

C A M B R I D G E A S S O C I A T E S L L C

U.S. TREASURY INFLATION-
PROTECTED SECURITIES:
FIXED INCOME SUBSTITUTE?

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Introduction

Many investors have recently inquired about whether they should replace conventional bonds with Treasury Inflation-Protected Securities (TIPS) in their portfolios. Because TIPS have been priced attractively both in absolute terms and relative to conventional bonds over the last two years (although their yields have recently begun to fall), investors added them to their portfolios without selling off equities, which have a higher expected return over the long term. Investors have considered replacing conventional bonds with TIPS in their portfolios based upon the assumption that they will perform well during both prolonged economic contractions and inflationary environments. While the inflation-hedging property of TIPS is quite intuitive, their capability to hedge against prolonged economic contraction is uncertain. Investors who use conventional bonds to hedge against prolonged economic contraction must evaluate the performance of TIPS during an economic downturn.

This report provides a supplement to our previous research report on TIPS that focused on their role in a portfolio from a total return, diversification, and inflation-hedging perspective.¹ This analysis focuses on their behavior during severe economic disruptions, evaluating whether a portfolio composed of equity and TIPS can weather a prolonged economic contraction as effectively as the more conventional portfolio composed of equity and nominal bonds.² The analysis concludes that TIPS would *not* perform as effectively as conventional bonds during a severe economic contraction. However, their potential outperformance during inflationary periods may compensate for the underperformance during recessions.

The best way to insure that a portfolio is sufficiently hedged against prolonged economic contraction is to stress-test the portfolio to determine if its allocation to conventional bonds and TIPS is sufficient to prevent the sale of equities at depressed prices in order to support spending needs. If the conventional bond allocation is reduced to allow for investing in TIPS, the hedging characteristics of the conventional bonds that remain in the portfolio may be improved by increasing their duration and/or quality. TIPS may hold their value relatively well during a deflationary environment, but their value largely depends upon the behavior of real yields in this environment, which is an unknown factor.

Do TIPS Perform Well in Deflationary Environments?

Six principal factors affect the performance of TIPS: (1) actual CPI-U; (2) the value of the embedded principal guarantee; (3) actual real yields; (4) expected real yields; (5) the real rate risk premium;

¹ See our paper, *U.S. Treasury Inflation-Protected Securities (TIPS)*, published in early 2000.

² For the purpose of this paper, bonds that redeem at their nominal par value and have a fixed yield to maturity are referred to as "conventional" or "nominal" bonds.

and (6) liquidity premium/discount. This analysis uses the first three factors to determine the price of TIPS. Expected real yields, the real rate risk premium, and the liquidity premium/discount are held constant. The most significant of these assumptions is that expected real yields remain constant. Although TIPS provide an opportunity to observe the behavior of real yields, they have not been in existence for a sufficient length of time to observe the behavior of real yields during a prolonged economic contraction. During the 1929-38 deflationary period in the United States, real yields initially increased, then decreased (real yields are estimated by subtracting inflation expectations, which are defined as trailing 12-month CPI, from nominal yields). Since we cannot know how real yields will move in future prolonged economic contractions, this analysis leaves real yields unchanged, while recognizing that the performance of TIPS would be significantly worse if real yields rose, and better if real yields fell.

Historical Simulations

Prolonged Economic Contraction

The following simulations examine the hypothetical performance of equity, bond, and TIPS portfolios during 1929 to 1938. First, we evaluate the cumulative wealth of nominal bonds, TIPS, TIPS that were purchased without the benefit of principal protection, and U.S. equities over this deflationary period. We then model three representative portfolios: (1) 70% equities/30% conventional bonds; (2) 70% equities/30% TIPS purchased at par with principal protection; and (3) 70% equities/30% TIPS purchased without the benefit of principal protection. In all three portfolios, we apply a spending rule of 5% of trailing three-year market value and a policy of rebalancing quarterly. The TIPS' market price was simulated assuming a ten-year par-value TIPS was purchased at auction and aged to maturity. We test the portfolio with unprotected TIPS in order to determine the performance of TIPS in a worst-case scenario. In this situation, TIPS are purchased at a significant premium to par, carry a sizable inflation accrual, and require a greater degree of deflation for the embedded principal protection to become valuable.

