the WSJ listed the yield to maturity at 4.18%.

Of course, TIPS compensate the investor for future inflation as it occurs. Future inflation is uncertain, but as indicated above, to calculate an after-tax nominal yield for TIPS using equation (9), we must make an assumption about future inflation. We use the fixed-income markets to guide us in estimating future inflation. As developed above, the difference in the coupon rates (conventional coupon rate less TIPS coupon rate) should as a first approximation reflect the market's expectation of future inflation. Thus, for the July/August 2012 matched pair, annual inflation was assumed to be 1.375% for the next ten years. We also assumed that all nominal income was taxed at the ordinary income tax rate of 34 percent, and capital gains are taxed at 20 percent.[5] With these assumptions, and the security prices from the WSJ, we have all of the necessary elements to solve for R_{FR} in equation (8) and R_{TIPS} in equation (9). The use of

[5] The overall implications of the findings remained the same with several alternative tax rates.

expected inflation, as we measure it, allows us to characterize the after-tax nominal yields as *expected* after-tax yields.[6]

Table 4 provides the details of the after-tax nominal yields for all TIPS securities in existence at the end of 2002 (ordered by maturity date) along with the after-tax nominal yields for matched conventional Treasury securities. We see that the after-tax nominal yield on the conventional Treasury security is higher than the after-tax nominal yield on the matched TIPS in six out of the ten pairs, with an average yield spread of 0.33%. In the four remaining matched pairs, however, the TIPS after-tax yield is higher, on average, by 0.515%. This average is heavily influenced by the large yield spread for the January 2007/October 2006-maturity pair, and without this pair the average spread is 0.23%.

As a reminder, the calculations incorporate the TIPS "tax disadvantage," as the TIPS investor is required to pay taxes on phantom income. Yet, as this Table illustrates, there is not a consistent, sizable difference in the after-tax nominal yields on TIPS versus their fixed-rate counterparts. These results suggest that either the tax disadvantage is not greatly consequential, or TIPS are being priced in the market so as to reduce the importance of the tax treatment in such a way that anticipated after-tax yields are not substantially different across the two security classes. The evidence in the Table also suggests the possibility of some maturity/tax clientele effects. TIPS have the higher after-tax nominal yields for maturities of seven years or less, and conventional instruments have higher expected after-tax nominal yields for longer maturities. The fact that the after-tax yield difference (FR less TIPS) widens with maturity is consistent with fixed-rate investors demanding higher nominal yields to compensate for a greater inflation *risk premium*, which TIPS investors need not be concerned about.

[6] Hereafter, we refer to *expected yields* simply as yields.

We present in Table 5 the inflation rate that equates the after-tax nominal yield on each TIPS with the after-tax nominal yield on the matched fixed-rate security (presented in Table 4). All calculations again use equations (8) or (9) and again assume a marginal ordinary income tax rate of 34% and a capital gains tax rate of 20%. Inflation rates above (below) this critical rate will result in the TIPS having a higher (lower) after-tax nominal yield than its fixed-rate counterpart. Therefore, it is informative to view the variation (or lack thereof) in the rates across the maturity spectrum.

We see from the evidence in Table 5 that there is relatively little variation in the critical inflation rates across the maturities. There is, however, a (near) monotonic increase in the critical rates with the lengthening of maturity. This is consistent with the evidence in Table 4 which shows an increasing yield spread (conventional fixed rate less TIPS) as maturity lengthens, which we link to the relationship between maturity and inflation risk premiums.

To return to our main point, the evidence in Table 5 indicates that the only way investors could currently view TIPS as being seriously tax disadvantaged would be if they were anticipating inflation rates to consistently remain below 2.5%. For those that anticipate inflation to be at or above this level in the foreseeable future, TIPS can be expected to provide after-tax returns as high as those on comparable conventional Treasury securities.

EMPIRICAL RESULTS: EX-POST HOLDING PERIOD RETURNS

Since these prior evaluations rely on inflation projections, explicitly or implicitly, to compare after-tax yields on TIPS versus conventional Treasury securities, we also calculated ex post holding period returns from issuance dates until early 2003 for a sub-sample of our matched pairs of securities. This backward looking analysis does not require any assumptions about future inflation. However, if TIPS are indeed tax disadvantaged their ex-post holding period returns should be less than that of conventional Treasury securities. Table 6 provides the annual after-tax holding period returns for the four maturity-date-matched pairs that mature in January or February. These four pairs were selected because of the close proximity of their respective maturity dates (i.e., only one month apart). The calculations were made using price data as of early 2003, a tax rate equal to 34%, and the actual reference inflation rates since issuance (for the TIPS).

