Increasing the Role of Inflation-Indexed Debt in US Government Finances

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Abstract

Evidence of a liquidity penalty on Treasury Inflation Protected Securities (TIPS) is often cited as a reason that the Treasury should eschew the issuance of inflation-protected securities. Conventional wisdom has been that this liquidity cost more than offsets the benefit to the Treasury of not having to pay higher yields to compensate investors for an inflation risk premium. This paper reviews the use of inflation-linked debt by the US government in the form of both the TIPS program and the much smaller I bond program. While the liquidity penalty has not decreased, the once-prominent gap between breakeven inflation rates implied by the TIPS-Treasury spread and several measures of inflation expectations has narrowed dramatically since 2021. This finding implies that the inflation risk premium has increased to a point where it is nearly large enough to outweigh the liquidity penalty, making a case for the Treasury to monitor the inflation risk premium and increase TIPS issuance if the inflation risk premium remains elevated. The case would be even stronger if Treasury were to undertake simple measures to increase the liquidity of inflation-linked debt. If the government actually wishes to limit the stealth tax represented by inflation, it can do so by raising the share of inflation-indexed debt and making such debt more liquid.

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I. Introduction

The rise in inflation that began in mid-2021 has led to renewed interest in investment instruments capable of protecting investors against unexpected price increases. This attention to inflation-indexed assets in turn raises the question of the role of inflation-linked debt in government finances.

The US Treasury issues two main types of inflation-indexed debt instruments: Treasury Inflation Protected Securities (TIPS) and Series I Savings Bonds (I Bonds). Both programs are small compared to the overall magnitude of marketable US government debt. As of February 2023, TIPS outstanding amounted to $1.88 trillion or 6.0% of US government debt. While I Bonds saw inflows of $34.8 billion in the 12 months to February 2023, their total outstanding value amounted to $94.7 billion, a miniscule 0.3% of US government debt, presumably due in large part to the $10,000 per investor cap on purchases. TIPS, despite periods of excitement regarding their potential to protect from inflation, have never risen to more than around 10% of the outstanding debt of the United States federal government. Yet investor demand for inflation-protected investments naturally increases with inflation expectations.

This paper reviews the role of inflation-indexed debt in US government finances, including the costs and benefits of issuing more inflation-indexed Treasury bonds under existing structures. It also makes recommendations for modifying these structures to make expanded issuance of inflation-linked debt more appealing to both investors and a taxpayer-representative government. The fact that the federal government has not issued more inflation-linked debt in the past has contributed to keeping current interest costs lower during a period of increased inflation. However, the important question for policy now is not looking ex post at the interest the government would have paid had it had more inflation-linked debt, but rather at the ex ante costs of inflation-linked debt versus nominal Treasury bonds.¹

When the Treasury began issuing inflation-indexed bonds in the 1990s, many economists and market analysts heralded the step. In addition to the point that inflation-indexed bonds protect investors from inflation uncertainty more than any other asset available in the market, the Treasury also hoped for substantial yield savings from not having to compensate investors for an inflation risk premium as it does in nominal bonds. Furthermore, a liquid market for inflation-indexed debt reveals information about the market’s inflation expectations, which observers hoped would be useful to the Federal Reserve and policymakers more generally (Shen 1995).

In recent years, however, research in financial economics has identified important costs of the issuance of inflation-indexed debt by the US Treasury, particularly though the TIPS program. TIPS command lower prices than “synthetic” versions of TIPS consisting of a nominal Treasury bond plus a market-priced swap of fixed for inflation-linked payments (Fleckenstein, Longstaff, and Lustig 2014). This likely reflects the fact that Treasury is able to issue nominal bonds at a particularly low yield due to money-like properties that TIPS do not enjoy, including deep market liquidity and convenience. Hence, by issuing TIPS, the Treasury both leaves this convenience yield on the table and subjects the budget to higher interest payments during inflationary times. These liquidity factors may also vary over time (Shen 1996). Furthermore, the tax treatment of TIPS is complex, involving annual taxation of what are effectively unrealized taxable gains in the inflation-linked principal increases. This means that the Treasury Department must offer a higher real interest rate component on issued TIPS to generate demand for a given issue size. These unforeseen burdens have offset some of the potential benefits to both investors and the Treasury Department.

Holding the convenience yield on nominal Treasury bonds fixed, for the cost calculation to reverse and point to budgetary efficiency of inflation-linked debt, investor interest in the insurance properties of inflation-linked debt would have to be so large as to overcome the liquidity headwinds. Given the low inflation environment most of the world has experienced in the last few decades, this shift in investor

¹ See also Dudley, Roush, and Ezer (2009).
expectations did not materialize over the period of low inflation. In this paper, however, I provide evidence that recently such a shift has occurred.

While there remains a clear liquidity-driven yield penalty for TIPS, as of the latest data, breakeven inflation rates in marketable inflation-linked government bonds are close to or exceed the level of consumer inflation expectations in the short end of markets in both the US and UK. This is also the case in the longer end of the US market if professional inflation forecasts are used, though not if consumer expectations are used. Findings of break-even inflation rates roughly meeting surveyed inflation expectations contrast with the prior period in which the TIPS-Treasury breakeven rate was generally considerably lower than expected inflation, so that investors did better by buying TIPS even when inflation fell considerably short of their actual expectations. This shift provides evidence the inflation risk premium has risen, making even the less liquid TIPS a plausibly beneficial source of financing for the US government. Investors now only break even at realized inflation rates that are much closer to the actual inflation expectations, as opposed to making money.

