The Benefits to U.S. Taxpayers from an Open Market Buyback of Treasury Inflation-Protected Securities

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I. Introduction

On January 29, 1997, the U.S. Treasury issued the first U.S.-government security indexed to the rate of inflation, called Treasury Inflation-Protection Securities or "TIPS." These bonds insulate their investors from risks associated with unanticipated inflation by guaranteeing them a certain real or inflation-adjusted return, with the inflation measured by the Consumer Price Index or CPI. TIPS provide a guaranteed hedge against the losses in purchasing power which accompany increases in inflation; and since the inception of TIPS, its market has grown steadily. This market now accounts for about 10 percent of all outstanding Treasury debt instruments.[2]

To provide an effective hedge against whatever inflation develops, the interest or coupon rates for TIPS are set at the time of an issue, the principal is adjusted daily for changes in the CPI, and every six months interest payments based on the inflation-adjusted principal are paid. Since the security's underlying principal grows at the same rate as inflation, its real value is maintained and repaid at maturity. By contrast, other Treasury securities pay a set interest rate on a set principal amount. While their values in the secondary market fluctuate with changes in market interest rates, which in part reflect inflation, their interest payments and the principal repaid at maturity do not change. Unanticipated inflation, therefore, represents a significant risk to investors in conventional Treasury bonds, since higher than anticipated inflation reduces the purchasing power of both the interest payments and the principal repaid at maturity. When inflation over a bond's lifetime is less than was anticipated at its issue, TIPS will generally underperform conventional bonds. During periods of high, unanticipated inflation, however, TIPS generally outperform conventional Treasury bonds, thereby increasing the financing costs to the Treasury and taxpayers.

The Treasury issues TIPS in four terms to maturity – five years, 10 years, 20 years, and 30 years. To clarify our terms of analysis, we will focus here on all TIPS with a term to maturity of less than 10 years. This includes overall 20 TIPS issues, 16 of which were issued with an original maturity of 10 years and four which were issued with an original term to maturity of 5 to 5.5 years. This set includes some securities issued nine years ago and due to mature a year from now, as well as others due to mature five, six

[1] This report was prepared with support from NDN. The views and analyses are solely those of the authors.
[2] D'Amico, Stefania, Kim, Don. H and Min Wei (2008), "Tips From TIPS: The Information Content of Treasury Inflation Protected Securities," http://www.dallasfed.org/news/research/2007/07price_damico.pdf.

and nine years from today. These TIPS comprise the bulk of outstanding TIPS today and account for more than 50 percent of the notional outstanding value of the overall TIPS market.[3]

With roughly 10 percent of the market of the Treasury bond market, TIPS can have serious revenue effects if inflation performs significantly differently from what the market has anticipated. Our analysis of the current market suggests strongly that TIPS investors are currently misjudging future inflation to a significant extent. If this analysis is correct, the Treasury and taxpayers stand to incur substantial future financing costs as TIPS purchased with the expectation of low inflation or deflation are adjusted for the higher inflation that actually occurs. As a result, the Treasury could save taxpayers substantial sums by buying back outstanding TIPS and issuing conventional bonds in their place.

This analysis estimates the costs to taxpayers if current market-implied expectations of moderate short-term deflation and sustained low inflation over the next 10 years prove incorrect. We document these current inflationary expectations based on current pricing of TIPS. We then use historical data as well as general macroeconomic analysis to estimate the likely path of inflation over the next 10 years and to calculate the cost to taxpayers under such a scenario. We estimate that the present value of the interest payments and principal repayments for outstanding TIPS with 10-year and shorter maturities under the most likely path for inflation comes to $414.76 billion. Next, we estimate the cost to the Treasury of buying back those TIPS, which comes to $365.77 billion. Assuming that TIPS purchased from the market can be efficiently refinanced by issuing nominal Treasury bonds, we conclude that a policy of buying back outstanding 10-year TIPS could save the Treasury and U.S. taxpayers $48.99 billion, in present value terms. If this buyback program were extended to TIPS with longer maturity terms, the savings for taxpayers could be substantially greater.

These estimates depend crucially on judgments or assumptions about how inflation will behave over the next ten years. The calculations above are based on our baseline judgment that in the long-run, inflation levels will most likely revert to the long-run average rate of 2.5 percent. It is very unlikely but still possible that the present, very low inflationary conditions associated with the financial crisis and deep recession will persist, lowering the potential gains from the buyback. However, given the government's current policies of extraordinary monetary ease and fiscal stimulus, we consider it more likely that actual inflation over the next ten years will exceed the long-term average, producing greater savings from a buyback program.

For a clear sense of the range of these effects, we also estimate the savings under two alternative inflation scenarios: If inflation over the next ten years averages just 1.5

[3] While the secondary-market trading volume of TIPS has increased gradually, it remains much lower than that for other Treasury securities, so that the TIPS market is not nearly as liquid as the markets for conventional Treasuries of comparable maturity. As a result, the yield on TIPS incorporates this liquidity premium, which at times may be substantial.

percent per-year, we estimate that taxpayers would still save $29.43 billion from a buyback program targeted at TIPS with 10 years or shorter maturity. If annual inflation averages 3.5 percent for the next decade, those savings would reach $69.6 billion. The higher the actual inflation rate, the greater interest and principal repayments on TIPS that Treasury will have to make and thus the higher the taxpayer savings from replacing those TIPS with conventional Treasury notes. In all cases, we find that a buyback policy would produce positive and substantial gains for the Treasury and the taxpayers.

II. Analyzing the Market's Current Inflation Expectations from TIPS Pricing

In principle, the market's expectations of future inflation can be gauged by comparing the yields on TIPS and conventional Treasury securities of comparable maturities. The yield-to-maturity on conventional Treasury bonds that pay investors a fixed, nominal coupon or interest rate and a fixed, nominal principal at maturity must compensate them for the inflation expected by those investors to accrue over a bond's lifetime. Therefore, the nominal yield on a conventional Treasury security includes a "real" rate of interest plus compensation for the inflation expected over the security's maturity horizon. By contrast, with TIPS, the interest payments and principal amount both rise and fall with the CPI, so their yield is the market's proxy for the real rate of interest. Therefore, the difference between the yields on conventional Treasury securities and the yield on TIPS should reflect the compensation for inflation embedded in the conventional securities. This inflation compensation is referred to as the "breakeven" inflation rate, because if future inflation actually tracks this rate, the realized returns from conventional Treasury bonds and TIPS of the same maturity will be the same.

The Federal Reserve Board commonly uses this comparison to gauge the market's view of future inflation. For example, the minutes of the June 2006 Federal Open Market Committee (FOMC) note,

> *"Yields on inflation-indexed Treasury securities increased by more than those on nominal securities, and the resulting decline in inflation compensation retraced a substantial share of the rise that had occurred over the preceding intermeeting period."*

References to the TIPS breakeven rates also appear often in public statements by Federal Reserve officials, and are frequently cited by the financial press in discussions of inflation expectations.[4]

There are two caveats to using this breakeven inflation rate to measure the market's inflationary expectations. First, it technically measures the compensation that investors in conventional Treasury bonds receive both for expected inflation and for bearing the risk that actual inflation may deviate from those expectations. The breakeven

[4] Federal Reserve Board Vice Chairman Kohn's speech in April 2006 included the following: "[L]onger-term inflation expectations remain well contained. . . . inflation compensation for investors implied by the spreads between the rates on nominal and CPI-indexed Treasury notes at both five- and ten-year maturities also has not shown any tendency to move higher on balance."

inflation rate, therefore, includes both expected inflation and an "inflation-risk" premium. Ideally, we would subtract the inflation-risk premium from the breakeven inflation rate and be left with a pure measure of inflation expectations – if we knew what the inflation-risk premium was. However, since the risk premium should be generally stable over relatively short periods of time, changes in the breakeven inflation rate should capture changes in the market's inflation expectations even if we don't know the inflation-risk premium. The second caveat is that TIPS yields contain a "liquidity premium:" The market for TIPS, while growing, remains relatively small compared to the market for conventional Treasuries; and to the degree that TIPS are less liquid than conventional Treasury paper, investors will demand a premium for holding TIPS over conventional Treasuries. Here, too, the liquidity premium should be generally stable over relatively short periods, so again, changes in the breakeven rate will capture changes in the market's inflationary expectations.[5]

The Breakeven Rate as a Predictor of Inflation

For these reasons, TIPS breakeven rates are seen by many in the financial community as a plausible measure of market inflation expectations. However, empirical evidence indicates that these breakeven rates are very sensitive to news, such as a sharp rise in the core CPI,[6] raising the question of how well the breakeven rate predicts actually realized inflation. If the breakeven rate does not accurately track either inflation expectation or actual inflation, TIPS investors may be seriously misjudging the real prospects for inflation, with potentially large costs to the U.S. Treasury and taxpayers.

One way to evaluate these issues is to compare the level and variability of breakeven rates with survey forecasts of inflation, such as the Michigan survey which polls households and the SPF survey which polls business forecasters. Figure 1, below, shows the long-term inflation forecasts by the Michigan survey and the 10-year SPF survey, compared to the 10-year TIPS breakeven inflation rate. With a few exceptions, the TIPS breakeven rates were substantially lower than the Michigan survey throughout the 1999-2007 period and lower than the business forecasters' survey for much of this period.[7] Generally, consumers and business forecasters have expected higher future inflation than implied by the TIPS breakeven rate, despite the assumption that the breakeven rate includes a positive inflation-risk premium. Nor can we ascribe the fault to the survey forecasts: A recent study found that such surveys forecast inflation more accurately than various model-based measures,[8] and another new study has shown that the SPF survey forecast inflation better over 1997-2007 than the 5-year TIPS.[9]

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[5] FRBSF Economic Letter (2005).