Exhibit 1 shows the real and nominal cumulative wealth of nominal bonds, TIPS, TIPS without principal protection, and U.S. equities during a severe deflationary environment. All three bond portfolios increased in value during this environment, with an initial investment of \$100 increasing to \$233 in nominal bonds, \$173 in TIPS, and \$147 in TIPS without principal protection. U.S. equities maintained their value in real terms over the full period, but lost significant value for much of the period. Nominal bonds outperformed TIPS with principal protection by 34.4%, and outperformed unprotected TIPS by 58.5%, cumulatively over the ten-year period.

At first glance, it seems surprising that an investment in TIPS could generate positive returns during a period when the cumulative inflation rate was -18.1%, or -2.0% annually. Two factors can

account for these positive returns. First, the negative CPI allowed the coupon income from the TIPS to exceed the drop in principal value. We assumed that the TIPS paid a coupon of 3.8% of the inflation-adjusted principal, which is average yield of ten-year TIPS since their inception in January 1997. Given that inflation decreased at a rate of 2%, the portfolio increased in value over the horizon. The second factor that contributed to the ability of TIPS to generate positive returns is the Treasury's guarantee that it will return at least the face value of the principal upon maturity. The value of this guarantee is shown by the 17.9% difference in value between the TIPS and TIPS without principal protection.

As noted above, we held real yields constant for the purpose of this analysis. In order for the total return of TIPS to equal the total return of nominal bonds at the end of the period, real yields would need to approach zero (assuming that TIPS have a duration of eight relative to real yields, which is the duration of the ten-year maturity TIPS). Conversely, in order for TIPS to perform as poorly as did U.S. stocks (a \$100 investment fell to the nominal value of \$91.47), real yields would have to rise by 400 basis points.

Exhibit 2 shows the nominal and real market value of \$100 invested in three portfolios net of spending starting in 1929 and ending in 1938. All three portfolios experienced a slight decline in market value in real terms, and, in order to support spending, they required a comparable amount of equities be sold—approximately \$13 to \$14 cumulatively over the ten-year period. The portfolio with nominal bonds held 93.8% of its value, the portfolio with TIPS 85.9% of its value, and the portfolio with unprotected TIPS 80.9% of its value. When compared to the cumulative wealth differential between a portfolio consisting entirely of nominal bonds, TIPS, and unprotected TIPS, the ending market values of these three portfolios were relatively close. This occurred because the vast majority of each portfolio (70%) is invested in U.S. equities. The portfolio with conventional bonds outperformed the one with TIPS by 9.1%, cumulatively, while it outperformed the unprotected TIPS portfolio by 15.9% cumulatively.

Exhibit 3 shows the same analysis, with the important modification of adding a spending floor equal to the prior year's nominal spending amount. This modification provides a more realistic picture of how most institutions would probably behave in an environment of severe declines in portfolio market value. Most institutions find it virtually impossible to cut the nominal dollar value of spending distributions from their endowments. This means that if the market value of their funds suffered a sharp decline, they would likely maintain spending at the expense of preserving the purchasing power of the endowment rather than vice-versa. Indeed, this was the case in the bear market of the early 1970s when most institutions were not willing to reduce the nominal value of their spending and overrode their own spending rules. Under this scenario, all three portfolios experienced a significant decline in market value in both real and nominal terms. The portfolio with conventional bonds outperformed the one with TIPS by 17.4%, cumulatively, and outperformed the unprotected TIPS portfolio by 29.3% cumulatively.