Furthermore, the lack of a highly liquid market for inflation-linked debt is not an inherent characteristic of inflation-linked debt, but instead is itself a policy choice. Legislation could easily make TIPS more liquid through several basic changes including changes in their tax treatment. Moreover, a more stable index to track inflation would also substantially reduce the short-term swings in principal value which can result from the utilization of the CPI-U. One inflation-linked program that has many of these constraints removed is the I Bonds program. However, the program’s cap and lack of marketability limits the ability of investors to take advantage of these securities. Removing these and other constraints on inflation-linked debt programs might actually give such issued securities the money-like properties they have lacked and that investors desire.

With many of the costs of the program being self-imposed, there must be some consideration of why a well-functioning inflation-linked debt program is not a policy objective. The common argument is that it increases long-term fiscal burdens, particularly during inflationary periods. Yet this need not be a disadvantage. In fact, it is often under-emphasized in the discussion of inflation-linked debt that it can play a disciplinary role in government finances. It has long been understood that inflation indexation of government debt removes the incentive for the government to pay off its debts with inflated money (Bach and Musgrave, 1941; Calvo 1978, Lucas and Stokey 1983). With more inflation-linked debt, rising inflation-linked interest costs would necessitate budgetary action to reduce debt. This disciplinary action could by itself encourage the government to run smaller deficits, and ultimately lead to less inflation, especially given the role that fiscal policy plays in determining the price level (Cochrane 2022a, b).

A majority of Americans, 56%, said in a Gallup poll conducted in August of 2022 that inflation was a hardship for them and their families; among the poorest Americans, this number is closer to 74% (Jones 2022). If US policymakers cannot both provide that protection to the hard-earned savings of average Americans and simultaneously reduce the impact of their own spending habits on inflation, these self-destructive tendencies will have increasing economic costs.

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2 Ermolov (2021) compares experiences across countries in data from Canada, France, Sweden, the United Kingdom, and the United States before the latest inflationary episode and finds that on average it has cheaper to issue nominal debt at medium-term tenors (5–10 years) and inflation-linked debt at longer-term tenors (20 or more years). However, outside the US the liquidity impact of convenience yields on nominal debt is likely substantially smaller than in the US, given the dollar’s role as a reserve currency and the important role of US Treasury bonds in international financial markets.

3 Price (1997) further provides arguments for the rationale and design of inflation-indexed bonds. Bohn (1988) finds it worth asking the question why governments issue nominal debt at all, answering that under distortionary taxation, nominal debt does provide insurance against the budgetary effects of economic fluctuations.
II. The Composition of US Government Debt and Inflation Exposure

Most US government debt is in the form of non-indexed Treasury bonds. Figure 1 shows the breakdown of US government debt that is inflation-indexed versus nominal, and among nominal bonds the percent that is short-term, from 2001 to the present. As of February 2023, 35.0% of US government debt was in the form of long-term Treasuries (maturity of 10 years or longer), 45.7% in the form of medium-term Treasuries (maturity between 10 years and 1 year), 13.0% in the form of short-term debt (maturity of less than 12 months) and 6.0% in TIPS. I Bonds are practically not visible in the figure, comprising only 0.3% of government debt.

The longer the maturity of a nominal bond, the more inflation risk to which investors are exposed, and in particular to the risk of unexpected inflation, as investors logically demand compensation in the form of higher yields at the time of issue for expected inflation over the maturity horizon of the bond. Shorter-term bonds also carry this risk of diminished purchasing power, as evidenced by the experience of any investor who bought short-term Treasury bonds during mid-2021 to mid-2022. The one-year Treasury yield on June 30, 2021 was 0.07%, compared to realized inflation in the year to June 30, 2022 of 9.0%. In the theory of a free market for securities, as inflation expectations rise, so should market yields on the newly issued instruments, although the Federal Reserve’s interventions in the Treasury market and setting of short-term interest rates may prevent this from happening. Figure 2 shows that the New York Fed’s measure of inflation expectations in the past decade has generally surpassed the one-year Treasury yield over the past decade. Short-term bonds seem to offer limited inflation protection for investors, particularly due to bouts of unexpected inflation.

A. TIPS

In the mid-1990s, the Clinton Administration was searching for ways in which to offer average American depositors a manner in which they could retain the real value of their savings. Starting in spring of 1996, the Treasury Department began a public comment period in which recommendations regarding a new index-linked security would be accepted (Bradbury 1996). Although the template would be based around principal adjustments according to some inflation index, the nature of that index and the inclusion of a non-zero real interest rate were not necessarily settled issues. The process of public input culminated by the end of September with a proposed set of modifications to 31 C.F.R. § 356, the product of which was a security with remarkable resemblance to both Canada’s Real Return Bonds (whose issuance was ceased in November 2022) and the UK’s index-linked gilts (Hammond 1996).

In the new TIPS program, the principal would be adjusted according to the Department of Labor’s CPI-U, the consumer price index for all urban consumers, lagged three months behind the issue date (31 C.F.R. § 356.B). Thus, the ratio between the CPI-U index three months prior to the current date and three months prior to issuance would be the factor inflating (or deflating) the principal. The fixed interest rate would then be applied semi-annually to the adjustable principal to produce a stream of income that was constant in real terms (even if it differed in nominal terms).