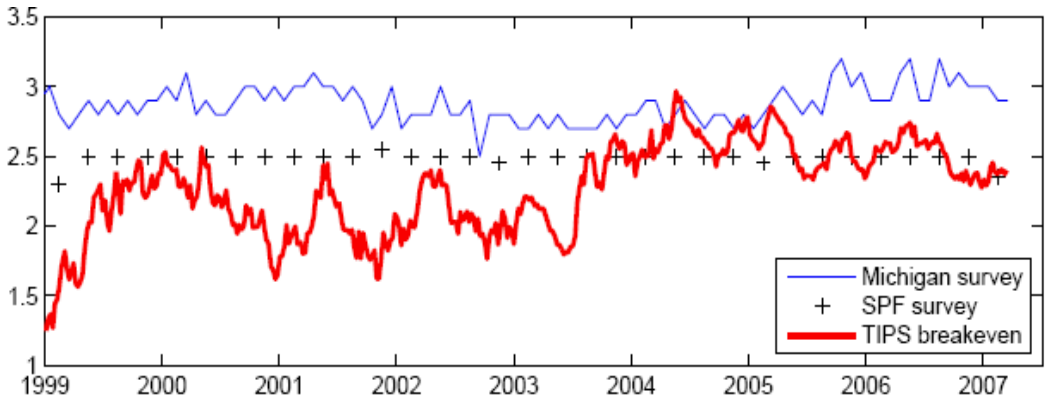
[6] For example, in the working paper version of Gurkaynak, Sack, and Swanson (2005), they find that a higher than-expected core CPI data release typically leads to a rise in the breakeven rates, suggesting an upward revision in inflation expectations. Gurkaynak, R., B. Sack, and E. Swanson (2005), "The Sensitivity of Long-Term Interest Rates to Economic News: Evidence and Implications for Macroeconomic Models", *American Economic Review*, 95, 425-36.

[7] D'Amico et al. (2008).

[8] Ang, A., G. Bekaert, and M. Wei (2007b), "Do Macro Variables, Asset Markets or Surveys Forecast Inflation Better?" *Journal of Monetary Economics,* 54, 1163-1212.

[9] D'Amico et.al., op. cit.

Figure 1: Inflation Forecasts and TIPS Breakeven Rate



Underscoring these findings, other researchers have compared changes in the TIPS yield spread to changes in inflation forecasts by the Livingston Survey conducted for the Federal Reserve Bank of Philadelphia, covering economists in industry, government, banking, and academia.[10] The absolute, annual change in the 10-year consensus inflation forecast reported by the Philadelphia Fed Survey averaged only 0.17 percentage points throughout the 1990s, just one-fourth of the average annual change in the TIPS yield spread from July 1997 to July 2001. For example, the Livingston inflation forecast edged down from 2.76 percent at the end of 1997 to 2.45 percent a year later, and then crept back up to 2.53 percent by the end of 1999. Over the same period, the TIPS yield spread plummeted from 2.46 percent in late 1997 to a remarkably low level of 0.89 percent a year later, and then rose back to 2.0 percent by the end of 1999. Compared to changes in survey forecasts, the TIPS yield spread is much more volatile and variable, too much so to be a reliable proxy for market-wide changes in expected inflation.

We also can evaluate the significance of the breakeven rate by comparing it to actual inflation. In theory, the expected inflation captured by the breakeven rate should be a reasonably accurate predictor of actual future inflation. Since investors may incur losses when their inflation forecasts are wrong, at a minimum they will try to forecast future inflation as accurately as possible; and their average forecast should reflect all of the information about future inflation available to investors. To evaluate this issue, we use 10-year conventional and inflation-indexed Treasuries, both of which are auctioned regularly by the Treasury and circulate in developed secondary markets. (Ten-year TIPS are the most liquid TIPS.) Table 1, below, shows the nominal yield on 10-year conventional Treasury notes, the real yield on the 10-year TIPS, and the consequent spread between them, on a monthly basis from January 2003 to December 2008.[11] These yields are for constant maturity securities, reflecting average yields for all outstanding securities with a 10-year maturity period. The breakeven inflation rate was 1.76 percent at the beginning of this period and 0.25 percent at the end, and the average breakeven rate over the six-year period was 2.26 percent. Unfortunately, to rigorously assess the implicit

[10] Shen and Corning (2001).

[11] Date on TIPS 10-year bond yields comes from the Federal Reserve Bank of St. Louis' economic database (FRED) for January 2003-December 2008. See http://research.stlouisfed.org/fred2/categories/115.

inflation forecast from 10-year yields, compared to actual 10-year average inflation rates, would require data covering a longer period covering successive business cycles.

However, alternative approaches can help us evaluate the predictive ability of the TIPS yield spread. One approach involves using past inflation rates to construct a realistic range for future inflation. A 2001 study used monthly CPI data to establish historical averages for inflation over 10-year periods from 1950 to 2001.[12] Based on 500 overlapping monthly averages of ten-year inflation rates, starting from1960, the analysis found that the actual 10-year average annual inflation rate has exceeded 2.5 percent fairly consistently since the early 1970s and has never fallen below 1.0 percent. In contrast, the TIPS yield spread has remained below 2.5 percent for most of its short history: This spread consistently has predicted lower inflation rates over its short history than those which actually occurred over most of the last half-century (Figures 2 and 3, below).[13]

Figure 2.

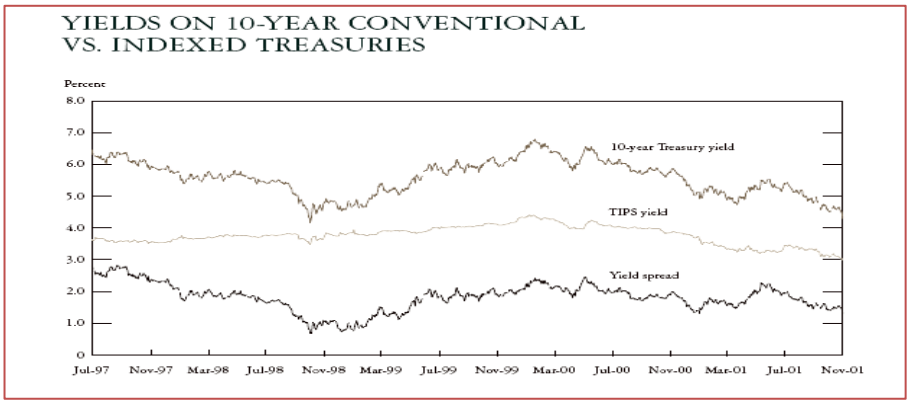
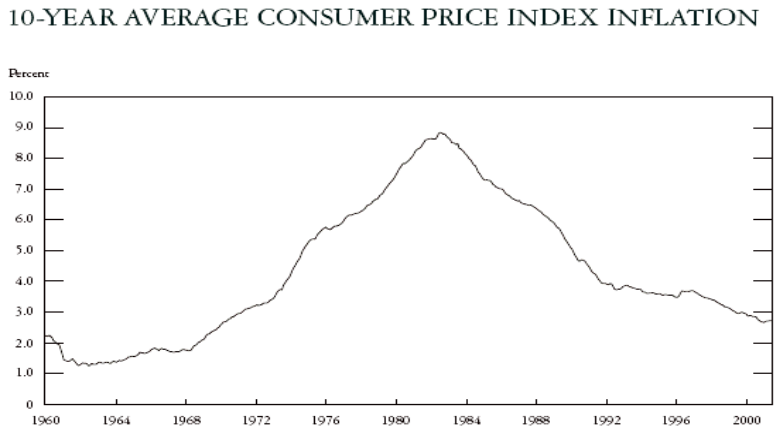


Figure 3.



[12] Shen, Pu and Jonathan Corning (2001), "Can TIPS Help Identify Long Term Inflation Expectations?", *Economic Review*, Federal Reserve Bank of Kansas City.

[13] Note that if were to include the period of the Great Depression (a period of deflationary pressures), we may get average inflation rates that are lower than the long-run averages we are predicting from the 1960s.

We extend this analysis to include more recent data, using month-to-month annualized inflation rates over 10-year periods that end from January 2003 through November 2008.[14] These data show that annual inflation has averaged 2.85 percent over the entire period and remained above 2.65 percent for the entire period. By contrast, the breakeven rate rarely reached 2.65 percent since 1997, when the first TIPS were issued. In November 1998, for example, the breakeven rate for 10-year TIPS was barely 1.0 percent, while the actual inflation rate over the 10 years starting in November 1998 averaged close to 3 percent annually. We conclude, consistent with previous studies, that the breakeven rate is a poor predictor of actual inflation. The following table provides these data in three-month increments for 2003-2007, and on a monthly basis since August 2008. A table showing month-to-month levels for the entire period is provided in Appendix A.

Table 1: Ten-Year Treasury Yields, Breakeven Rates and Actual Inflation Rates

Date	10- Year TIPS Yield	10-Year Treasury Yield	Breakeven Rate	Annualized 10-Year Inflation Rate
January-03	2.29	4.05	1.76	2.73
April-03	2.18	3.96	1.78	2.75
July-03	2.11	3.98	1.87	2.72
October-03	2.08	4.29	2.21	2.69
January-04	1.89	4.15	2.26	2.66
April-04	1.90	4.35	2.45	2.74
July-04	2.02	4.50	2.48	2.75
October-04	1.73	4.10	2.37	2.75
January-05	1.72	4.22	2.50	2.68
April-05	1.71	4.34	2.63	2.79
July-05	1.88	4.18	2.30	2.79
October-05	1.94	4.46	2.52	2.92
January-06	2.01	4.42	2.41	2.82
April-06	2.41	4.99	2.58	2.86
July-06	2.51	5.09	2.58	2.92
October-06	2.41	4.73	2.32	2.73
January-07	2.44	4.76	2.32	2.71
April-07	2.26	4.69	2.43	2.87
July-07	2.64	5,00	2.36	2.94
October-07	2.2	4.53	2.33	2.90
January-08	1.47	3.74	2.27	3.01
April-08	1.36	3.68	2.32	3.15
July-08	1.57	4.01	2.44	3.37
August-08	1.68	3.89	2.21	3.31
September-08	1.85	3.69	1.84	3.28
October-08	2.75	3.81	1.06	3.14
November-08	2.89	3.53	0.64	2.92
December-08	2.17	2.42	0.25	-

[14] *Ibid.*

In summary, the yield spreads between conventional Treasury securities and TIPS of comparable maturities do *not* reflect expected inflation, do *not* accurately predict future inflation, and exhibit much greater variability and volatility than forecast by business economists or consumers. As we will now show, current TIPS yields which predict sustained disinflation or deflation also are not supported by fundamentals.