It is clear that for each of these matched-pairs, TIPS have provided higher after-tax returns than their matched-sample conventional Treasury securities, with the difference getting larger for the more recently issued matched-pairs. The overall evidence indicates that even investors with 34% marginal tax rates would have been better off buying the TIPS at issuance, as opposed to the conventional Treasury security issued about the same time. Recognize also that inflation was basically the same for any of these four matched-pairs, so that TIPS would also have higher after-tax real returns, as well. An important caveat to consider when looking at these results is that changes in the relative levels of the real and nominal interest rate over time could have been an important source of these return differences. Nonetheless, over the recent period of relatively stable inflation, all four TIPS issuances that are very closely issuance-date-matched and maturity-date-matched have fared well on an after-tax basis compared to similar conventional Treasury securities. This again suggests that the tax treatment of TIPS is not as severe as suggested by many.

SUMMARY AND CONCLUSIONS

The U.S. Treasury began issuing inflation indexed (or "protection") securities in 1997. Primarily because of their well-established benefit as an inflation hedge, several studies have concluded that TIPS can be an important component of most investment portfolios (e.g., see Campbell, et al. (2003)). Contrary to this view, others have argued that TIPS are "tax disadvantaged," and therefore should not be considered for taxable accounts because they are inferior to conventional securities on an after-tax basis.

In this paper, we reexamine the tax treatments on TIPS and conventional debt in a Fisherian framework. Our framework allows us to conclude that a tax disadvantage, at least relative to other Treasury securities. In fact, we argue the tax treatments are not greatly dissimilar. Our empirical results support this notion. We provide empirical evidence that a sizable proportion of outstanding TIPS have higher expected after-tax nominal yields than their conventional Treasury counterparts. Moreover, we also find that after-tax returns have been higher for TIPS than their matched maturity conventional Treasury security counterparts since the introduction of the former securities. Our evidence further suggests that previous work considering the portfolio benefits of TIPS and/or the pricing of TIPS need not be revisited because this literature has ignored the tax treatment of TIPS.

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TABLE 1
Net Cash Flows (per $1000 Par Value) on TIPS: After-Tax Coupon Payment Minus the Tax Obligation on the Increase in Inflation-Adjusted Principal, at 3% Inflation

	20% Tax	30% Tax	40% Tax
1% C_T	+$2	-$2	-$6
3% C_T	+$18	+$12	+$6

C_T is the *before-tax nominal* coupon payment on TIPS, and Tax is the ordinary income tax rate.

TABLE 2
Net Cash Flows (per $1000 Par Value) on TIPS: After-Tax Coupon Payment Minus the Tax Obligation on the Increase in Inflation-Adjusted Principal, at 5% Inflation

	20% Tax	30% Tax	40% Tax
1% C_T	-$2	-$8	-$14
3% C_T	+$14	+$6	-$2

C_T is the *before-tax nominal* coupon payment on TIPS, and Tax is the ordinary income tax rate.

TABLE 3

Information on Ten Outstanding TIPS and Matched Conventional Fixed-Rate Treasury Securities

Instrument	Issuance Date	Maturity	Coupon Rate	Reference CPI at TIPS Issuance
TIPS	January 1997*	January 2007	3.375%	158.43548
Conventional	October 1996	October 2006	6.500%	
TIPS	January 1998	January 2008	3.625%	161.55484
Conventional	February 1998	February 2008	5.500%	
TIPS	April 1998	April 2028	3.625%	161.74000
Conventional	August 1998	August 2028	5.500%	
TIPS	January 1999	January 2009	3.875%	164.00000
Conventional	May 1999	May 2009	5.500%	
TIPS	April 1999	April 2029	3.875%	164.39333
Conventional	February 1999	February 2029	5.250%	
TIPS	January 2000*	January 2010	4.250%	168.24516
Conventional	February 2000	February 2010	6.500%	
TIPS	January 2001*	January 2011	3.500%	174.04516
Conventional	February 2001	February 2011	5.000%	
TIPS	October 2001	April 2032	3.375%	177.50000
Conventional	February 2001	February 2031	5.375%	
TIPS	January 2002	January 2012	3.375%	177.56452
Conventional	February 2001	February 2012	4.875%	
TIPS	July 2002	July 2012	3.000%	179.80000
Conventional	August 2002	August 2012	4.375%	

* In the case of this security the actual issuance date was delayed up to three weeks. The dates listed then correspond to the dating of the security for purposes of the reference CPI and coupon and principal payments. Source: Bureau of Public Debt Online.