Notable to this new type of bond was the promise of partial protection against deflation; should there be a period of sustained deflation throughout the security’s horizon, the nominal principal would be repaid, if it is larger than the real principal (31 C.F.R. § 356.30). The tax treatment of TIPS was defined to include as taxable income coupon payments, as well as the level of principal adjustments in the year the adjustments happen. That is, the adjustments that occur to the principal trigger an immediate tax liability even though the investor has not actually realized a capital gain. With these regulations in place, the U.S.
Treasury first issued TIPS in January 1997, and many economists commented on and began to study the market.4

The TIPS program was explicitly designed to protect investors against inflation through principal that is indexed to the change in prices. Thus, although TIPS coupon rates do not adjust with inflation, since the coupon rate itself is applied to a higher (lower) base when CPI rises (falls), the real value of both the interest payment and the principal are protected. To determine the real size of these interest payments over the lifetime of the security, TIPS bonds are quoted at the real yield and are expected to deliver that real yield plus expected inflation. A standard decomposition of the yield on nominal Treasury securities into its components shows that the yield on a nominal security of a given horizon reflects the real yield plus compensation for expected inflation plus an inflation risk premium:

\[
\text{Nominal Yield} = \text{Real Yield} + \text{Expected Inflation} + \text{Inflation Risk Premium}
\]  

This equation assumes that the nominal yield and real yield are measured using instruments with similar liquidity, an assumption which will likely not be valid if comparing yields on nominal Treasury bonds to TIPS yields.

As explained above, TIPS are also to some extent protected against deflation. While negative realizations of the CPI reduce TIPS principal, the face value is guaranteed never to fall below its original value at issuance. Thus, outstanding TIPS bonds with substantial embedded increases in face value will see those increases reversed during a deflationary period, but only until the face value of the bond falls back to the original value at issuance. Given these features, TIPS are clearly a long-run inflation hedge, but in the short term they do not serve investors looking for inflation protection well for two reasons.

First, the CPI-U is a fairly poor measure of inflation in the short-term. Shoemaker (2015) finds that standard errors increase on a relative basis (standard error divided by price change), as the price change interval gets shorter. Holding TIPS to hedge against inflation in the short-term therefore subject to the increased variability of CPI-U measurement. The Treasury Borrowing Advisory Committee, a group of private investors who confer with the Treasury Department about debt issuance have voiced such volatility concerns since at least 2009.5 The fact that the indexation of the TIPS bonds is based on CPI inflation three months in advance also reduces the hedging properties of TIPS and leading to a stale link. Practically this feature also has the effect that the inflation hedging of TIPS ends three months before the maturity of the bond, effectively turning it into a Treasury bill for the final three months (Chu et al 2011).

Second, as real interest rates increase, the value of a portfolio of long-term TIPS declines due to the realization of interest rate risk. These losses are recovered as the bonds mature, but this requires holding the bonds to maturity. For this reason, exchange traded funds (ETFs) that hold portfolios of TIPS declined substantially in value over the first half of 2022 even as inflation and inflation expectations accelerated. For example, on December 31, 2021, one share of the iShares TIPS Bond ETF had a price of $129.20. On June 30, 2022, the price of this ETF stood at $113.91, having paid dividends of $3.78, for a net return of -8.9%, over a period of rising inflation and rising inflation expectations.

Figure 3 shows the evolution of the net issuance of TIPS by the Treasury, where net issuance is defined as sales less redemptions using the Treasury’s Monthly Statement of Public Debt. The Obama Administration oversaw a substantial increase in TIPS issuance beginning in 2010. Two reports, one from the Government Accountability Office (GAO) and one from SIFMA’s Treasury Borrowing Advisory

4 Roll (1996), for example, in one early contribution highlighted that the “central conundrum here, as with any security’s design, is that tradeoff between broad market liquidity and specific structures that appeal to clientele groups.” Roll (2004) analyzes the role of TIPS in investor portfolios and the factors driving the changes in their pricing over time.

5 See for example the August 4, 2009 minutes of the Meeting of the Treasury Borrowing Advisory Committee.
Committee, had both advised that not only did the net issuance of TIPS need to increase substantially, but so did the schedule of auctions and the maturity window on TIPS (Treasury Borrowing Advisory Committee 2009; Irving 2009). The Treasury at this time concluded that the issuance of inflation-linked securities could provide it with the liquidity it needed to carry out fiscal plans, as the perceived safety of the securities could assuage investor-related fears regarding inflation (Treasury Borrowing Advisory Committee 2008). However, despite the fiscal expansion in the wake of the global financial crisis, fear of inflation gave way to fears of disinflation (Treasury 2016). Demand for the bonds was not as robust as expected, leading to a drop in net issuance post-2016.

The amount of TIPS debt outstanding is not necessarily a function of net issuance, as the inflation adjustments to the principal can impact the magnitude of the debt burden. As shown in Figure 4, the gross monthly principal adjustment to all outstanding TIPS was $328.4 billion in February 2023. This fact invariably increases the outstanding inflation-linked debt as prices naturally fluctuate over time, but this is hardly the runaway effect one might think. In fact, when the effect of maturing securities is excluded from the analysis, the oscillatory nature of the CPI-U, the index upon which the TIPS principal is adjusted, becomes quite apparent. As shown in Figure 5, this adjustment has not materially affected the amount of TIPS bonds outstanding in the long term, especially considering that there are many short periods of negative adjustment to TIPS principal.

**B. Series I Bonds**

The Clinton administration set up the I Bond program in 1998 with several unique characteristics for individual investors. Compared to TIPS, the I Bond program offers less liquidity but greater tax benefits and less interest rate risk. The intention was to create two different products tailored to two interrelated but ultimately distinct consumers. I bonds would be for households, and TIPS for banks.