III. The TIPS Market and Underlying Fundamentals

As Table 1 shows, the difference in yields on the nominal 10-year Treasury bond and the inflation-indexed TIPS recently has become extremely small -- 0.64 percent in November 2008 and 0.25 percent in December 2008.[15] This implies that investors expect inflation to run close to zero or negative over the next 10 years, since they are willing to accept nearly the same yields on nominal and inflation-protected Treasuries. If they expected positive inflation, the breakeven rate would be higher.

The most plausible explanation for this expectation is that investors today are pricing in the risk of a serious, sustained deflation associated with the current, dismal U.S. and global economic conditions. The Consumer Price Index has trended down since mid-2008, perhaps leading these investors to expect even lower inflation in the future. It is certainly the case that economic conditions do not support economic confidence for the short-term: The problems that started in housing markets now affect firms across the economy, unemployment has been rising at the fastest rate since the World War II demobilization, and bankruptcies and failures are widespread. Such conditions, both here and abroad, have depressed demand and sharply reduced commodity prices, including energy; and many economists predict that this dismal outlook conditions will persist well into 2010. It is unsurprising that investors would respond to these conditions and might be willing to accept smaller differences in the yields on nominal and inflation-indexed securities than were acceptable in the past.

The problem with this explanation is that it bases extended expectations – notably, the value of TIPS due three, five, seven, or even 10 years from now -- on developments that are still very recent and thus far short lived. This reasoning also does not take into account other notable developments, such as the actions by Congress and the new administration that will increase spending by as much as $1 trillion over the next two years. On top of the large, pre-existing, underlying deficits and bailout spending, these measures will produce huge budget deficits, measured both nominally and as a share of GDP, which generally are associated with subsequent inflationary pressures.

In addition to the extraordinary fiscal stimulus, the Federal Reserve has embarked on a series of equally extraordinary steps to stabilize the credit markets by providing funds on an unprecedented scale to banks and non-financial firm. Most notably,

[15] http://research.stlouisfed.org/fred2/series/GS10?cid=115; and http://research.stlouisfed.org/fred2/series/FII10?cid=115

- The Federal Open Market Committee (FOMC) has cut the federal funds rate by 500 basis points since September 2007, lowering it in December 2008 to a "zero bound" (a target of 0 to ¼ percent), and announced its expectation that conditions will warrant very low federal funds rates for some time.

- For the first time since the 1930s, the Fed has used its authority to lend in "unusual and exigent circumstances" to "individuals, partnerships, or corporations" that are "unable to secure adequate credit accommodations from other banking institutions."[16] Under this authority, the Fed used its discount window lending facility to facilitate the acquisition of Bear Stearns and stabilize AIG, Citigroup, and other major financial firms.

- The Fed also introduced a new auction system, the Term Auction Facility (TAF) to distribute discount window loans, and it has supported additional dollar liquidity around the world by increasing borrowing lines with its swap partners and expanding its network of swap lines with foreign central banks.[17]

- The Fed also created the Asset-Backed Commercial Paper Money Market Mutual Fund Liquidity Facility (AMLF) and Money Market Investor Funding Facility (MMIFF) to provide support to money market mutual funds coping with large redemptions, with non-recourse loans to banks so they can purchase asset-backed commercial paper from money market funds, and loans to a special, private-sector vehicle created to purchase a range of assets from these funds.

- The Fed also committed itself to provide loans to a new Commercial Paper Funding Facility (CPFF) created to purchase commercial paper from high-rated issuers.

- The Fed also established a new, $600 billion program to purchase agency debt and agency-insured mortgage-backed securities.

- Finally, the Fed created the Term Asset-based Securities Loan Facility (TALF) to spur lending to small businesses and households by committing up to $200 billion to support new issues of securities collateralized by auto, student, credit card and Small Business Administration (SBA) loans.[18]

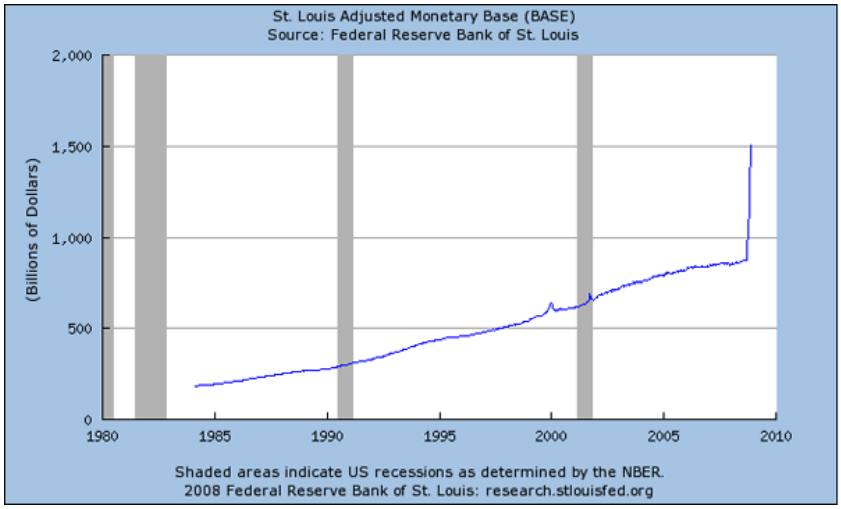
These steps already have produced vast expansions in the Federal Reserve's balance sheet and the nation's monetary base. Over the course of 2008, the Fed's balance sheet expanded from $900 billion to more than $2.2 trillion; and it continues to grow.[19] Moreover, from September 24, 2008 to the end of that year, the most narrow measure of the U.S. monetary base increased by more than $550 billion, an unprecedented 58 percent

[16] Section 13(3) of the Federal Reserve Act.
[17] http://www.frbsf.org/news/speeches/2009/0104b.html.
[18] The Treasury has committed $20 billion of TARP funds to protect the Fed against losses from the TALF.
[19] http://www.frbsf.org/news/speeches/2009/0104b.html.

increase in three months. This monetary base -- the sum of all currency and the reserves of commercial banks held by the central bank – provides the ultimate basis for future expansions of credit and the overall money supply. The Fed also has taken steps to ensure investors, businesses and individuals of its commitment to positive inflation in the future by publishing inflation forecasts for the next three years by FOMC members.[20]

The scale and the scope of these recent increases are unique in Federal Reserve history. In most years, the monetary base grows by one-to-two percent per-month and only very occasionally by as much as 5 percent per-month. From September 24, 2008 to November 30, 2008, the base grew twice as fast as during any previous two-month period in the Fed's history; and the absolute increase in that base over this brief period was greater than the entire monetary base at the end of 1999. The figure below, Figure 4, illustrates these recent increases in the monetary base, seen in the recent, unprecedented, vertical slope. When the economy stabilizes and begins to expand again, this vast expansion in the monetary base will almost certainly produce very large expansions in the broader monetary aggregates that reflect overall credit.

Figure 4. Increases in the Monetary Base, 1980-2008



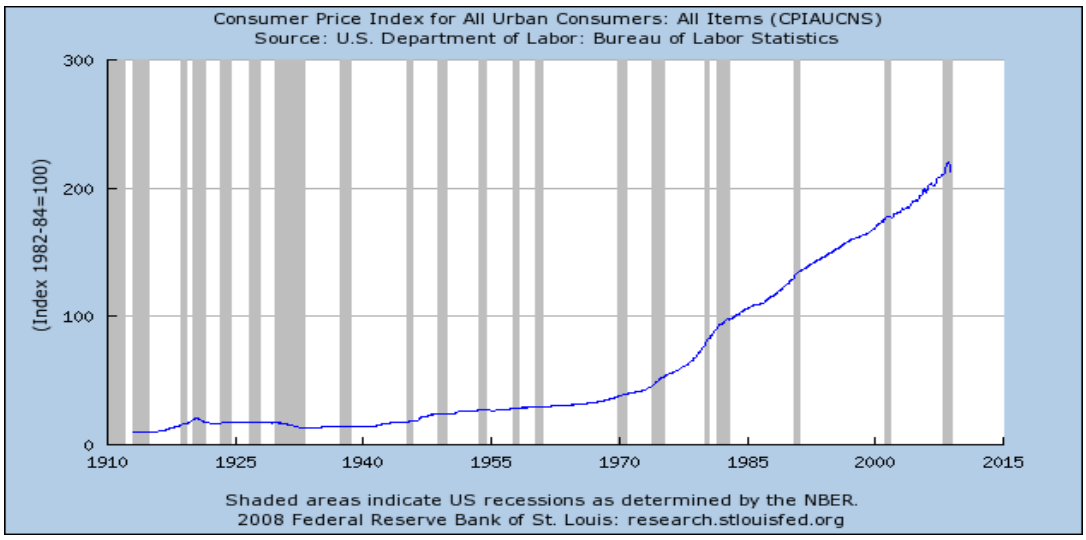
The path from large expansions in the monetary base and money supply to significant inflation is well known. Unless the Federal Reserve withdraws the excess reserves or raises interest rates sharply – an unlikely and dangerous course in the current business cycle – these huge increases in the monetary base will leave the demand for credit as the only real constraint on the provision of credit. Moreover, the liquidity that the Fed injected into the markets in such unorthodox ways may prove difficult to take back quickly when the time comes. The likely result is a process known as a wage-price spiral, which begins when firms borrow funds to build new office buildings, expand business centers, and the like, and thereby increase demand for the people to build the

[20] Studies by Refet Gürkaynak et al. (2005) suggest that a central bank's commitment to a long-term inflation objective helps anchor long-run inflation expectations.

buildings or operate the centers. When this goes on for a period of time, the supply of workers to manufacturing or service sectors begins to tighten, and the continuing demand for more workers drives up wages. As workers earn and spend more, demand for goods and services also rises, putting upward pressure on their prices– which in turn creates yet more demand for credit to expand the facilities, spurring yet another round of rising prices. Effectively, a wage-price spiral takes place when the supply of money increases faster than the supply of the goods and services purchased with that money.

These price increases unfold over an extended period; and while we cannot know their timing, we can be fairly certain that over the long run, the vast increases already seen in the nation's money supply will produce significant inflation. Figure 5, below, shows the long-trend of prices (CPI) since the Fed was created in 1913; and it is clear that steady price increases have accompanied the steady expansion depicted in Figure 4, above, for the years since 1985. This record, illustrating the long-run relationship between monetary expansion and inflation, suggests strongly that the modest deflationary decline in prices seen in this severe recession is unlikely to last long – and that current 10-year TIPS yields do not accurately reflect likely future inflation.

