Information Content of Maturing TIIS

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We saw in the first quarter of 2002 numerous articles expressing a concern about disinflation. The CPI-U during the last quarter of 2001 declined 0.4%. The cover story of *BusinessWeek* on March 18, 2002, entitled "Would a Pinch of Inflation Help?" noted:

> In presenting the Fed's semiannual economic update to Congress on February 27, Greenspan signaled that he will tolerate a pickup in inflation if that's what it takes to ease companies' pinched profit margins. That has big implications for monetary policy: Greenspan will be slow to tighten credit as the recovery gains steam to give profit-starved companies a chance to jack up prices. It's a risky strategy, to be sure. If bond investors conclude Greenspan has gone soft on inflation, they're likely to push long-term interest rates sharply higher, aborting the recovery in the process (Miller [2002, p. 39]).

During this pivotal period in monetary policy, as Chairman Greenspan sought to convince the market of his stance, information regarding the market's assessment of changing inflation risk would have been beneficial. The Treasury Inflation-Indexed Securities (TIIS), as they approached final maturity, revealed that the market was more concerned about disinflation than inflation from January 15, 2002, through April 15, 2002.

Introduction of the TIIS was expected to provide additional information to monetary authorities regarding the market's inflation expectations and the ex ante real rate. They would help policymakers assess whether current monetary policy is generating the appropriate market confidence in future price stability.

The conventional approach is to track the difference between the current yield to maturity on nominal and TIIS instruments with the same maturity in order to extract information about the market's inflation expectations. The yield difference of course includes factors other than expected inflation. It may include a risk premium (positive or negative), depending on the market's aversion to inflation or disinflation risk, and also a liquidity premium. In fact, there are many practical difficulties arising from contrasting features of the two securities that complicate the accurate measurement and interpretation of the yield difference. Adjustments for tax effects, indexation lags, term structures, and reinvestment rates associated with coupons prior to maturity are required.

The first issue of TIIS matured on July 15, 2002. During their last coupon period, TIIS are transformed from inflation-protection securities into Treasury bills. This transformation period permits a controlled experiment that 1) may reveal the market's aversion to inflation or disinflation risk, and 2) measures

the market's ability to aggregate information about inflation. While the lag effect incorporated into the TIIS structure has been described as a necessary but complicating feature, we find that the lag creates a rare and more transparent window through which monetary policymakers may observe the market's aversion to inflation or disinflation risk. We illustrate its use here to explore the overall market's expectations about inflation risk and to evaluate the efficiency of TIIS prices in reflecting inflation information during the period between January 16, 2002, and July 15, 2002.

TIIS maturing on July 15, 2002, guarantee one remaining cash flow of principal and interest based on the consumer price index (CPI) as of April 15, 2002.[1] They have all of the characteristics of a Treasury bill with one exception. From January 15 until April 15, the TIIS still has the ability to hedge against future inflation. After this date, in the middle of the last coupon period, its hedging capabilities evaporate. The finalization of the April 15 CPI has to wait until the May 2002 CPI is announced on June 18, 2002; therefore, the final cash payment remains uncertain until June 18. After the announcement date, the uncertainty concerning the terminal cash flow on July 15 is eliminated, and TIIS essentially become Treasury bills.

Prior to announcement of the May 2002 CPI on June 18, 2002, TIIS pricing implicitly takes into account the expected target CPI on July 15.[2] Assuming that TIIS earn the same yield as a synthetic Treasury bill while anticipating a single fixed payment, we derive a time series of the daily implied target CPI from the daily prices of the July 2002 TIIS and a synthetic Treasury bill.[3] Any difference between the implied target CPI and the actual CPI from April 15 until the announcement date on June 18 could be attributed only to belated market adjustments to the actual CPI.

We divide the study window from January 16, 2002, until the maturity date on July 15, 2002, into three subperiods. Period I runs from January 16 through April 15, the actual CPI date linked to the reference CPI on July 15. A persistent difference between the implied target CPI and the reference CPI on July 15 reveals the overall market's risk aversion to inflation risk during period I.

Period II ranges from April 16 through June 18, the announcement date for the May 2002 CPI. Information about the reference CPI on July 15 begins to be accumulated in period II. How quickly the gap between the implied target CPI and the actual target CPI closes demonstrates the efficiency of TIIS prices in aggregating information about inflation.