Series I Bonds were excluded from all state and local taxation and could have the entirety of its taxes paid at the maturity date, rather than throughout the life of the bond (31 CFR § 359.B). The principal benefit is the reinvestment of dividends that otherwise would have been taxed. Investors can also avoid paying taxes entirely on the bond if the principal is used strategically, as the Series I bond falls under the Education Savings Bonds Program, a program which allows for exemption from taxes should the interest earned be spent on higher education during the same time (31 CFR § 359.66). Treasury imposed an initial cap of $30,000 per social security number on I bond purchases (Hammond 1998), and this cap has kept Series I bonds smaller than other government securities programs. The tailoring of the rules of this program to retain its consistency with other savings bonds is suggestive of how the Clinton administration designed the security, especially with regard to TIPS.

As mentioned above, the principal of TIPS scales with inflation, while its interest rate remains the same (31 C.F.R. § 356.30). Series I bonds differ significantly in that they have a fixed principal but a variable interest rate. In particular, Series I bond interest consists of two components: a fixed interest rate, which is constant from issue, and a variable inflation component based on CPI (31 CFR 359.13). The variable component is typically announced on November 1 and May 1 of each year (31 CFR 359.9.a), where all bonds subsequently sold after these dates until the next rate announcement have the same composite rate (31 CFR 359.10). When a new rate is announced, the new composite rate will not apply to each series immediately, but instead will lag by the number of months the original sale was subsequent to the rate announcement (31 CFR 359.11). For example, bonds bought in October will have the same composite rate announced five months earlier in May, but will not have the new November rate applied until April, being separated from November by five months.

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6“The presenting member then stated that TIPS have been a good value to investors, helping them to diversify inflation risks in fixed income portfolios and to express views on realized and expected inflation.”
Under the TIPS programs, the principal can be increased or decreased, depending on the prevailing inflationary conditions. Although the real, adjusted principal cannot be less than the nominal principal, the government must honor this condition only at redemption (31 C.F.R. § 356.30). The interest payments from TIPS can therefore be deflated, and gains to the principal during inflation can be, to some extent, eaten away by deflation, a particular concern for buyers who buy TIPS in the secondary market after inflation has already increased their principal. This stands in contrast to I bonds was given a floor interest rate of 0.00% in legislation surrounding the Uruguay Round Agreements (31 CFR § 359.12). Although interest payments might temporarily go to zero during periods of deflation (say, when the deflation exceeds the fixed rate on the bond, bringing the composite rate to 0%), the principal on I bonds never shrinks because of this 0% floor interest rate, protecting investor gains. Therefore, even under the same fixed rate, TIPS and I bonds differ greatly in their response to deflation. For an investor looking to protect embedded gains from inflation against deflation, I bonds are a more attractive investment than TIPS, which can lose their nominal gains.

Unlike TIPS, the Treasury does not control the I bond supply directly, other than through the per-investor cap and the ability to make I bonds more or less attractive through the setting of the fixed rate component of the I bond return. Once those parameters have been set, the net amount of I bonds issued is determined not by how much of the security the Treasury chooses to auction off net of maturing bonds, as they do with TIPS, but rather investor purchases and redemptions. Unlike TIPS, if the Treasury wants to increase or decrease issuance, it cannot just issue more or fewer bonds. Rather it must adjust the fixed rate for the next six months to influence investor demand. Investor demand subject to the cap and the Treasury-determined fixed rate thus essentially dictate the issuance and redemption of I bonds. Moreover, the horizons of the two instruments differ, with the government committing to an I bond maturity of 30 years unless investors want to redeem sooner. In fact, the first I bonds issued will not actually mature until 2028. The limited set of tools the Treasury has in the I Bonds program along with the slow pace of redemption on account of the maturity period makes it difficult to fine-tune supply. During periods in which future fiscal burdens are perceived as small, this is not binding, but when investors are concerned about long-term inflation, the Treasury has to change program rules to affect issuance directly.

For example, during the middle of the 2008-2009 financial crisis, the Bush administration made one of the most substantive reforms to the program since it was first conceived: the purchase cap was reduced to $10,000 (72 Fed. Reg. 67853). The primary reason cited was the need to divert some of this demand for I bonds to TIPS. The high level of uncertainty about inflation due to the financial crisis might have driven up Series I demand significantly, especially if the manner of deflationary protection provided differed substantially from TIPS. It is possible then that the cap was introduced to prevent Series I from becoming a great fiscal burden, even if it limited investment options for savers. As a result of this change, for much of the time since 2007, net issuance has actually been negative. Figure 6 shows this annual I Bond issuance. Regardless of whether it was intended to shrink the scope of the program or not, the reduction in the cap effectively did that.

Historically the US Treasury has set the real rate on I Bonds to be below the real rate on TIPS. For example, as of June 30, 2022, investors could buy a 30-year TIPS bond at a real rate of 0.96%, while the I bonds had a real yield fixed component of 0%. Arak and Rosenstein (2006) analyze the spread between I bonds and TIPS during a time period when the spreads were as large or larger than they are today (1999-2004). They estimate the value of the tax deferral and early-redemption option for investors and conclude that these features may be sufficiently valuable as to offset the lower real rate of I Bonds.