Figure 5. Increases in the Consumer Price Index, 1913 - 2010



There is another critical factor that affects long-term inflation trends in the United States: The definition of price "price stability" which the Fed uses to set its monetary policies. Although the Fed does not issue any formal statements about an inflation target, comments by FOMC members suggest that the central bank currently strives to keep the annual inflation rate above 2 percent. The upper bound of this target is unstated, but we believe that the fed's current "comfort zone" for inflation is 2 percent to 3 percent, which places our baseline scenario of 2.5 percent in the middle.

Lessons from Japan's Inflation-Indexed "Linkers" Market

The market for Japanese indexed bonds (JGBi), commonly called the "linkers" market, also provides important lessons. The Japanese Ministry of Finance (MOF) first issued these bonds in March 2004; but the market for them has remained very thin and illiquid, and the government has struggled to find buyers in recent years. In fact, according to press reports, Japanese investors have asked the MOF to cancel scheduled auctions of 10-year linkers for the rest of this fiscal year.[21] The very low, current demand for these bonds reflects strong deflationary expectations in Japan: The breakeven rate fell to minus 40 basis points in September and minus 130 basis points in November. These levels would seem to imply that investors expect significant deflation over the next 10 years; in fact, they mostly reflect very low demand for the bonds.

Many observers in Japan question the current pricing of the "linkers." In July 2008, for example, the six-year inflation-linked security was priced at 60 basis points of inflation, while the world's largest mutual fund firm, Fidelity, projected 1 percent annual inflation for Japan over the same period. Several firms have advised their clients that this period is a good time to invest in linkers, based on their expectations that investors, remembering the deflation of the 1990s, now place too much weight on current deflation, and that the value of these bonds will benefit as energy prices recover and consumption taxes rise, both elements of Japan's core CPI.[22]

While there are some parallels with the current conditions in the United States and the Japanese 1990s experience of mild deflation, the differences are greater and more significant. Both economies saw asset price bubbles, followed by sharp declines in equity and housing prices.[23] However, the Japanese government waited three years before embarking on large-scale fiscal stimulus, delayed eight years before taking steps to recapitalize its banking sector, and the Bank of Japan pursued moderate, "too little, too late" monetary ease for several years. By contrast, the United States has moved quickly to avoid deflation. The Treasury is recapitalizing financial institutions, establishing a policy that major financial institutions will not be permitted to fail; the Federal Reserve has taken the multiple steps outlined above to inject enormous liquidity into the system, including quantitative easing that has produced negative real interest rates; and the Obama administration and Congress have enacted the largest fiscal stimulus in U.S. history. Most policymakers in the United States have understood the painful lessons from the Great Depression and Japan's lost decade. It also appears that Japanese policymakers now appreciate those lessons as well, making another period of sustained deflation there unlikely as well.

Unless the long, historical record of factors contributing to inflation has ended abruptly, investors today are seriously mispricing TIPS. Such market "over-corrections" are common at times of unexpected and unusual volatility. The effects of significant

[21] http://forexdaily.org.ru/Dow_Jones/page.htm?id=339972.
[22] http://www.pimco.com/LeftNav/PIMCO+Spotlight/2007/Masanao+Cycilcal+11-2007.htm.
[23] http://www.ingwholesalebanking.com/content/documents/pdf/2008/12/Japan%E2%80%99sLostDecade CouldIt HappenOverHere-Financial%20Markets%20Outlook.pdf.

future inflation on the TIPS market, however, will reach U.S. taxpayers as well as the investors now mispricing the bonds: As inflation rises, the principal and interest payments that the Treasury will have to make will increase.

The Treasury can avoid these costs by entering the market, buying back TIPS at their current low prices, and reissuing the debt through nominally-denominated securities. If the net present value of the interest and principal payments of outstanding TIPS – their fair, fundamental value, which also can be thought of as a "hold-until-maturity" value -- is greater than the cost of buying them back and issuing conventional securities in their place, the Treasury and taxpayers will be better off under a buyback. In the following section, we analyze this policy, focused on 10-year TIPS and 10-year conventional Treasury securities. As we will see, we estimate that this policy could save taxpayers and the deficit nearly $50 billion over ten years (in present value terms).

IV. Methodology: A Brief Review

In this section, we describe our methodology, step by step, for calculating the net benefit to the Treasury from buying back all outstanding under 10-year maturity TIPS.

As noted earlier, these calculations cover buying back all outstanding TIPS with a maturity of less than 10 years. In principle, this analysis could cover all outstanding TIPS, including those maturing 20 or 30 years from today. However, such a proposal would almost certainly be impractical: At current prices (January 26, 2009), we estimate that it would cost nearly $520 billion to buy back all outstanding TIPS. Even this estimate is probably too conservative, since a new Treasury policy to start buying back all TIPS will produce sharp increases in their prices in secondary markets. The savings from such a broad, buyback program, therefore, would fall. Other considerations also support the decision to focus our analysis on the under 10-year maturity TIPS. For example, the Treasury reports that the 20-year and 30-year maturity term TIPS all mature at some point after 2025, which is so far in the future that any inflation projections become highly problematic. And as noted earlier, the under 10-year maturity TIPS constitute the bulk of all TIP securities outstanding today and account for more than half of the face value of all TIPs securities. In addition, the current mispricing of TIPS is likely to be most serious for the 10-year maturity term, since investors whose view of future inflation is biased by current conditions expect to recover their principal within a reasonably short investment horizon. Therefore, we limit this analysis to outstanding under 10-year TIPS, all of which mature on or before January 2019.

Step 1: To estimate the cost of a buyback program, we obtained data on the secondary market prices of all outstanding under 10-year TIPS, with their original coupon rates and dates of maturity. We increased the price of each security by the amount of the current accrued interest. We further adjusted these prices using the inflation index ratio provided by the Treasury, and multiply the result by the notional outstanding amounts of each security issue. The result, summed for all outstanding under 10-year TIPS issues, provides the initial estimate of the cost of buying them back.

Step 2: Next, we estimate the cost of *not* buying back these securities by calculating the cost to the Treasury of paying the remaining interest and repaying the principal on all outstanding under 10-year TIPS. To calculate the interest payments, made semi-annually on each security, we multiply the inflation-adjusted, outstanding notional value of these securities using half the coupon rate. To adjust the value of these securities for future inflation, we adopt certain assumptions about the average annual inflation rate over the course of the remaining life of the securities. As the base case, we use an annual average inflation rate of 2.5 percent to predict future inflation from January 2009 to January 2019. We expect inflation in near term to be considerably lower than that average, but we also expect that the current, extraordinary monetary and fiscal efforts will stabilize the economic decline and help trigger a recovery that will result in higher-than-average inflation several years from now. However, we also present alternative estimates based on average, annual inflation rates of 1.5 percent and 3.5 percent over the next decade.

Step 3: Next, we use these estimates of future inflation to calculate the interest payments and principal repayments due on TIPS securities. To estimate the semi-annual interest payments, we multiply the notional, outstanding amount of each security issue by the "inflation index ratio" – the ratio of projected CPI at the time of those payments to the actual CPI at the time of the security's issue. To actually calculate the semi-annual interest payments, we multiply this inflation-adjusted amount by half of the coupon rate. This calculation is performed for each six-month period, including the date when the security matures. At that time, the principal is also repaid; we calculate those payments by multiplying the notional outstanding amount of the issue by the inflation index ratio.

Step 4: Next, we discount the interest payments and principal repayments for each security issue back to the present, using discount factors based on the yields of comparable, conventional (nominal) Treasury bills. For instance, if a TIPS security matures two years from today, we use the yield on the two-year constant maturity, nominal Treasury bill as its discount rate.

Step 5: The final step involves subtracting the total cost of the buyback from the present value of all of their interest payments and principal repayments. Since this difference is positive, we conclude that taxpayers would benefit from the Treasury buying back all outstanding, under 10-year maturity TIPS. The Treasury could refinance this debt at no additional cost, in present value terms, by issuing nominal bonds at par.

V. Costs of a Treasury Buy Back of Outstanding 10-Year TIPS

To calculate the precise cost of this policy, we first obtained Treasury Department data on TIPS 10-year yields for different nominal coupon-rates bonds. For instance, there are 16, 10-year TIPS issues and four 5-year TIPS issues outstanding, maturing from January 15, 2010 to January 15, 2019, with nominal interest rates that vary from 0.625 percent to 4.25 percent. For each issue, we obtained Treasury data on the auction to sell the securities, including price, coupon rate and total outstanding notional amount for each

issue at the time of its auction.[24] The auction price was above (premium) or below (discount) the security's face value, typically denominated in $100 units. The value of each auction was typically around $8 billion, although the Treasury subsequently reopened some issues and reissued securities with a comparable coupon and maturity, nearly doubling the amount of outstanding securities. The FRED database of the Federal Reserve Bank of St. Louis provides data on the yields of each issue at any given time, and in principle we can calculate the market price of each security by using the present value of its interest payments (and principal repayment), discounted using the yield.[25]

Direct quotes of TIPS prices also are available from the Bloomberg database, which aggregates the prices obtained from the largest broker-dealers operating in the TIPS market to produce a composite mid-market price for each issue. This price is referred to as the "clean" price of the security. We also obtained information on the so-called "dirty" price, which includes the accrued interest component of the price. The accrued interest is the interest that the security earns from the most recent coupon payment date to the time the security is sold by its current owner to a new investor. At the time of purchase, the accrued interest has to be paid along with the price, and therefore the actual purchase price includes this accrued interest. These prices are quoted as percentages, as in the Table 2, below. In most cases, the difference between the "clean" and "dirty" price is less than 1 percentage point. To calculate the cost of buyback, we multiply the "dirty" price by the notional value of the outstanding securities; and the notional outstanding value of the securities is then inflation-adjusted using the inflation index ratios provided by the Treasury.[26] The price data were obtained from Bloomberg on January 26, 2009. We calculate the cost of a buyback as follows:

*Buyback Cost = Price*Inflation Index Ratio*Notional Outstanding Amount (or the total value of securities outstanding)*

Table 2, below, presents these calculations.