TABLE 4
After-Tax Nominal Yields on TIPS and Matched Conventional Fixed-Rate Securities*

TIPS Maturity (Coupon rate)	Conventional Treasury Maturity (Coupon Rate)	Expected Inflation	TIPS After-Tax Nominal Yield	Conventional Treasury After-Tax Nominal Yield
January 2007 (3.375%)	October 2006 (6.500%)	3.125%	2.96%	1.60%
January 2008 (3.625%)	February 2008 (5.500%)	1.875%	2.40%	2.14%
January 2009 (3.875%)	May 2009 (5.50%)	1.625%	2.32%	2.22%
January 2010 (4.25%)	February 2010 (6.50%)	2.250%	2.82%	2.42%
January 2011 (3.50%)	February 2011 (5.00%)	1.500%	2.52%	2.66%
January 2012 (3.375%)	February 2012 (4.875%)	1.500%	2.54%	2.76%
July 2012 (3.00%)	August 2012 4.375%)	1.375%	2.56%	2.86%
April 2028 (3.625%)	August 2028 (5.50%)	1.875%	3.10%	3.46%
April 2029 (3.875%)	February 2029 (5.25%)	1.375%	2.72%	3.48%
April 2032 (3.375%)	February 2031 (5.375%)	2.000%	3.16%	3.34%

* All calculations use equations (4) or (5) and assume a marginal ordinary income tax rate of 34% and a capital gains tax rate of 20%. Inflation is estimated as the difference between the FR coupon rate and the TIPS coupon rate, and assumed to remain constant for the life of the TIPS.

TABLE 5
Inflation Rate that Equates After-Tax Yield on TIPS with After-Tax Yield on Fixed Rate Securities*

TIPS Maturity (Coupon rate)	Conventional Treasury Maturity (Coupon Rate)	After-tax Nominal Yield on Both	Inflation Rate
January 2007 (3.375%)	October 2006 (6.500%)	1.60%	1.12%
January 2008 (3.625%)	February 2008 (5.500%)	2.14%	1.50%
January 2009 (3.87%)	May 2009 (5.50%)	2.22%	1.46%
January 2010 (4.25%)	February 2010 (6.50%)	2.42%	1.67%
January 2011 (3.50%)	February 2011 (5.00%)	2.66%	1.72%
January 2012 (3.375%)	February 2012 (4.875%)	2.76%	1.83%
July 2012 (3.00%)	August 2012 (4.375%)	2.86%	1.83%
April 2028 (3.625%)	August 2028 (5.50%)	3.46%	2.39%
April 2029 (3.875%)	February 2029 (5.25%)	3.48%	2.47%
April 2032 (3.375%)	February 2031 (5.375%)	3.34%	2.26%

* All calculations use equations (4) or (5) and assume a marginal ordinary income tax rate of 34% and a capital gains tax rate of 20%. The "critical inflation rate" is the inflation rate at which the after-tax nominal yield on the TIPS will equal the after-tax nominal yield on the matched fixed-rate Treasury security. Inflation rates above (below) this critical rate would result in the TIPS having a higher (lower) after-tax nominal yield.

TABLE 6
Annual After-Tax Holding Period Returns (HPR, as of January 15, 2003 for the TIPS and February 14, 2003 for the conventional Treasury securities) for the Four Maturity-Date-Matched Pairs Maturing in January or February

TIPS Issuance FR Issuance	Maturity Year	Approximate Holding Period	TIPS After-Tax HPR	Conventional After-Tax HPR
January 1998 February 1998	2008	5 Years	5.84%	5.04%
January 2000 February 2000	2010	3 Years	9.08%	8.34%
January 2001 February 2001	2011	2 Years	8.22%	6.58%
January 2002 February 2002	2012	1 Year	12.52%	8.68%