Period III covers the remainder of the period after the June 18 announcement date until the maturity date for the July 2002 issue of TIIS on July 15.

I. UNIQUE CHARACTERISTICS OF MATURING TIIS

In 1997 TIIS began to be sold on an unrestricted basis. TIIS provide two guarantees: 1) that investors will receive an inflation-adjusted amount or the real par value at maturity, whichever is greater; and 2) that coupon payments will be adjusted for inflation occurring between issuance and payment dates.

The consumer price index for all urban consumers (CPI-U) was chosen to measure price level changes. As the most widely used index, the CPI-U is generally accepted as a measure of inflation. The Bureau of Labor Statistics (BLS) surveys prices each month. Around the middle of the month, it announces changes in retail prices experienced by American consumers during the previous month. Although the CPI-U is not a cost of living index, it is the deflator commonly used to adjust wages and salaries for collective bargaining agreements, and to keep pensions, rents, and child support payments in line with inflation.

The CPI reference used to accrue interest on any date is based on a lag of three months. For example, the CPI reference for July 1 is the announced CPI for the month of April. On July 2, the CPI reference will be computed by a linear interpolation of the difference between the April and the May index. Therefore, to compute the CPI reference for the rest of the month of July, including July 15, it is necessary to know the May CPI.

A nominal Treasury security alone does not allow measurement of the aggregation of information about inflation as it occurs. It instead incorporates estimates of future inflation information in its expected yield. The price of the TIIS, however, responds in a different manner. Its nominal price will increase over its life as the CPI level changes, because all future coupons and the principal adjust automatically to the CPI level. TIIS prices respond to changes in inflation as they occur; the higher the price index, the higher the nominal income from the bond. Offering a certain real return, TIIS hedge against a rising price level.

The TIIS hedge against inflation is not perfect, however, because of the three-month lag in the inflation adjustment. The lag lets us conduct a controlled experiment by comparing the prices of a synthetic Treasury bill

and a maturing issue of TIIS. Except for its inflation protection during the three months between January 16, 2002, and April 15, 2002, the 2002 maturing TIIS looks like a Treasury bill with the same maturity date. While TIIS offer protection if actual inflation is higher than expected, a Treasury bill with the same maturity date gives the holder a hedge against unexpected disinflation. The difference in pricing between the maturing TIIS and the synthetic Treasury bill reveals the type of uncertain inflation that the market most wants to avoid.

The information conveyed through the prices of most of a TIIS' life is not clear because we cannot isolate variables that impact the price. That is, when there are many payments remaining, a typical TIIS price is too noisy to reveal the process of aggregating inflation information—we cannot isolate implied reinvestment rates for interim cash flows by observing TIIS prices. During the six-month period prior to final TIIS maturity when just one cash flow remains, though, there is no need for reinvestment rate assumptions. Moreover, there is no difference in tax treatment to anyone purchasing a Treasury bill or a TIIS during the last six months prior to expiration, and there is no call feature.

A review of international indexed bond markets indicates the unique properties associated with the first maturing issue of TIIS. The U.S. indexed bond is modeled on the Canadian real return bond. For both bonds, the coupon period exceeds the lag period, so Canada's real return bonds should offer a similar opportunity for study. Canadian real return bonds, however, are issued with only long-term maturities; the first maturity date is December 1, 2021.

During the last six months of maturing U.K. index-linked gilts, there is no distinction between the maturing U.K. index-linked gilt and a U.K. Treasury bill with the same maturity date. Some of the index-linked gilts have matured, but the eight-month lag on index-linked gilts requires a reinvestment rate assumption for the next-to-last coupon payment, which imposes additional uncertainty on replicated cash flows.

Israeli indexed bonds have a long history of maturities, but the Israeli market has not been immune to government intervention. The Israeli indexed bond market is subject to additional complicating factors such as default risk, partial indexation, and the risk of ex post changes in contract terms by the government (see Huberman and Schwert [1985]).

II. LITERATURE REVIEW

With the short history of the TIIS, there have been few studies that have used this instrument to extract monetary information about inflation and real rates. Although the Department of the Treasury stated that the primary purpose of issuing TIIS was to reduce financing costs, Wilcox [1998, p. 224] includes their ability to open "a new window onto market expectations of future inflation and real interest rates" in a list of benefits.