[24] http://www.treasurydirect.gov/instit/annceresult/press/press.htm.
[25] http://research.stlouisfed.org/fred2/categories/82.
[26] http://www.treasurydirect.gov//instit/annceresult/tipscpi/tipscpi.htm.

Table 2: Cost to Buy Back 10-Year TIPS, January 2009

Coupon Rate and Maturity	Total Outstanding Notional ($ million)	Secondary Market Price with accrued interest (%)	Inflation Index Ratio	Cost of Buyback ($ million)
	(1)	(2)	(3)	(4=1x2x3)
4.25% (1/15/10)	$11,321	101.039	1.26657	$14,488
3.5% (1/15/11)	11,001	101.913	1.22436	13,727
3.375% (1/15/12)	6,004	102.682	1.20009	7,399
3.0% (7/15/12)	23,018	102.545	1.18517	27,975
1.875% (7/15/13)	20,008	98.453	1.16024	22,855
2.0% (1/15/14)	21,002	98.777	1.15327	23,925
2.0% (7/15/14)	19,002	98.879	1.13049	21,241
1.625% (1/15/15)	19,001	96.249	1.11600	20,410
1.875% (7/15/15)	17,000	97.843	1.09554	18,222
2.0% (1/15/16)	17,001	98.582	1.07364	17,994
2.5% (7/15/16)	20,000	101.825	1.05517	21,489
2.375% (1/15/17)	17,249	101.133	1.05668	18,433
2.625% (7/15/17)	13,998	103.853	1.02817	14,947
1.625% (1/15/18)	16,417	96.640	1.01717	16,138
1.375% (7/15/18)	14,001	95.319	0.98819	13,188
2.125% (1/15/19)	8,000	102.594	0.99252	8,129
0.875% (4/15/10)	28,001	97.203	1.12483	30,615
2.375% (4/15/11)	20,178	100.952	1.07359	21,869
2.0% (4/15/12)	17,281	100.900	1.05013	18,311
0.625% (4/15/2013)	14,734	97.061	1.00818	14,418
TOTALS	**$334,217**			**$365,771**

The cost to buyback all outstanding TIPS of less than 10 year maturity is an estimated $365.77 billion ($365,771,436,137), in the current period.

VI: The Total Cost of Outstanding, 10-Year TIPS, If Not Bought Back

To evaluate the potential benefits of this policy for taxpayers and the Treasury, we next estimate the total interest and principal payments for outstanding TIPS. Since the interest payments and principal repayments for TIPS depend on inflation rates, we have to estimate inflation over the course of these issues. To make these estimates, we collected more than 70 months of monthly CPI data from January 2003 to the present. We use these data to form rational expectations about future inflation, assuming that past inflation can be used as a predictor of future inflation. Using past, realized inflation rates to ballpark future inflation has particular merit, because the Fed is currently targeting certain inflation rates in its effort to avert deflation. Thus, the Fed is regulating the money supply to try to keep inflation at moderate levels (around 2.5 percent) and avoid both deflation in the near-term and high inflation later. We then performed two projections of future inflation. First, we projected the inflation rate using the long-term, 2.5 percent annual average rate. Next, we performed a projection of the CPI using the

short-term, inflation rate for 2008, which is approximately 0.1 percent, to take account of people's expectations of future inflation based on the disinflationary and deflationary environment they face today. The two projections, as we would expect, diverge over time. In all TIPs issued before 2008, however, the projected level of the CPI is higher than the CPI in the years in which those TIPS were issued. As a result, the inflation-adjusted principal should always be higher than the initial principal. These two projections are shown in long- and short-term trends of Table 3, just below, covering the first half of this period, from January 2009 to July 2014.

Table 3: Projected CPI and Inflation, January 2009-July 2014

	Long-Term Trend	Short-Term Trend	Breakeven Rate: Predicted Inflation Using Short-Term Trend
January-09	210.661	210.244	1.15
February-09	211.095	210.260	1.09
March-09	211.530	210.276	1.03
April-09	211.966	210.292	0.98
May-09	212.402	210.308	0.93
June-09	212.840	210.324	0.88
July-09	213.278	210.340	0.84
August-09	213.717	210.356	0.79
September-09	214.158	210.372	0.75
October-09	214.599	210.388	0.71
November-09	215.041	210.404	0.68
December-09	215.484	210.420	0.64
January-10	215.928	210.436	0.61
February-10	216.372	210.452	0.58
March-10	216.818	210.468	0.55
April-10	217.265	210.484	0.52
May-10	217.712	210.500	0.49
June-10	218.161	210.516	0.47
July-10	218.610	210.532	0.44
August-10	219.060	210.548	0.42
September-10	219.512	210.564	0.40
October-10	219.964	210.580	0.38
November-10	220.417	210.596	0.36
December-10	220.871	210.613	0.34
January-11	221.326	210.629	0.32
February-11	221.782	210.645	0.31
March-11	222.238	210.661	0.29
April-11	222.696	210.677	0.28
May-11	223.155	210.693	0.26
June-11	223.615	210.709	0.25
July-11	224.075	210.725	0.23
August-11	224.537	210.741	0.22
September-11	224.999	210.757	0.21
October-11	225.463	210.773	0.20
November-11	225.927	210.789	0.19
December-11	226.393	210.805	0.18
January-12	226.859	210.821	0.17
February-12	227.326	210.837	0.16

March-12	227.794	210.853	0.15
April-12	228.264	210.869	0.15
May-12	228.734	210.885	0.14
June-12	229.205	210.901	0.13
July-12	229.677	210.917	0.12
August-12	230.150	210.934	0.12
September-12	230.624	210.950	0.11
October-12	231.099	210.966	0.11
November-12	231.575	210.982	0.10
December-12	232.052	210.998	0.10
January-13	232.530	211.014	0.09
February-13	233.009	211.030	0.09
March-13	233.489	211.046	0.08
April-13	233.970	211.062	0.08
May-13	234.452	211.078	0.07
June-13	234.935	211.094	0.07
July-13	235.419	211.110	0.07
August-13	235.904	211.126	0.06
September-13	236.390	211.142	0.06
October-13	236.877	211.158	0.06
November-13	237.365	211.175	0.05
December-13	237.854	211.191	0.05
January-14	238.344	211.207	0.05
February-14	238.835	211.223	0.05
March-14	239.327	211.239	0.04
April-14	239.820	211.255	0.04
May-14	240.313	211.271	0.04
June-14	240.809	211.287	0.04
July-14	241.305	211.303	0.03

This table also includes a projection of inflation based on the current, average breakeven rate for 2008: What would inflation look like, if investors based their expectations of that inflation on the current, very low breakeven rate? This calculation shows, again, that TIPS investors are currently much more risk-averse than implied by a projection of future inflation based on either long-term or short-term trends. This calculation, in column four of the table above, projects almost zero inflation after the first couple of years and remains that way for the following years. It appears that investors are using the breakeven rate as an indicator of future prices, creating the fear of a vicious cycle of future, accelerating deflation. Yet, as demonstrated earlier, the breakeven rate is a very inaccurate predictor of future inflation rates, consistently under-predicting actual inflation. The data and other evidence suggest that the more reasonable way to assess the likelihood of future deflation is to use actual CPI data, which do *not* support a fear of long-term deflation. This conclusion is reinforced by the extraordinary monetary ease pursued by the Federal Reserve in recent months, precisely to counter deflationary concerns and revitalize the economy.

We next use the long-term trend predictions of future inflation to estimate the total payments by the Treasury on outstanding under 10-year TIPS, including calculations of the inflation-adjusted principal and the interest payments on inflation-adjusted principal. Since this interest is paid semi-annually, we adjust the principal amounts in

January and July of each year (or April and October, as the case may be), using the ratio of the CPI in the current month and year divided by the CPI in the month and year when the bond was issued. The Treasury calls this calculation the "Index Ratio". The total interest costs of each issue are calculated as follows:

*Semi-Annual Interest Payment = 0.5 * Coupon Rate * Index Ratio * Total Notional Amount of Securities Outstanding*

The principal repayment when the bond reaches maturity equals the initial principal, times the Index Ratio. The total principal repayment costs for each issue are calculated as follows:

*Principal Repayment = Index Ratio * Total Notional Amount of Securities Outstanding*

The following table, Table 4, shows our estimates of the total, adjusted interest payments and principal repayments for each issue. Appendix 2 provides tables with the estimates for principal and interest for each issue, at each interest payment interval.

Table 4: Estimated Interest Payments and Principal Repayment on 10-Year TIPS

Date of Maturity	Semi-Annual Interest Rate (Half the Coupon Rate)	Total Interest Payments	Total Principal Repayments
Due 1/15/10	2.125	$917,222,932	$14,481,729,382
Due 1/15/11	1.750	1,190,467,692	13,905,223,173
Due 1/15/12	1.6875	876,785,676	7,690,913,603
Due 7/15/12	1.5000	3,378,451,825	29,354,292,397
Due 7/15/13	0.9375	2,275,610,155	25,613,183,320
Due 1/15/14	1.0000	2,799,917,755	27,028,578,948
Due 7/15/14	1.0000	2,720,247,849	24,209,443,856
Due 1/15/15	0.8125	2,392,441,692	24,341,826,992
Due 7/15/15	0.9375	2,611,642,028	21,518,584,563
Due 1/15/16	1.0000	2,959,168,781	21,468,565,430
Due 7/15/16	1.2500	4,553,556,371	24,916,026,647
Due 1/15/17	1.1875	4,011,463,786	21,872,288,266
Due 7/15/17	1.3125	3,725,646,638	17,462,880,180
Due 1/15/18	0.8125	2,836,005,984	20,461,888,572
Due 7/15/18	0.6875	2,081,525,674	16,953,851,792
Due 1/15/19	1.0625	1,940,212,198	10,240,676,354
Due 4/15/10	0.4375	413,157,941	31,868,135,792
Due 4/15/11	1.1875	1,291,998,274	22,300,570,758
Due 4/15/12	1.0000	1,287,772,718	19,085,106,441
Due 4/15/13	0.3125	431,725,673	16,047,246,741
TOTAL	--	**$44,695,021,644**	**$410,821,013,209**

VI. The Savings from Buying Back TIPS

To estimate the net benefit to the Treasury and taxpayers of buying back the outstanding under 10-year TIPS, the cost of the buyback is compared with the benefit in terms of foregone interest and principal payments on outstanding TIPS until 2019. In order to make this comparison, the future payments must be recalculated in present value terms. The relevant discount factor to make those calculations is the discount rate on the comparable term, nominal Treasury bill. These discount rates or yield data also are available from Bloomberg. For instance, for TIPS securities due 10 years from now -- in 2019 -- the relevant discount rate is the current yield on the 10-year Treasury bill, which is 2.643 percent. For securities maturing in one or two years, the comparable discount rate or yield on the nominal Treasury bill was approximately 0.5 percent.[27]

The formula for calculating the net present value of these payments is as follows:

$$NPV = \beta(t) + \frac{\beta(t+1)}{(1+r)} + \frac{\beta(t+2)}{(1+r)^2} + \frac{\beta(t+3)}{(1+r)^3} + \ldots \text{ ,}$$

where β refers to the total payments due (interest and principal) in year t. In our analysis, the earliest payments are due in January 2009; and we treat that as year t, 2010 as year t+1, and so forth. Payments in year t are not discounted since they are due immediately. Payments in all other years are discounted at the compounded rate of $(1+r)^g$ where g refers to the difference between the first year (2009) and the future year in which payments have to be made.