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7 An additional amount of up to $5,000 in paper I Bonds can be accessed if a tax filing household is due a tax refund and files IRS Form 8888.
C. Other Inflation-Indexed Liabilities

The fact that a large portion of implicit government debt is already in effectively inflation-linked entitlement programs such as Social Security and Medicare could in theory play a similar disciplinary role for government borrowing as inflation-linked bonds do. These benefit programs promise streams of cash flows that are linked to inflation. In the case of Social Security, benefits are indexed to wage growth before an individual’s retirement and indexed to inflation thereafter. In the case of Medicare, the rules are complex but for a given promise of medical services, it is clear that such a promise increases in nominal dollars to the extent that increases in inflation affect the cost of medical services.

Inflationary fiscal or monetary policy would not reduce the promised cash flows associated with a purely inflation-linked benefit stream. Rising inflation would put increasing pressure on the unified federal budget, providing incentives for the federal government to increase taxes or reduce other spending to prevent further increases in debt. Two key factors limit this discipline, however. First, Congress can make changes to these programs without deleterious effects on its borrowing costs, so program costs are not necessarily expected to increase fully with inflation in the future. Second, Social Security and Medicare can only be viewed as partially inflation-protected, given the rules of these programs. The unindexed thresholds in the US personal income tax code for Social Security benefits subjects an increasing share of Social Security benefits to taxation, and rising Medicare premiums often rise faster than Social Security’s cost of living adjustment (Munnell and Hubbard 2021).

III. Inflation Expectations and Market Prices

One advantage of a market for inflation-indexed debt is that it should provide an opportunity for officials and the public to read a signal of market expectations of future inflation from market prices. The difference between a nominal yield and a real yield of the same tenor is often described as a “breakeven rate”. Rearranging Equation (1) makes it clear that a breakeven rate reflects not only the market-implied rate of expected inflation but also a compensation for the risk that inflation will deviate from expectations as of the time of issue:

\[
\text{Expected Inflation} = (\text{Nominal Yield} – \text{Real Yield}) – \text{Inflation Risk Premium}
\] (2)

Considering only this factor, the breakeven rate would be an upper bound on a measure of market-implied expected inflation, since the yield on inflation-indexed debt reflects the valuable insurance provided by real debt against inflation rising above expectations.

In US Treasury markets, the breakeven rate for a given tenor is defined more explicitly as the difference between Treasury and TIPS yields.

\[
\text{US Breakeven Rate} = \text{Treasury Yield} – \text{TIPS Yield}
\] (3)

In interpreting the US Breakeven Rate relative to market-implied inflation expectations, one must consider an additional factor beyond the fact that the nominal bonds include an inflation risk premium. In addition, the exceptional liquidity of nominal Treasury debt pushes down its yields, introducing a countervailing downward bias in the US Breakeven Rate as a measure of expected inflation. That is, liquidity and convenience of nominal US Treasury bonds likely pushes down nominal yields relative to TIPS and any other securities that do not share the same money-like quality as nominal bonds (Krishnamurthy and Vissing-Jorgensen 2012). Whether the Treasury benefits from issuing TIPS or not can be seen as a question as to whether the losses to the Treasury of issuing less-liquid securities in the form of TIPS are outweighed
by the gains to the Treasury of not having to compensate investors for the inflation risk premium (Christensen and Gillan, 2011).

Combining equations (2) and (3) and recognizing that the observed nominal yield includes downward liquidity pressure, generates the following expressions for expected inflation, or equivalently for the relationship between the US Breakeven Rate and expected inflation.

\[
\text{Expected Inflation} = \text{US Breakeven Rate} + \text{Liquidity Adjustment} - \text{Inflation Risk Premium} \quad (4a) \\
\text{US Breakeven Rate} = \text{Expected Inflation} + \text{Inflation Risk Premium} - \text{Liquidity Adjustment} \quad (4b)
\]

In markets other than the US, the liquidity adjustment is expected to be somewhat smaller, as non-US nominal bonds generally do not have the same convenience yield as US Treasuries given the dollar’s critical role as a reserve currency. UK gilts may also have somewhat lower yields reflecting their important role in financial markets (Jiang, Krishnamurthy, and Lustig 2021). An additional factor affecting UK markets is that UK inflation-linked gilts (“linkers”) pay a return that is linked to the Retail Price Index (RPI), an index which is estimated to exceed overall consumer price inflation by as much as one percentage point.

Figure 7 shows the US Breakeven Rate as defined by the Treasury bond markets on the left side of equation (4b). The figure shows the 5-year, 5-year forward 5-year rates, and 10-year rates. The breakeven inflation rate on a five-year horizon spiked in 2022 to above 3%, a level not seen previously during the two decades for which these data are available. The 5-year forward 5-year rates have increased coming out of the Covid crisis period but remained moderate by historical standards. Furthermore, the breakeven inflation rates prevailing in 2022 were substantially below the trailing 12-month inflation, which reached 9.1% in the year ending June 2022.

Figure 8 shows breakeven inflation rates implied by the UK inflation-linked gilt market versus nominal UK gilts. These breakeven rates have been somewhat less variable over the past two decades than the US breakeven rates, but also at somewhat higher levels, perhaps reflecting the fact that the market inflation expectations reflected in the index-linked gilts are RPI rates as opposed to CPI rates.

Various research papers have estimated a range of values for the inflation risk premium, although these estimates are highly dependent on model assumptions. In Treasury bond data from 1965 to 2005, Buraschi and Jiltsov (2005) estimate an inflation risk premium that averages 70 basis points. The Federal Reserve Bank of Cleveland estimates the inflation risk premium using a model-based approach, and its value has largely stayed within a range of 30-50 basis points since the start of the series in the mid-1980s (Haubrich, Pennacchi, and Ritchken 2012).