Emmons [2000], Sack [2000], and Shen and Corning [2001] provide research on the information content of this new security in association with the Federal Reserve System. Emmons [2000] observes TIIS prices of ten-year maturities and hypothesizes that the TIIS yield to maturity may differ from the ex ante real rate by an illiquidity premium as well as by a premium for risks uniquely associated with TIIS, including imperfect indexation, tax considerations, and a longer duration. Sack [2000] uses the TIIS to derive inflation expectations by subtracting the yield on TIIS from a STRIPS of comparable maturity after adjusting for the off-the-run spread assumed to be associated with the TIIS.

Shen and Corning [2001] examine the yield difference between nominal bonds and TIIS bonds, and conclude that, because the yield spread between ten-year securities consistently underestimates expected inflation and actual inflation, this is due to an illiquidity premium associated with the TIIS. They use off-the-run and on-the-run differences in Treasury yields as a proxy for the size of the liquidity premium of TIIS.

Sack and Elsasser [2002, p. 3] report that TIIS yields have been "chronically high relative to those on comparable nominal Treasury securities, with the spread between nominal and TIIS yields falling well below many measures of long-run inflation expectations." They attribute the high relative yields of the TIIS to the failure of investors to adjust to a new asset, lack of major dealer participation, low liquidity, and differences in supply. They conclude that the difference in liquidity cannot explain the observed low levels of inflation compensation, despite using off-the-run securities. Their finding casts doubt that illiquidity of TIIS is an adequate explanation for its relatively high real yield.

Our approach, focusing on the characteristics of the maturing TIIS, does not necessitate computation of the real yield or focus on the explicit spread between the two instruments. We compute a time series of the CPI level implied by the TIIS price using synthetic Treasury

bill prices with the same maturity as the benchmark. This approach can be used only to compare short-term maturities, but it does eliminate many ambiguities. We find the market correctly anticipates the near-term inflation, but requires additional compensation for holding TIIS that will have a lower payoff if disinflation occurs.

Viard [1993] expects investors who are averse to the risk of unexpected inflation to invest in indexed bonds and those who are less risk-averse to hold negative amounts. To put it another way, investors who are averse to unexpected inflation would be expected to prefer indexed bonds over nominal bonds, while those who are averse to unexpected disinflation would be expected to prefer nominal bonds over indexed bonds.

We also investigate the efficiency of the TIIS in incorporating current inflation information into prices. Huberman and Schwert [1985] investigate the efficiency of Israeli indexed bond prices in aggregating inflation information as it occurs. They find that indexed Israeli bond prices reflect about 85% of the new information about inflation as it occurs—that is, while prices are being sampled. On the day after the announcement, the remaining 15% of adjustment in indexed bond prices takes place.

Chu [1991] uses a short-lived experiment in the U.S. with inflation futures contracts traded on the New York Coffee, Sugar, and Cocoa Exchange to document how efficiently a futures market aggregates inflation information. He finds inflation futures prices reveal 71% of inflation information prior to the public announcement.

Both Huberman and Schwert [1985] and Chu [1991] generate the expected components of the inflation rate by applying a time series model based on past inflation rates. Any difference between predicted inflation from the time series model and the actual inflation subsequently announced is used as the measurement of unexpected inflation. On the other hand, our method does not need to decompose inflation into expected and unexpected components. Using the Treasury bill yield as a discount rate captures the only remaining difference between the two instruments, i.e. the market's estimate of the actual level of inflation on April 15.

III. THREE PROPOSITIONS ON TIIS INFORMATION CONTENT

Exhibit 1 depicts the three distinct periods for the final six months of the July 2002 issue of TIIS. On any specific date in period I, the differential TIIS-synthetic Treasury bill pricing is characterized by a trade-off between the benefit of the inflation protection provided by TIIS and the risk associated with the possibility that the actual target CPI will be below the forecasted target CPI. For an investor facing a choice between the synthetic Treasury bill and the July issue of TIIS, the synthetic Treasury bill offers a hedge against unexpected disinflation, while maturing TIIS offer a hedge against unexpected inflation.