Table 5, below, shows the interest payments and principal repayments due each year and the present value of the totals of those payments.

Table 5. The Annual Cost of 10-Year TIPS Interest and Principal Payments, And the Total Net Present Value of These Payments: Average Inflation Rate =2.5%

Year	Total Interest Payments Due	Total Principal Payments Due
2009	7,653,342,290	0
2010	7,433,396,032	46,349,865,174
2011	6,646,418,612	36,205,793,932
2012	5,969,022,052	56,130,312,440
2013	4,839,745,026	41,660,430,062
2104	4,146,460,516	51,238,022,805
2015	3,279,596,057	45,860,411,555
2016	2,530,488,500	46,384,592,076
2017	1,476,181,846	39,335,168,446
2018	611,563,527	37,415,740,365
2019	108,807,186	10,240,676,354
Present Discounted Value	**$39,920,896,976**	**$374,845,067,001**

[27] http://research.stlouisfed.org/fred2/categories/115

The present value of the total principal and interest costs on outstanding, under 10-year TIPS issues totals $414,765,963,977. Since we estimated earlier that it would cost the Treasury $365,771,436,137 to buy back these issues (Table 2), the net benefit from buying back all under 10-year TIPS comes to $48,994,527,840.

The Treasury would have to refinance this buyback program by issuing new 10-year conventional Treasury securities, which would entail their own costs in interest payments and principal repayments by the Treasury. However, *in present value terms*, the cost of those interest and principal payments is equal to the amount that the Treasury raises. Therefore, there should be no additional cost of refinancing. In such terms, the coupon and the yield rate are equivalent mathematically, so that the present discounted value of the debt issue matches precisely the amount raised.

Put another way, these results show that the buyback of outstanding, under 10-year TIPS would cost the Treasury, in present value terms, $365.77 billion. However, the buyback would save the Treasury and taxpayers, in present value terms, $414.76 billion, in inflation-adjusted interest and principal payments on the outstanding TIPS (Table 5). On balance, therefore, the buyback and its refinancing would save taxpayers and the Treasury, in present value terms, $48.99 billion.

VII. Alternative Inflation Scenarios

These results are contingent on the inflation path assumed for the period 2009 to 2019. While these assumptions do not affect the cost of buyback, since current data on inflation are readily available, they do affect the estimates of the future interest payments and principal repayments on the outstanding TIPS 10-year issues, since each of those estimates uses an inflation adjustment for the principal amount. To consider a range of cost and savings estimates, we consider here two inflation paths in addition to our base case of average annual inflation of 2.5 percent over the next 10 years.

The first alternative assumes an average, annual inflation rate of 1.5 percent for the next decade. This scenario assumes that the current financial crisis and severe economic decline drives down inflation rates below their long-term averages for an extended period, as some people currently fear. This result is possible, if financial markets remain damaged and the recession continues for several more years, and if people continue to hoard their funds rather than spend them. Using this inflation path and the same methodology as before, we estimate that the present value of the payments due on outstanding under 10-year TIPS would total about $395.20 billion ($395,206,066,847), including $356.40 billion in principal repayments and $38.80 billion in interest payments. Table 6 below shows the annual interest payments and principal repayments under this scenario and the billion total present value of those payments of $395.20 billion.

Table 6. The Cost of 10-Year TIPS Interest and Principal Payments And Their Total Net Present Value, Assuming 1.5 Percent Average Annual Inflation

Year	Total Interest Payments Due	Total Principal Payment Due
2009	7,627,841,613	0
2010	7,335,296,280	45,782,999,319
2011	6,495,629,149	35,420,303,562
2012	5,777,261,803	54,274,340,911
2013	4,638,531,939	39,867,504,739
2014	3,935,956,158	48,634,431,060
2015	3,082,726,015	43,106,083,281
2016	2,355,561,446	43,159,051,200
2017	1,361,103,759	36,259,329,287
2018	558,613,700	34,151,969,583
2019	98,645,970	9,284,326,600
Present Discounted Value	**$38,801,743,498**	**$356,404,323,348**

Using the cost estimate for the buyback already developed, of $365.77 billion, we estimate that the net savings to taxpayers from this policy would come to nearly $29.43 billion ($29,434,630,710), if inflation averages just 1.5 percent over the next decade. The net savings is less than the estimate under a 2.5 percent, long-term average annual inflation path, because less inflation produces a lower inflation adjustment for the interest payments and principal repayment, which in turn reduces Treasury payouts on their outstanding TIPS.

Another alternative path assumes a relatively high, average annual inflation rate of 3.5 percent over the next decade. This path could become pertinent if the current campaign by the Federal Reserve, President Obama and Congress to revive the economy by pumping more money into it produces stronger than average results. As explained earlier, the recent, large increases in the money supply, unmatched by corresponding real increases in goods and services, could eventually fuel strong inflationary pressures and drive inflation to levels well above the long-run trend averaging 2.5 percent per-year. In this case, the Treasury's burden from its outstanding, under 10-year TIPS would rise sharply, in order to compensate TIPS investors for the inflation spike. Table 7 below shows the annual interest payments and principal repayments under inflation averaging 3.5 percent, per-year. It shows that the present value of the payments due on outstanding under 10-year TIPS under this scenario would total $435.37 billion ($435,372,073,398), including $41.07 billion ($41,077,827,524) for interest payments and $394.29 billion (**$**394,294,245,874) to repay principal at maturity.

Table 7. The Cost of 10-Year TIPS Interest and Principal Payments And Their Total Net Present Value, Assuming 3.5 Percent Average Annual Inflation

Year	Total Interest Payments Due	Total Principal Payment Due
2009	7,678,746,576	0
2010	7,531,885,661	46,918,203,594
2011	6,799,235,045	37,000,875,043
2012	6,165,228,457	58,030,978,961
2013	5,047,634,702	43,515,458,789
2104	4,366,039,895	53,953,988,725
2015	3,486,962,922	48,761,687,868
2016	2,716,531,965	49,816,618,546
2017	1,599,737,590	42,638,457,239
2018	668,947,459	40,955,349,204
2019	119,900,895	11,284,790,085
Present Discounted Value	**$41,077,827,524**	**$394,294,245,874**

Netting out the Treasury's $365.77 billion cost to buy back the outstanding under 10-year maturity TIPS, the policy should save taxpayers an estimated $69.60 billion ($69,600,637,262). The higher the inflation rate over the next decade, the greater the savings for the Treasury and taxpayers from buying back TIPS securities today.

VIII. Conclusion

At times of unexpected developments and unusual volatility in financial markets and the overall economy, the prices of certain assets often deviate from their underlying fundamentals. There is strong evidence that this form of mispricing is currently occurring in the market for Treasury Inflation-Protected Securities. Based on the breakeven rates for 10-year TIPS, investors appear to expect sustained disinflation and deflation for the next decade. Analysis of the record of those breakeven rates over the last decade, however, shows that the breakeven rate has been a very unreliable indicator of both inflationary expectations and actual inflation. Moreover, economic fundamentals, including the long-term and even short-term record of U.S. inflation, as well as the extraordinary measures taken by the Federal Reserve to inject massive liquidity into the U.S. financial markets and the extraordinary fiscal stimulus adopted by Congress, strongly suggest that moderate or even substantial inflation is the most likely outcome over the next decade. Historical lessons from the Japanese market also suggest that extended disinflationary and deflationary periods occur only in the absence of the aggressive measures of monetary and fiscal ease now being undertaken by the U.S. government. Therefore, investors' current fears of sustained disinflation and deflation are almost certainly misplaced. As a result, the Treasury and U.S. taxpayers face the prospect of large additional financing costs over the next decade, as the interest payments and principal repayments on outstanding under 10-year maturity TIPS are adjusted upwards for actual inflation.

The Treasury and U.S. taxpayers can avoid these costs if the Treasury institutes a policy of buying back the outstanding TIPS and refinancing the debt with conventional

10-year Treasury notes at current interest rates. We estimate that this policy would save taxpayers at least $48.99 billion over the next decade, assuming inflation averages 2.5 percent per-year over this period. If inflation is less than we expect, averaging just 1.5 percent per-year over the next decade, taxpayers would still save $29.43 billion under this policy. If inflation outstrips the 2.5 percent long-term trend and averages 3.5 percent per-year over the next decade, the Treasury and taxpayers could save some $69.60 billion. We conclude that this policy represents a unique opportunity to contain the costs of financing the rising U.S. debt and should be seriously considered.