Measures of the liquidity effect on nominal Treasury bonds can be directly estimated by comparing breakeven inflation rates based on the Treasury-TIPS spread with inflation swaps. In an inflation swap contract, counterparties exchange a stream of nominal cash flows for a stream of inflation-linked cash flows. Fleckenstein, Longstaff, and Lustig (2014) calculate these spreads on a cashflow-by-cashflow basis in US data on individual bonds through 2009; they document substantial “mispricing” between the Treasury-TIPS breakeven rate and the inflation swap rate. Such price differences may reflect limits to the depth of capital available to arbitrage away price differences (Shleifer and Vishny 1997) but may also reflect fundamentally different liquidity properties of Treasuries versus TIPS. An assessment by Sack and Elsasser (2004) argues that “because of the low valuation of [TIPS] relative to nominal securities, inflation-indexed debt has not yet lived up to its purpose of reducing financing costs for the Treasury.” D’Amico et al (2018) use no-

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8 Other papers have studied the properties of these risk and liquidity premia over time. For example, Pflueger and Viceira (2011) empirically estimate risk and liquidity premia in both nominal and real bonds, finding significant variation.

9 For further details, see FRED series “Inflation Risk Premium” (Series ID: TENEXPCHAINFRISPRE)
arbitrage term structure models to find that TIPS yields exceeded true underlying real yields by as much as 300 basis points during the financial crisis period of 2007-2008.

Figure 9 offers a similar analysis at an aggregate level, comparing US zero-coupon inflation swap rate (for 5-year, 10-year, 15-year, and 20-year tenors) with the breakeven rate of inflation at the same horizon. This is not a perfect arbitrage comparison given that the swaps are zero-coupon and the breakeven rate is calculated for Treasury securities of a given maturity using Federal Reserve methodology (Gürkaynak, Sack, and Wright 2010).10 The differences plotted in the graph follow a similar pattern to those found by Fleckenstein et al through the end of their sample period in 2009; after that coupon rates on Treasury securities were very low, implying a close match between maturity and duration, so that breakeven inflation is more directly comparable to the zero-coupon inflation swap. Since the market dislocations of 2008-9, the deviations between the actual and synthetic breakeven rates have generally ranged between zero and 50 basis points, with the longer maturities generally showing larger differences. The most recent observations in 2022 are close to the highs for the post-2009 series, indicating that breakeven inflation implied by the TIPS and Treasury markets seems low compared to levels of expected inflation implied by inflation swaps. Ultimately, therefore, the observed differences between the US breakeven rate and inflation implied by the swap market, do not seem so large as to outweigh the typical estimates from the literature of the inflation risk premium.

Figure 10 shows the results of a similar analysis carried out on UK data. Since the UK zero-coupon inflation swap is also defined relative to the RPI, the use of RPI rather than CPI should not materially affect the liquidity analysis. Compared with the US series in Figure 9, several key differences emerge. First, the dislocation in the financial crisis was not as large but extended for a longer period of time. Second, while the pricing differences were also roughly in the zero to 50 basis point range for the 2011-2021 decade, they generally have hovered around zero for the longer tenors (15-year and 20-year), suggesting that there is little or no excess liquidity in gilts of these longer-term maturities. Third, during the 2022 inflationary episode, the difference between the UK breakeven rate and the zero-coupon inflation swaps for the 5-year rose to its highest level since the financial crisis reaching almost 150 basis points, and the 10-year rose to its highest level since 2013, reaching nearly 100 basis points.

Figure 11 demonstrates the relationship between breakeven inflation rates and inflation expectations, particularly those of consumers, in the United States.11 Without the liquidity adjustment and inflation risk premium, one might expect these to be roughly equal, if one assumes that the inflation expectations of consumers reflect the inflation expectations of the marginal investor. In reality, however, expectations consistently outpace breakeven inflation rates, suggesting that the liquidity adjustment is greater than the inflation risk premium. This behavior has changed recently at the short end, however, where the three-year breakeven inflation has increased by over three hundred basis points in the last eighteen months but inflation expectations have increased only by about half that.

The implication, especially lacking any movement on the short end of the illiquidity measures suggested by the top panel of Figure 9, is that the inflation risk premium on a three-year horizon has increased substantially in the last two years. The bottom panel shows that whether this divergence has also occurred on at longer horizons depends on which forecasts one uses to measure expected inflation. If the

10 Gürkaynak, Sack, and Wright (2010) calculate a zero-coupon yield for each individual interest payments due between now and maturity for all outstanding nominal and inflation-indexed securities, and then use that set of interest payments to calculate a yield for a given time period based on the Nelson-Siegel-Svensson functional form. The breakeven inflation rates are merely the difference between nominal and real yields for a given period.
11 Consumer expectations for the ten- and three-year horizon are represented by both University of Michigan’s and the New York Federal Reserve’s Survey of Consumer Expectations, respectively. These surveys gauge the general public regarding their expectations for the inflation rate over certain time frames. In both surveys, each response is weighted via demographic characteristics and confidence of prediction.
long-term consumer inflation forecasts published by the University of Michigan are used, the expected rate and breakeven rates seem to move in tandem with relatively constant spreads between them. The story changes quite considerably, however, if professional forecasts might more closely mirror the expectations of the marginal investor. The breakeven rate more closely tracks professional forecasts of the Philadelphia Fed Survey, with the inflation risk premium shrinking and/or the liquidity adjustment increasing to drive a wedge between expected inflation and the breakeven rate only during flights to safety or particularly near-deflationary periods, like the mid-2010s. Otherwise, the relative parity between breakeven inflation rates and inflation expectations demonstrates that the inflation risk premium and liquidity adjustment are close to equal, which as shown in equation (4a) leads to the breakeven rate being very close to inflation expectations. Thus, the recent return to a market where breakeven inflation and expectations more closely mirror one another is an expression of an increase in the inflation risk premium over the last year to a magnitude that more closely matches the liquidity premium.