In a world of uncertain inflation and inflation hedge securities, investors are willing to accept a lower yield in exchange for protection from unexpected increase in inflation for the duration of period I. If an unexpected increase in inflation becomes the major concern, the market sets TIIS prices so that the yield on the maturing TIIS is lower than the yield on the synthetic Treasury bill. This lower nominal expected yield on the TIIS leads to setting TIIS prices so that the implied target CPI is higher than the actual target CPI. A higher implied target CPI than actual target CPI indicates the market's preference for protection from an unexpected increase in inflation.[4]

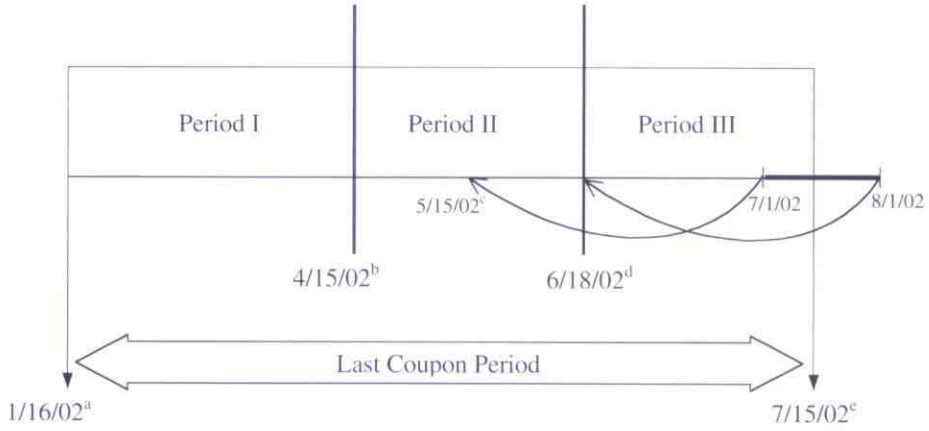
If the major concern is instead unexpected disinflation, we would expect the market to set TIIS prices so that the implied target CPI is lower than the actual target CPI. If TIIS investors are concerned that announced inflation may be lower than forecasted, holding the synthetic Treasury bill provides protection from unexpected disinflation. A lower implied target CPI than actual target CPI would indicate the market's preference for avoiding unexpected disinflation.

The sign of a persistent gap between the implied target CPI and the actual target CPI reveals the current market's assessment of inflation risk. The gap is expected to narrow nearing April 15, the actual date linked to the reference CPI on July 15, when the inflation hedging characteristic of the TIIS evaporates. We define the gap as the actual target CPI minus the implied target CPI.

Proposition 1 summarizes the relationship between the sign of the gap and the market's assessment of inflation risk in period I: *A positive and shrinking gap (actual target CPI minus implied target CPI) indicates the overall market's concern about unexpected disinflation. A negative and shrinking gap indicates the overall market's concern about unexpected inflation.*

When we enter period II, information regarding the target CPI is gradually available to the market. If a market were processing inflation information efficiently, we would expect consumer price information to be reflected contemporaneously in security prices. Conversely, if a market were slow to absorb inflation information as it occurs, security prices will reflect that information only

EXHIBIT 1
Three Periods of a Maturing TIIS



[a] January 16, 2002, is one day after the next-to-last coupon payment date.
[b] April 15, 2002, is linked to the reference CPI on July 15, 2002, because of the three-month lag in indexing CPI.
[c] May 15, 2002, is the announcement date of the April 2002 CPI, which becomes the reference CPI for July 1, 2002.
[d] June 18, 2002, is the announcement date of the May 2002 CPI. Once the May 2002 CPI is announced, the reference CPI for July 15, 2002, is determined.
[e] July 15, 2002, is the maturity date of the July 2002 TIIS.

after announcement of the CPI.

Period II fits a controlled experiment to demonstrate how efficiently the market aggregates inflation information. To investigate the speed of information aggregation, we compare the implied and actual target CPI. In an efficient market with respect to incorporation of inflation information, we would expect to see the implied target CPI rapidly approach the actual target CPI as inflation takes place. If the market were perfectly efficient, TIIS prices would incorporate information about the level of the CPI as it occurs, without a lag, on April 15.

In other words, there is no need for the market to wait until announcement of the CPI to incorporate inflation information into TIIS prices. TIIS prices should reflect the market aggregation of inflation information as the inflation occurs.

Proposition 2 is that: *The implied target CPI derived from the prices of TIIS and the actual target CPI will converge in period II if the TIIS prices efficiently incorporate information about the level of the CPI on April 15.*

After announcement of the May 2002 CPI on June 18, the target CPI becomes known. There is now no difference in cash flow patterns between the synthetic Treasury bill and the maturing TIIS. Both securities offer a fixed amount of nominal dollars on the maturity date on July 15. Given the same yield for the TIIS and the synthetic Treasury bill, the implied target CPI is indistinguishable from the actual target CPI.