The underperformance of the portfolio without principal protection underscores two issues regarding TIPS. Most significantly, in order to maximize the value of the principal guarantee at maturity in a deflationary environment, it is important to own the security with the least inflation accrual, which is usually the most recently issued security. For example, a previously issued TIPS, with the indexed principal adjusted for five years of 2.5% inflation, would experience deflation of as much as 11.5% before the principal guarantee had any value. Secondly, purchasing TIPS at a premium to par, even if there were no inflation accrual in the bond, would expose the investor to a slight additional loss if one were to experience deflation during the life of the bond. The table below summarizes the potential principal loss of the outstanding ten-year TIPS based on the inflation accrual. As of this writing, the 3½ of January 2011 has the least potential principal loss.

TIP Issue	Price	Yield	Index Ratio	Potential Principal Loss Based on Inflation Accrual
3 ½ 1/15/2011	99-3/4	3.54%	1.000	0.00%
4 1/4 1/15/2010	105-3/8	3.55%	1.034	3.44%
3 7/8 1/15/2009	102-15/32	3.52%	1.061	6.11%
3 5/8 1/15/2008	100-27/32	3.49%	1.077	7.72%

In summary, in order to optimize the value of the principal guarantee, investors must diligently construct a TIPS portfolio. During deflationary periods, the portfolio outcome can vary significantly depending on the specific TIPS holdings. Active managers may hold older TIPS in order to maximize current yield at the sacrifice of deflation protection. The U.S. Treasury has traditionally auctioned TIPS at par, while the cost of rolling from old bonds into the most recently issued security has been minimal (zero to one basis point of real yield). Under these circumstances, it would be beneficial to roll old TIPS into new ones. However, the yield differential between the most recently auctioned bond and an old TIPS may widen as more investors recognize the value of maximizing the par value protection of their TIPS portfolios.

Unexpected Inflation

We analyze the performance of a portfolio with nominal bonds and a portfolio with TIPS during a period of unexpected inflation. This analysis is shown in order to explore whether the outperformance of TIPS relative to nominal bonds during periods of unexpected inflation is greater than their underperformance relative to nominal bonds during periods of economic contraction. Exhibit 4 shows the nominal and real market values of two portfolios beginning in 1972 and ending in 1981. Here, the

portfolio with TIPS significantly outperforms the one with conventional bonds. The conventional bond portfolio would need to gain 41% to match the value of the TIPS-inclusive portfolio. In the inflationary scenario, the return may be slightly overstated because it is unlikely that real yields will remain constant or fall. However, it is also unlikely that real yields would rise enough to completely erase the outperformance differential.