Figure 12 shows that in the UK, consumer inflation expectations, as measured by the Bank of England/Ipsos Inflation Attitudes Survey, are closely linked with the long-term behavior of breakeven inflation. As shown in Figure 10, the liquidity adjustment on inflation-indexed gilts at short-to-medium maturities is quite substantial, having been this way since the end of the Great Financial Crisis but increasing dramatically in the past year. Under such circumstances, other things equal one might expect that the gap between the breakeven inflation rates and inflation expectations to widen, but in practice it shrunk. Taken together, the evidence suggests that both the liquidity premium and the inflation risk premium have increased substantially, with the inflation risk premium having increased even more.

Overall, if US consumer expectations are reflective of the expectations of the marginal investor, then the liquidity adjustment has often been greater than the implied inflation risk premium in nearly all time periods and tenors we consider prior to the current inflationary wave. During the current inflationary wave, the gap between expected inflation and the breakeven rate collapsed on the shorter (3-year) tenor, suggesting an increase in the inflation risk premium to the level of the liquidity penalty. If professional forecasters reveal the survey expectations of the marginal investor, then there has been a similar convergence at the long (10-year) end of the curve. In the UK, expected inflation and breakeven inflation have more closely tracked each other at the shorter maturities, and have shown a similar convergence as seen in the US at the longer horizons, where the liquidity penalty has generally remained stable. Lacking sufficient movement in the liquidity adjustment to offset the growth in breakeven inflation, equations (4a) and (4b) imply that the inflation risk premium must have increased.

IV. Conclusion: Expanding Markets for Inflation-Indexed Debt

In this section, I conclude with a short assessment of two options for expanding markets for inflation-indexed government debt. The main advantages of expanding government issuance of inflation-indexed debt would be more accurate market-based inflation signals for the Fed and market participants, the avoidance of Treasury having to pay an inflation risk premium, more access by market participants to inflation protection, and more discipline by the federal government. The disadvantages are that Treasury must pay any liquidity spread over regular government bonds or find a way to eliminate that spread, as well as the fact that in inflationary episodes interest rates automatically would increase placing a greater burden on the budget. Given the disciplinary role that inflation-indexed debt serves, the latter may be more of a feature than a bug.

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12 Inflation expectations of economic professionals, obtained from the Philadelphia Federal Reserve’s Survey of Professional Forecasters, estimate the inflation for the next year are based on the geometric mean of the forecaster’s prediction for each of the coming four economic quarters.
The evidence presented in this paper suggests that after what appears to be a recent increase in the inflation risk premium, the observed differences between the breakeven rates and inflation implied by the swap market do not seem so large as to outweigh the typical estimates from the literature of the inflation risk premium. Thus, even without changes to that might address liquidity in the inflation-indexed market, there is a case to be made for expanding the issuance of TIPS. That case would be even stronger if the TIPS market were expanded in conjunction with actions that would increase its liquidity. Indeed, if one of the key disadvantages to the main form of inflation-indexed debt as it currently structured is the liquidity cost, it would be valuable to consider whether this liquidity cost could be addressed directly rather than assumed to be unalterable.

In fact, there are two important aspects of the structure of TIPS that dramatically reduce their liquidity. First, an already small market is spread over many maturities, and to complicate matters the deflation protection in TIPS means that the amount of inflation that has occurred since the issuance of a given inflation-protected TIPS bond affects the amount of deflation protection that the bond has should price changes turn negative (Cochrane (2015)). A TIPS bond that has only a small historically-embedded inflation increase has more deflation protection than one that does not. Second, as explained in Section II.A, TIPS have a complex tax treatment. The adjustments that occur to the principal trigger an immediate tax liability even though the investor has not actually realized a capital gain.

Fortunately, both of these problems could be addressed. The tax treatment of TIPS could be changed so that principal increases due to the inflation indexation are not taxed upon accrual. Deflation protection could also be defined in a way that did not vary with the price of the bond relative to its original face value, either by eliminating the deflation protection, or by allowing the adjusted face value to fall below its original value. In addition, liquidity would improve if substantially more bonds were issued. It is unlikely that the liquidity effect would go to zero, but it could be substantially reduced.  

Another way of issuing more inflation-linked debt would be to liberalize the market for I bonds. A straightforward approach to this would lift the $10,000 per Social Security number cap, as suggested by Rauh and Warsh (2022). The Protecting Americans’ Savings Act of 2022 introduced in the 117th Congress on March 9, 2022 and referred to the Committee on Financial Services and Committee on Ways and Means, would “direct the Department of the Treasury to report on the effects of inflation on the value of individuals' savings and the feasibility of raising the current individual limit on inflation-protected Treasury Series I Savings bonds.” The I bond market could also be made more liquid by allowing for earlier withdrawals penalty-free. These measures would bring substantial additional savings into the I bond market, as owners of I bonds often report wanting more I bonds than they can access.