Proposition 3 summarizes the relationship between the implied target CPI and the actual target CPI in period III: *In period III, the implied target CPI will be indistinguishable from the actual target CPI since all features of both securities are the same.*

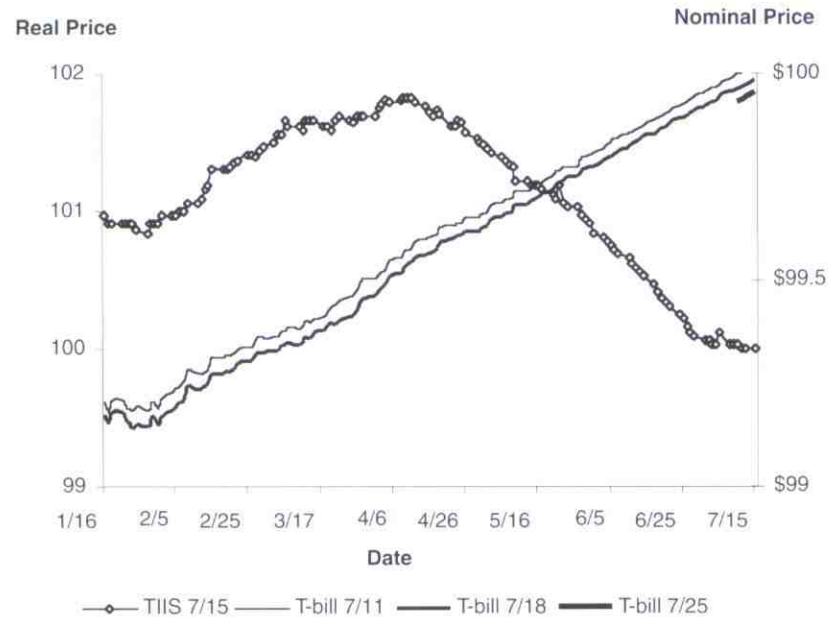
On the maturity date, the TIIS price in real terms should converge to 100, because by definition the reference CPI on July 15 equals the actual target CPI.

IV. DATA AND METHODOLOGY

Four daily price series for four Treasury securities are retrieved from the Datastream database. The four Treasury securities are the TIIS maturing in July 2002 and Treasury bills with maturity dates on July 11, 18, and 25, 2002. The time period is from January 16, 2002, through July 11, 2002. January 16, 2002, is one day after the next-to-last coupon payment date for the July 2002 TIIS. July 11, 2002, is the last trading date for the July 2002 TIIS.

Exhibit 2 graphs the four time series. The three

EXHIBIT 2
Time Series of Price Data



Treasury bill prices are reported in nominal discount terms with a face value of $100. Treasury bill price time series do not intersect because of different times to maturity for the three Treasury bill issues. The TIIS price series is reported in real terms excluding the coupon accrual.

The daily implied target CPI is derived from daily TIIS prices, assuming that the yield on the TIIS is identical to the yield on a synthetic Treasury bill. For any observation date t between January 16 and July 9, let $b(t, T_1)$ and $b(t, T_2)$ denote the pure discount prices of a $1 face value Treasury bill maturing on July 11 and on July 18, respectively. A linear approximation is used to obtain the price of the synthetic Treasury bill on observation date t:

$$b(t, T^*) = \frac{1}{7}[\ 3\,b(t, T_1) + 4\,b(t, T_2)] \tag{1}$$

Since the market stops trading Treasury bills one business day before the maturity date, the price for the Treasury bill maturing on July 11 is no longer available after July 9. The Treasury bill maturing on July 25 is used instead.

The price of the synthetic Treasury bill for July 10 or 11 is linearly approximated by Treasury bills maturing on July 18 and July 25:

$$b(t, T^*) = \frac{1}{7}[\ 10\,b(t, T_2) - 3\,b(t, T_3)] \tag{2}$$

where $b(t, T_3)$ is the pure discount price of a $1 face value Treasury bill maturing on July 25.

Exhibit 3 shows the time line for the maturity dates of the four Treasury securities and computation of the prices of the synthetic Treasury bill, $b(t, T^*)$.