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Appendix

Table A. Ten-Year Treasury Yields, Breakeven Rates and Actual Inflation Rates, Monthly, January 2003 – December 2008

Date	10- Year TIPS Yield	10-Year Treasury Yield	Breakeven Inflation Rate	Annualized 10-Year Inflation Rate
January-03	2.29	4.05	1.76	2.73
February-03	1.99	3.9	1.91	2.78
March-03	1.94	3.81	1.87	2.81
April-03	2.18	3.96	1.78	2.75
May-03	1.91	3.57	1.66	2.71
June-03	1.72	3.33	1.61	2.71
July-03	2.11	3.98	1.87	2.72
August-03	2.32	4.45	2.13	2.73
September-03	2.19	4.27	2.08	2.75
October-03	2.08	4.29	2.21	2.69
November-03	1.96	4.3	2.34	2.65
December-03	1.98	4.27	2.29	2.64
January-04	1.89	4.15	2.26	2.66
February-04	1.76	4.08	2.32	2.68
March-04	1.47	3.83	2.36	2.72
April-04	1.9	4.35	2.45	2.74
May-04	2.09	4.72	2.63	2.80
June-04	2.15	4.73	2.58	2.80
July-04	2.02	4.5	2.48	2.75
August-04	1.86	4.28	2.42	2.71
September-04	1.8	4.13	2.33	2.70
October-04	1.73	4.1	2.37	2.75
November-04	1.68	4.19	2.51	2.74
December-04	1.67	4.23	2.56	2.70
January-05	1.72	4.22	2.5	2.68
February-05	1.63	4.17	2.54	2.70
March-05	1.79	4.5	2.71	2.75
April-05	1.71	4.34	2.63	2.79
May-05	1.65	4.14	2.49	2.76
June-05	1.67	4	2.33	2.74
July-05	1.88	4.18	2.3	2.79
August-05	1.89	4.26	2.37	2.82
September-05	1.7	4.2	2.5	2.94
October-05	1.94	4.46	2.52	2.92
November-05	2.06	4.54	2.48	2.84
December-05	2.12	4.47	2.35	2.80
January-06	2.01	4.42	2.41	2.82
February-06	2.05	4.57	2.52	2.81
March-06	2.2	4.72	2.52	2.81
April-06	2.41	4.99	2.58	2.86
May-06	2.45	5.11	2.66	2.90
June-06	2.53	5.11	2.58	2.91

July-06	2.51	5.09	2.58	2.92
August-06	2.29	4.88	2.59	2.93
September-06	2.32	4.72	2.4	2.83
October-06	2.41	4.73	2.32	2.73
November-06	2.29	4.6	2.31	2.70
December-06	2.25	4.56	2.31	2.71
January-07	2.44	4.76	2.32	2.71
February-07	2.36	4.72	2.36	2.74
March-07	2.18	4.56	2.38	2.81
April-07	2.26	4.69	2.43	2.87
May-07	2.37	4.75	2.38	2.95
June-07	2.69	5.1	2.41	2.96
July-07	2.64	5	2.36	2.94
August-07	2.44	4.67	2.23	2.90
September-07	2.26	4.52	2.26	2.90
October-07	2.2	4.53	2.33	2.90
November-07	1.77	4.15	2.38	2.97
December-07	1.79	4.1	2.31	2.98
January-08	1.47	3.74	2.27	3.01
February-08	1.41	3.74	2.33	3.02
March-08	1.09	3.51	2.42	3.10
April-08	1.36	3.68	2.32	3.15
May-08	1.46	3.88	2.42	3.23
June-08	1.63	4.1	2.47	3.33
July-08	1.57	4.01	2.44	3.37
August-08	1.68	3.89	2.21	3.31
September-08	1.85	3.69	1.84	3.28
October-08	2.75	3.81	1.06	3.14
November-08	2.89	3.53	0.64	2.92
December-08	2.17	2.42	0.25	-

Tables B1 – B20:

Interest and Principal Repayments on under 10-Year maturity TIPS Issues

Table B1: 10-Year TIPS Issue due January 15, 2010, Coupon Rate 4.25%

	Interest Rate	Index Ratio	Total Interest Payment	Principal Repayment
January 2009	2.125	1.27	305,525,488	
July 2009	2.125	1.26	303,960,695	
January 2010	2.125	1.28	307,736,749	14,481,729,382

Table B2: 10-Year TIPS Issue due January 15, 2011, Coupon Rate 3.5%

	Interest Rate	Index Ratio	Total Interest Payment	Principal Repayment
January 2009	1.75	1.22	234,871,350	
July 2009	1.75	1.22	234,493,179	
January 2010	1.75	1.23	237,406,249	
July 2010	1.75	1.25	240,355,508	
January 2011	1.75	1.26	243,341,406	13,905,223,173

Table B3: 10-Year TIPS Issue due January 15, 2012, Coupon Rate 3.375%

	Interest Rate	Index Ratio	Total Interest Payment	Principal Repayment
January 2009	1.6875	1.20	121,581,000	
July 2009	1.6875	1.20	122,014,670	
January 2010	1.6875	1.22	123,530,439	
July 2010	1.6875	1.23	125,065,037	
January 2011	1.6875	1.25	126,618,700	
July 2011	1.6875	1.27	128,191,663	
January 2012	1.6875	1.28	129,784,167	7,690,913,603

Table B4: 10-Year TIPS Issue due July 15, 2012, Coupon Rate 3.0%

	Interest Rate	Index Ratio	Total Interest Payment	Principal Repayment
January 2009	1.5	1.18	407,418,600	
July 2009	1.5	1.18	408,875,679	
January 2010	1.5	1.20	413,955,075	
July 2010	1.5	1.21	419,097,571	
January 2011	1.5	1.23	424,303,952	
July 2011	1.5	1.24	429,575,011	
January 2012	1.5	1.26	434,911,551	
July 2012	1.5	1.28	440,314,386	29,354,292,397

Table B5: 10-Year TIPS Issue due July 15, 2013, Coupon Rate 1.875%

	Interest Rate	Index Ratio	Total Interest Payment	Principal Repayment
January 2009	0.9375	1.16	217,587,000	
July 2009	0.9375	1.16	217,540,124	
January 2010	0.9375	1.17	220,242,590	
July 2010	0.9375	1.19	222,978,628	
January 2011	0.9375	1.20	225,748,655	
July 2011	0.9375	1.22	228,553,093	
January 2012	0.9375	1.23	231,392,371	
July 2012	0.9375	1.25	234,266,921	
January 2013	0.9375	1.26	237,177,180	
July 2013	0.9375	1.28	240,123,594	25,613,183,320

Table B6: 10-Year TIPS Issue due January 15, 2014, Coupon Rate 2.0%

	Interest Rate	Index Ratio	Total Interest Payment	Principal Repayment
January 2009	1	1.15	241,523,000	
July 2009	1	1.15	241,860,986	
January 2010	1	1.17	244,865,585	
July 2010	1	1.18	247,907,510	
January 2011	1	1.20	250,987,225	
July 2011	1	1.21	254,105,198	
January 2012	1	1.22	257,261,906	
July 2012	1	1.24	260,457,828	
January 2013	1	1.26	263,693,453	
July 2013	1	1.27	266,969,274	
January 2014	1	1.29	270,285,789	27,028,578,948

Table B7: 10-Year TIPS Issue due July 15, 2014, Coupon Rate 2.0%

	Interest Rate	Index Ratio	Total Interest Payment	Principal Repayment
January 2009	1	1.13	214,722,600	
July 2009	1	1.13	213,976,208	
January 2010	1	1.14	216,634,399	
July 2010	1	1.15	219,325,613	
January 2011	1	1.17	222,050,259	
July 2011	1	1.18	224,808,753	
January 2012	1	1.20	227,601,515	
July 2012	1	1.21	230,428,972	
January 2013	1	1.23	233,291,553	
July 2013	1	1.24	236,189,696	
January 2014	1	1.26	239,123,842	
July 2014	1	1.27	242,094,439	24,209,443,856

Table B8: 10-Year TIPS Issue due January 15, 2015, Coupon Rate 1.625%

	Interest Rate	Index Ratio	Total Interest Payment	Principal Repayment
January 2009	0.8125	1.12	172,909,100	
July 2009	0.8125	1.12	172,661,409	
January 2010	0.8125	1.13	174,806,354	
July 2010	0.8125	1.15	176,977,945	
January 2011	0.8125	1.16	179,176,513	
July 2011	0.8125	1.18	181,402,393	
January 2012	0.8125	1.19	183,655,925	
July 2012	0.8125	1.20	185,937,453	
January 2013	0.8125	1.22	188,247,324	
July 2013	0.8125	1.23	190,585,889	
January 2014	0.8125	1.25	192,953,507	
July 2014	0.8125	1.27	195,350,537	
January 2015	0.8125	1.28	197,777,344	24,341,826,992

Table B9: 10-Year TIPS Issue due July 15, 2015, Coupon Rate 1.875 %

	Interest Rate	Index Ratio	Total Interest Payment	Principal Repayment
January 2009	0.9375	1.09	173,718,750	
July 2009	0.9375	1.09	173,956,950	
January 2010	0.9375	1.11	176,117,989	
July 2010	0.9375	1.12	178,305,874	
January 2011	0.9375	1.13	180,520,939	
July 2011	0.9375	1.15	182,763,521	
January 2012	0.9375	1.16	185,033,962	
July 2012	0.9375	1.18	187,332,609	
January 2013	0.9375	1.19	189,659,811	
July 2013	0.9375	1.20	192,015,924	
January 2014	0.9375	1.22	194,401,307	
July 2014	0.9375	1.23	196,816,322	
January 2015	0.9375	1.25	199,261,339	
July 2015	0.9375	1.27	201,736,730	21,518,584,563

Table B10: 10-Year TIPS Issue due January 15, 2016, Coupon Rate 2.0 %

	Interest Rate	Index Ratio	Total Interest Payment	Principal Repayment
January 2009	1	1.07	181,910,700	
July 2009	1	1.08	182,851,236	
January 2010	1	1.09	185,122,767	
July 2010	1	1.10	187,422,517	
January 2011	1	1.12	189,750,836	
July 2011	1	1.13	192,108,080	
January 2012	1	1.14	194,494,607	
July 2012	1	1.16	196,910,782	
January 2013	1	1.17	199,356,972	
July 2013	1	1.19	201,833,551	
January 2014	1	1.20	204,340,896	
July 2014	1	1.22	206,879,390	
January 2015	1	1.23	209,449,419	
July 2015	1	1.25	212,051,375	
January 2016	1	1.26	214,685,654	21,468,565,430