A further obstacle to I bond purchases relates to the antiquated nature of the Treasury Direct website, with which users often report bad experiences. According to Fuller and Zweig (2022) in the Wall Street Journal, some customers are not instantly approved for Treasury Direct accounts, especially if their information does not match the Treasury’s verification information on file. In this case, the taxpayer must have their signature certified on IRS Form 5444, a process which involves finding a bank branch that provides this service. Modernizing the Treasury Direct website and verification process, improving liquidity, and lifting the cap would be all be popular measure among savers.

There are two main objections that might be raised against such measures. The first is the claim that even with improvements in the market, the government will still lose more in the liquidity reduction it suffers when moving from nominal to real debt than it will gain by not having to pay the inflation risk premium to investors. The analysis in this paper has shown that the magnitude of this effect is not as large

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13 In addition, Cochrane (2015) points out that if all bonds were perpetual, the debt would be considerably more liquid, as the bonds would be identical rather than divided into hundreds of distinct securities.

14 According to this article, the fact that some “investors give up vacation and drive hours to navigate bureaucracy” indicates that they place a high value on access to this inflation protected savings vehicle.
relative to the inflation risk premium as might be assumed, particularly at times when investors are worried about inflation. Except in periods of serious market dislocation like financial crises, breakeven inflation rates do in fact proxy inflation expectations in the professional forecaster market and have come much closer recently in the consumer market – and this before any attempt to reform and improve the liquidity of the inflation-linked market.

The second objection is that generally that inflation-linked bonds are costly to the government in periods of inflation, as interest payments would automatically rise with inflation. But this is an ex post statement. From the perspective of optimal debt policy, what the government should care about is the ex ante tradeoff between liquidity premium and inflation risk premium. Furthermore, the rise in interest payments in inflationary episodes when there is inflation-linked debt provides an incentive for fiscal policymakers to address inflation. Given the acknowledged role that fiscal policy plays in inflation, the recognition by policymakers ex ante that inflation would have a more direct impact on debt costs would provide a strong disciplinary incentive to avoid and combat inflation.

It has long been stated that inflation is a stealth tax on savings. If the government actually wishes to limit this stealth tax, it could easily do so by raising the share of inflation-indexed debt and making such debt more liquid.

References


Christensen, Jens, and James Gillan. “Has the Treasury Benefited from Issuing TIPS?” *FRBSF Economic Letter* 2011, no. 12 (18 April 2011).


Fuller, Andrea and Jason Zweig, “If Inflation Hasn’t Made You Crazy, Try Buying an I Bond.” Wall Street Journal (29 June 2022).


Figure 1: Proportion of Outstanding Debt by Maturity

Note: Figures obtained from the *Monthly Statement of Public Debt*, Jan 2001-Feb 2023, end of calendar year, except 2023 which is as of February 28, 2023.
Figure 2: Expected and Actual Inflation vs. Treasury Yields

Note: Expectation figures obtained from New York Federal Reserve’s Survey of Consumer Finances, University of Michigan Survey of Consumer Finances, and the Philadelphia Federal Reserve’s Survey of Professional Forecasters; CPI and Treasury yield obtained from the Federal Reserve. Data are through Feb 2023.
Figure 3: Net Annual Issuance of Treasury Inflation-Protected Securities (TIPS)

Note: Figures obtained from the Monthly Statement of Public Debt, Jan 2001-Jan 2023.
Figure 4: Gross Monthly Inflation Adjustment for All Outstanding TIPS

*Note:* Figures obtained from the *Monthly Statement of Public Debt*, Jan 2001-Feb 2023. The figure represents the total inflation adjustment to the principal on all outstanding debt, by month.
Figure 5: Net Monthly Inflation Adjustment for All Outstanding TIPS

Note: Figures obtained from the Monthly Statement of Public Debt, Jan 2001- Feb 2023. The figure represents the net change in the total inflation adjustment to the principal on all outstanding debt (ignoring adjustments previously applied to maturing debt), by month.
Figure 6: Net Annual Issuance of Series I Bonds

Figure 7: Breakeven Inflation Rates from the United States

Note: Breakeven inflation figures obtained from the Gürkaynak, Sack, and Wright (2010); the authors calculate a zero-coupon yield for each individual interest payments due between now and maturity for all outstanding nominal and inflation-indexed securities, and then use that set of interest payments to calculate a yield for a given time period based on the Nelson-Siegel-Svensson functional form. The breakeven inflation rates are merely the difference between nominal and real yields for a given period. All series are through February 28, 2023.
Figure 8: Breakeven Inflation Rates from the United Kingdom

Note: Breakeven inflation figures obtained from the Bank of England; Anderson and Sleath, authors of the methodology behind the yields used to calculate breakeven inflation, built upon the work of Daniel Waggoner at the Federal Reserve, which uses a spline method combined with a roughness penalty that increases with time to generate a likely yield curve. All series are through February 28, 2023.
Figure 9: Zero-Coupon Inflation Swap minus Breakeven Inflation in the United States

Note: Inflation swaps obtained from Bloomberg [USSWIT05, 10, 15, 20], and breakeven inflation are the series shown in Figure 7 as calculated from Federal Reserve data. All series are through February 28, 2023.
Figure 10: Zero-Coupon Inflation Swap minus Breakeven Inflation in the United Kingdom

*Note:* Inflation swaps obtained from *Bloomberg* [BPSWIT05, 10, 15, 20], and breakeven inflation are the series shown in Figure 7 as obtained from the Bank of England. All series are through February 28, 2023.
Figure 11: Expected Inflation, Breakeven Inflation, and Actual Inflation in the United States
Figure 12: Expected Inflation vs. Breakeven Inflation in the United Kingdom