Prices for the TIIS are reported in real terms. The reported prices are clean in the sense that they are net of the accrual of the known portion of the final coupon payment. We convert a real, clean price to a nominal, invoice price as follows:

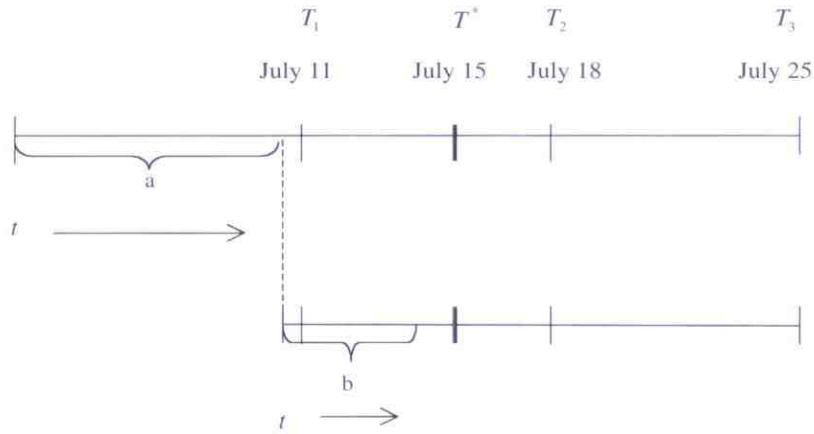
$$P_t = \left[\textit{Reported Clean Price} + \left(\frac{c}{2}\right) \frac{\textit{Days Since January 15, 2002}}{181} \right] \frac{I_t}{I_B} \tag{3}$$

where:

P_t: nominal invoice price of the TIIS on observation date t,
c: annual coupon in real terms,
I_t: reference CPI for the observation date t, and
I_B: reference CPI for the original dated issue date.

EXHIBIT 3

Computation of Synthetic Treasury Bill Price b(t, T^*)



$b(t, T_1)$ ←---------$1.00

$b(t, T^*)$ ←----------$1.00

$b(t, T_2)$ ←----------$1.00

$b(t, T_3)$ ←----------$1.00

[a] Observation date (t) is between January 16, 2002, and July 9, 2002:

$$b(t, T^*) = \frac{1}{7}[3b(t, T_1) + 4b(t, T_2)]$$

[b] Observation date (t) is July 10 or 11, 2002:

$$b(t, T^*) = \frac{1}{7}[10b(t, T_2) - 3b(t, T_3)]$$

The reference CPI comes from the Bureau of Public Debt Online website (http://www.publicdebt.treas.gov/). For the July 2002 issue of TIIS, c is 3.625 per real face value of 100, and I_B is 160.15484. There are 181 calendar days between the next-to-last coupon payment date on January 15, 2002, and the final coupon payment date on July 15, 2002.

On July 15, 2002, the terminal cash flow to the holders of TIIS, P_T, is specified as

$$P_T = \left[100 + \frac{c}{2}\right]\frac{I_T}{I_B} \tag{4}$$

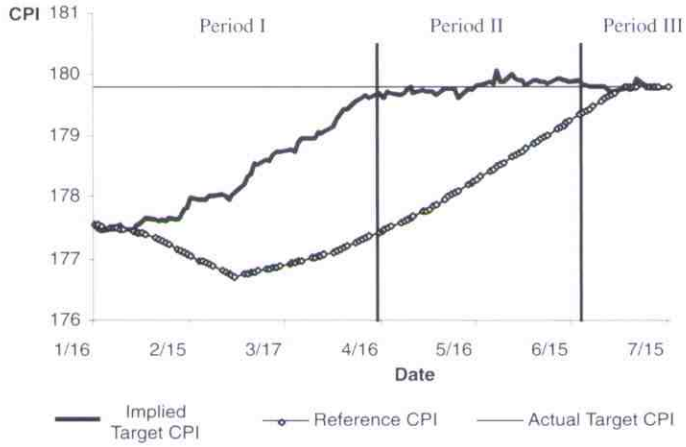
where I_T is the actual target CPI. The value for I_T becomes known after the announcement of the May 2002 CPI on June 18, 2002 (its actual value is 179.8). Before the announcement date, the value of I_T can be solved for implicitly by assuming an identical yield for both the maturing TIIS and the synthetic Treasury bill. Assuming an identical yield, the invoice price P_t equals the present value of the terminal cash flow P_T discounted at the pure discount price of $b(t, T^*)$:

$$P_t = b(t, T^*)P_T \tag{5}$$

Substituting P_T from Equation (4), the implied target CPI based on the invoice price of TIIS on observation date t can be computed as

EXHIBIT 4

Implied, Reference, and Actual Target CPI



Implied Target CPI is the CPI derived from TIIS prices, assuming that the yield on TIIS is identical to a synthetic Treasury bill maturing on July 15, 2002.