Table B11: 10-Year TIPS Issue due July 15, 2016, Coupon Rate 2.50 %

	Interest Rate	Index Ratio	Total Interest Payment	Principal Repayment
January 2009	1.25	1.05	262,500,000	
July 2009	1.25	1.05	262,012,338	
January 2010	1.25	1.06	265,267,274	
July 2010	1.25	1.07	268,562,646	
January 2011	1.25	1.09	271,898,956	
July 2011	1.25	1.10	275,276,712	
January 2012	1.25	1.11	278,696,430	
July 2012	1.25	1.13	282,158,630	
January 2013	1.25	1.14	285,663,841	
July 2013	1.25	1.16	289,212,596	
January 2014	1.25	1.17	292,805,437	
July 2014	1.25	1.19	296,442,911	
January 2015	1.25	1.20	300,125,573	
July 2015	1.25	1.22	303,853,983	
January 2016	1.25	1.23	307,628,712	
July 2016	1.25	1.25	311,450,333	24,916,026,647

Table B12: 10-Year TIPS Issue due January 15, 2017, Coupon Rate 2.375%

	Interest Rate	Index Ratio	Total Interest Payment	Principal Repayment
January 2009	1.1875	1.06	217,121,788	
July 2009	1.1875	1.05	215,823,559	
January 2010	1.1875	1.07	218,504,699	
July 2010	1.1875	1.08	221,219,147	
January 2011	1.1875	1.09	223,967,317	
July 2011	1.1875	1.11	226,749,626	
January 2012	1.1875	1.12	229,566,500	
July 2012	1.1875	1.13	232,418,367	
January 2013	1.1875	1.15	235,305,662	
July 2013	1.1875	1.16	238,228,826	
January 2014	1.1875	1.18	241,188,304	
July 2014	1.1875	1.19	244,184,547	
January 2015	1.1875	1.21	247,218,011	
July 2015	1.1875	1.22	250,289,160	
January 2016	1.1875	1.24	253,398,462	
July 2016	1.1875	1.25	256,546,389	
January 2017	1.1875	1.27	259,733,423	21,872,288,266

Table B13: 10-Year TIPS Issue due July 15, 2017, Coupon Rate 2.625%

	Interest Rate	Index Ratio	Total Interest Payment	Principal Repayment
January 2009	1.3125	1.03	189,235,463	
July 2009	1.3125	1.02	188,115,362	
January 2010	1.3125	1.04	190,452,289	
July 2010	1.3125	1.05	192,818,246	
January 2011	1.3125	1.06	195,213,596	
July 2011	1.3125	1.08	197,638,702	
January 2012	1.3125	1.09	200,093,936	
July 2012	1.3125	1.10	202,579,670	
January 2013	1.3125	1.12	205,096,284	
July 2013	1.3125	1.13	207,644,162	
January 2014	1.3125	1.14	210,223,691	
July 2014	1.3125	1.16	212,835,266	
January 2015	1.3125	1.17	215,479,283	
July 2015	1.3125	1.19	218,156,147	
January 2016	1.3125	1.20	220,866,266	
July 2016	1.3125	1.22	223,610,051	
January 2017	1.3125	1.23	226,387,922	
July 2017	1.3125	1.25	229,200,302	17,462,880,180

Table B14: 10-Year TIPS Issue due January 15, 2018, Coupon Rate 1.625%

	Interest Rate	Index Ratio	Total Interest Payment	Principal Repayment
January 2009	0.8125	1.02	136,055,888	
July 2009	0.8125	1.01	134,777,138	
January 2010	0.8125	1.02	136,451,452	
July 2010	0.8125	1.04	138,146,566	
January 2011	0.8125	1.05	139,862,738	
July 2011	0.8125	1.06	141,600,230	
January 2012	0.8125	1.07	143,359,307	
July 2012	0.8125	1.09	145,140,236	
January 2013	0.8125	1.10	146,943,290	
July 2013	0.8125	1.12	148,768,742	
January 2014	0.8125	1.13	150,616,872	
July 2014	0.8125	1.14	152,487,961	
January 2015	0.8125	1.16	154,382,294	
July 2015	0.8125	1.17	156,300,160	
January 2016	0.8125	1.19	158,241,851	
July 2016	0.8125	1.20	160,207,664	
January 2017	0.8125	1.22	162,197,897	
July 2017	0.8125	1.23	164,212,855	
January 2018	0.8125	1.25	166,252,845	20,461,888,572

Table B15: 10-Year TIPS Issue due July 15, 2018, Coupon Rate 1.375%

	Interest Rate	Index Ratio	Total Interest Payment	Principal Repayment
January 2009	0.6875	0.99	95,294,306	
July 2009	0.6875	0.97	93,331,081	
January 2010	0.6875	0.98	94,490,518	
July 2010	0.6875	0.99	95,664,358	
January 2011	0.6875	1.01	96,852,781	
July 2011	0.6875	1.02	98,055,967	
January 2012	0.6875	1.03	99,274,100	
July 2012	0.6875	1.04	100,507,366	
January 2013	0.6875	1.06	101,755,953	
July 2013	0.6875	1.07	103,020,050	
January 2014	0.6875	1.08	104,299,852	
July 2014	0.6875	1.10	105,595,552	
January 2015	0.6875	1.11	106,907,348	
July 2015	0.6875	1.12	108,235,440	
January 2016	0.6875	1.14	109,580,032	
July 2016	0.6875	1.15	110,941,326	
January 2017	0.6875	1.17	112,319,532	
July 2017	0.6875	1.18	113,714,860	
January 2018	0.6875	1.20	115,127,521	
July 2018	0.6875	1.21	116,557,731	16,953,851,792

Table B16: 10-Year TIPS Issue due January 15, 2019, Coupon Rate 2.125%

	Interest Rate	Index Ratio	Total Interest Payment	Principal Repayment
July 2009	1.0625	1.01	86,055,941	
January 2010	1.0625	1.03	87,125,000	
July 2010	1.0625	1.04	88,207,340	
January 2011	1.0625	1.05	89,303,125	
July 2011	1.0625	1.06	90,412,523	
January 2012	1.0625	1.08	91,535,703	
July 2012	1.0625	1.09	92,672,836	
January 2013	1.0625	1.10	93,824,096	
July 2013	1.0625	1.12	94,989,657	
January 2014	1.0625	1.13	96,169,698	
July 2014	1.0625	1.15	97,364,399	
January 2015	1.0625	1.16	98,573,941	
July 2015	1.0625	1.17	99,798,509	
January 2016	1.0625	1.19	101,038,289	
July 2016	1.0625	1.20	102,293,471	
January 2017	1.0625	1.22	103,564,246	
July 2017	1.0625	1.23	104,850,808	
January 2018	1.0625	1.25	106,153,352	

July 2018	1.0625	1.26	107,472,078	
January 2019	1.0625	1.28	108,807,186	10,240,676,354

Table B17: TIPS Issue due April 15, 2010, Coupon Rate 0.875%

	Interest Rate	Index Ratio	Total Interest Payment	Principal Repayment
April 2009	0.4375	1.11	136,022,531	
October 2009	0.4375	1.12	137,712,316	
April 2010	0.4375	1.14	139,423,094	31,868,135,792

Table B18: TIPS Issue due April 15, 2011, Coupon Rate 2.375%

	Interest Rate	Index Ratio	Total Interest Payment	Principal Repayment
April 2009	1.1875	1.05	252,058,801	
October 2009	1.1875	1.07	255,190,086	
April 2010	1.1875	1.08	258,360,271	
October 2010	1.1875	1.09	261,569,838	
April 2011	1.1875	1.11	264,819,278	22,300,570,758

Table B19: TIPS Issue due April 15, 2012, Coupon Rate 2%

	Interest Rate	Index Ratio	Total Interest Payment	Principal Repayment
April 2009	1	1.03	177,224,186	
October 2009	1	1.04	179,425,813	
April 2010	1	1.05	181,654,791	
October 2010	1	1.06	183,911,458	
April 2011	1	1.08	186,196,160	
October 2011	1	1.09	188,509,245	
April 2012	1	1.10	190,851,064	19,085,106,441

Table B20: TIPS Issue due April 15, 2013, Coupon Rate 3.375%

	Interest Rate	Index Ratio	Total Interest Payment	Principal Repayment
April 2009	0.3125	0.99	45,431,292	
October 2009	0.3125	1.00	45,995,678	
April 2010	0.3125	1.01	46,567,075	
October 2010	0.3125	1.02	47,145,570	
April 2011	0.3125	1.04	47,731,251	

October 2011	0.3125	1.05	48,324,209	
April 2012	0.3125	1.10	50,850,638	
October 2012	0.3125	1.08	49,532,314	
April 2013	0.3125	1.09	50,147,646	16,047,246,741

About the Authors

Robert J. Shapiro is the chairman of Sonecon, LLC, a private firm that advises U.S. and foreign businesses, governments and non-profit organizations. Dr. Shapiro has advised, among others, U.S. President Bill Clinton and British Prime Minister Tony Blair; private firms including Amgen, AT&T, Gilead Sciences, Google, MCI, Inc., SLM Corporation, Nordstjernan of Sweden, and Fujitsu of Japan; and non-profit organizations including the American Public Transportation Association, the Education Finance Council, BIO, and the U.S. Chamber of Commerce. He is also a senior fellow of the Georgetown University Business School and the Progressive Policy Institute (PPI), chairman of the Globalization Initiative of NDN, co-chair of the Climate Task Force and American Task Force Argentina, and a director of the Ax:son-Johnson Foundation in Sweden. From 1997 to 2001, he was Under Secretary of Commerce for Economic Affairs, where he directed economic policy for the U.S. Commerce Department and oversaw the nation's major statistical agencies. Prior to that, he was co-founder and Vice President of PPI. Dr. Shapiro also served as principal economic advisor in William Clinton's 1991-1992 presidential campaign, senior economic advisor to Albert Gore, Jr. in 2000, Legislative Director for Senator Daniel P. Moynihan, and Associate Editor of *U.S. News & World Report.* In 2008, he advised the campaign and transition of Barack Obama. He also has been a Fellow of Harvard University, the Brookings Institution, the National Bureau of Economic Research, and the Georgetown Business School. He holds a Ph.D. and M.A. from Harvard, as well as an A.B. from the University of Chicago and a M.Sc. from the London School of Economics and Political Science.

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