Reference CPI is the CPI reported by the Bureau of Public Debt for each observation date. Reference CPI is used to compute nominal invoice price.

Actual Target CPI is the actual CPI for April 15, or 179.8. This CPI was used to compute the final coupon payment of the TIIS issue that matured on July 15, 2002. It was not publicly announced until June 18, 2002.

$$I_T^*(t) = I_B \frac{P_t / b(t, T^*)}{100 + \frac{c}{2}} \tag{6}$$

All variables on the right-hand side of Equation (6) are given or observable in the Treasury security markets. A time series of the implied target CPI, $I_T^*(t)$, is estimated during the study period.

V. RESULTS

Exhibit 4 plots the daily implied target CPI and the daily reference CPI during the study period. The reference CPI for each observation date is published at the Bureau of Public Debt Online website. A linear interpolation is used to compute the daily reference CPI from the monthly CPI. The horizontal line represents the actual target CPI for the July 15 payment as the benchmark for comparison.

Period I

During period I, the implied target CPI consistently lies below the actual target CPI. This is equivalent to finding that the nominal expected yield on the TIIS is higher than the expected yield on the synthetic Treasury bill.

We further observe that the gap steadily closes toward the target CPI until it closes almost entirely around April 15, the date that the hedging capability of the TIIS expires. The pricing of TIIS during period I reveals that the market prefers a hedge against a disinflation surprise. Observing this, Chairman Greenspan would have confirmation that the market did not conclude from his signal that he had "gone soft on inflation," a possibility raised in the *BusinessWeek* article. A higher expected yield is required to hold TIIS to relieve the overall market's concern about disinflation.

Previous research attributes the perplexingly high TIIS yield relative to Treasury securities for ten-year maturities to several possibilities: tax considerations, a longer duration due to later arrival of real cash flows, and liquidity concerns. We find that none are valid alternative explanations in this situation. In our study there is only one cash flow remaining to be received on the same date, so taxes and duration are equal in both securities.

Amihud and Mendelson [1991] study the relative liquidity of U.S. Treasury bills and maturing U.S. Treasury notes with maturities less than 180 days. These two instruments have known terminal cash flows, identical in every respect except liquidity. This is the precise situation in our

study during period III. The price differential between TIIS and the synthetic Treasury bill was $0.022 per $100 of redemption value, which is less than one tick (1/32) of TIIS. Amihud and Mendelson [1991] report an arbitrage profit due to differential liquidity of $0.04 per $100 of redemption value during a comparable range of maturity days. The TIIS liquidity is comparable to that of the maturing Treasury notes reported in Amihud and Mendelson.

During period I, the Treasury bill and TIIS are not identical because of the differential hedging capacity and liquidity. Assuming perfect foresight, the price differences between synthetic Treasury bills and TIIS during period I were much greater. Based on a $100 redemption value, the price differences ranged from $1.25 at the beginning of the period to $0.07 on April 15, with an average of $0.81. A price difference of this extent cannot reasonably be explained by the differential liquidity reported in Amihud and Mendelson [1991].

Period II

By April 15, the implied target CPI approaches 179.8, the actual value of the target CPI for July 15. On April 15, the TIIS price implies a target CPI of 179.7, only 0.1 away from the actual target CPI. The implied target CPI moves very little from the actual target CPI through the announcement date on June 18. On the announcement date, there is no major adjustment in the implied target CPI. During period II, the average absolute difference between implied and actual target CPI is 0.09 (or 0.05% of actual target CPI) with a maximum deviation of 0.27.

The implied target CPI and the actual target CPI converge as the inflation process occurs on April 15. The empirical results demonstrate that TIIS prices are efficient in reflecting the inflation information set needed to compute the CPI on April 15. The official announcement of the actual April 15 CPI nine weeks later confirms the implied CPI already reflected in the TIIS prices. The empirical results are consistent with evidence of market efficiency in aggregating information about contemporaneous inflation.

Period III

When the trading of TIIS enters period III, all uncertainties related to terminal cash flow have been eliminated. There is no major TIIS price adjustment after announcement of the May 2002 CPI on June 18. The average absolute difference between implied and actual target CPI is 0.035 in period III. The average absolute differential is equivalent to a reported real price difference of $0.031, less than one tick (1/32) of TIIS. We find no difference in pricing between the TIIS and the synthetic Treasury bill in period III.

VI. CONCLUSION

The last six months of a maturing Treasury Inflation-Indexed Securities issue provide a special controlled environment that lets us investigate the security market's assessment of inflation risk and its aggregation of information about inflation. We examine here the relative pricing of TIIS and Treasury bills, given the TIIS three-month lag design in indexing inflation.

The study window is separated into three periods. In period I, we find investors are more averse to disinflation than inflation surprise. In other words, the major concern in the first quarter of 2002 is disinflation, and not higher inflation. If there were more examples of maturing TIIS, they could be used to inform both investors and monetary authorities about current market assessment of inflation risk. As long as there are few TIIS issues and they are for long maturities, this window into the inflation process will be rarely open. Yet such a window can offer a view of attitudes underlying the current inflation regime whenever it is open.

In period II, we find TIIS prices efficiently incorporate inflation information as the inflation picture develops. Announcement of the actual CPI nine weeks later serves only as confirmation of the CPI already implied in the TIIS price. There is no difference in pricing of the TIIS or the synthetic Treasury bill in period III.

There are two potential criticisms of our findings. The first is that our findings from the price series of a maturing TIIS represent a single episode, and more events are needed to demonstrate the robustness of the information content of maturing TIIS. A second is that consistent forecast errors rather than rational inflation hedge preference could explain the gap between the actual and implied CPI observed during the first quarter of 2002.

To address the first criticism, we point out that security prices other than prices of maturing TIIS have been observed to reflect the market's assessment of inflation risk. Chu [1988] documents that during 1985 and 1986 the majority of the short-lived inflation futures prices traded on the Coffee, Sugar, and Cocoa Exchange were higher than the actual CPI on the maturity date. Unlike concerns about disinflation reflected in the July 2002 issue of maturing TIIS, the inflation futures prices revealed that the market in 1985 and 1986 was concerned about higher inflation.

Regarding the second criticism, consistent forecast errors imply that the TIIS market ignores information about inflation in the pricing of TIIS. The presumption of ignorance of inflation information is contradicted by other studies on market efficiency with respect to inflation. Market efficiency in aggregating inflation information has been documented in the Israeli index bond market as well as in the U.S. inflation futures market.

Our contribution is to illustrate how this relatively new Treasury security, during its last coupon period, sends a useful signal about the market's inflation concerns. Observers of the TIIS market have viewed the maturing issue as uninteresting because it begins to resemble a Treasury bill. In fact, the last six-month window offers a unique view of inflation hedge preference, as TIIS prices respond to its metamorphosis from an inflation hedge instrument to a fixed-rate instrument.

If monetary policymakers would benefit from this new signaling source about the market's inflation concerns, a policy implication suggests we should offer TIIS with more frequent maturities.

ENDNOTES

Part of this article was completed while Chu was on a professional development leave and visiting at TamKang University. He is grateful for research support from Fogelman College and TamKang University.

[1]As a practical matter, so that the Bureau of Labor Statistics has enough time to compile price data, there is a three-month lag in indexing CPI.

[2]Target CPI is the reference CPI for July 15, i.e., the actual CPI as of April 15, 2002.

[3]A synthetic Treasury bill is a hypothetical Treasury bill with maturity date on July 15, 2002, the maturity date for the issue of TIIS. Since there is no Treasury security maturing on July 15, 2002, a synthetic Treasury bill is created as a proxy for a nominal risk-free security. We use the prices of two issues of Treasury bills to approximate the price of the synthetic Treasury bill. For the period between January 16 and July 9, there were two issues of Treasury bills that matured on July 11 and July 18. For the period July 10 and July 11, there were two issues of Treasury bills maturing on July 18 and July 25.

[4]The nominal expected yield on the TIIS is defined as the annual yield from holding the TIIS under the assumption of perfect foresight about the target CPI. Note that the nominal expected yield and the implied target CPI are mirror images. An actual target CPI higher than implied target CPI is equivalent to a higher nominal expected yield on TIIS than on the synthetic Treasury bill. The reverse is also true.

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