Conclusion

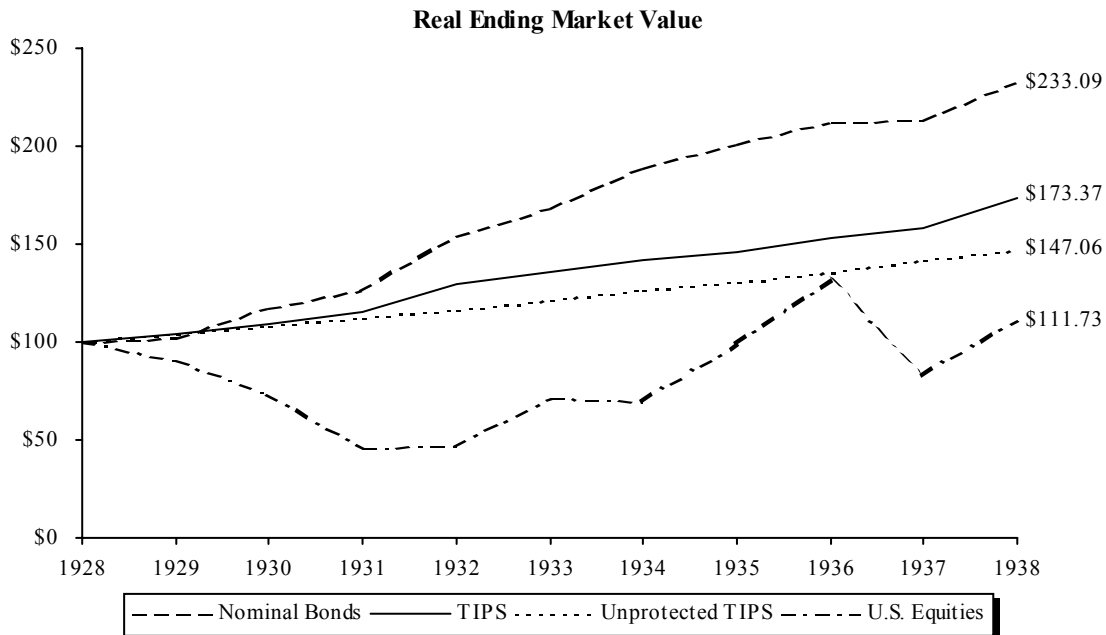
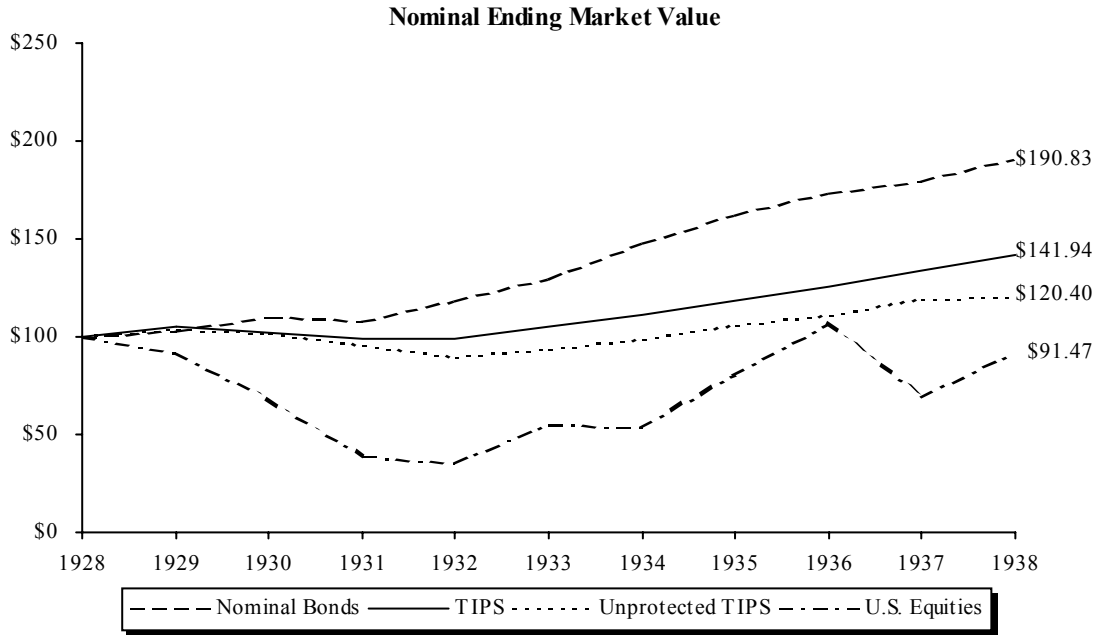
Our main conclusion is that the potential performance of TIPS in severe deflationary periods does not warrant their use as a replacement for conventional bonds. Second, in order to maximize the value of the Treasury's principal protection, investors should hold TIPS issues that have the lowest inflation accrual. If bonds are intended to protect the investor's ability to maintain spending during times of severe economic contraction, conventional high quality non-callable, intermediate- to long-duration bonds represent the most direct hedge. However, during periods of deflation, holding TIPS does not result in disastrous consequences, assuming that real yields do not rise significantly.

Investors should determine whether they have sufficient conventional bonds and TIPS in order to support spending without selling off equities during a prolonged economic contraction. Given the potential of TIPS to significantly outperform conventional bonds during inflationary periods, as well as the expectation that they will hold their value relatively well during prolonged economic contractions, TIPS deserve a permanent allocation in a "bond" portfolio. However, their ability to hold their value is predicated on the assumption that real yields at least remain constant during a prolonged economic contraction. Should TIPS yields increase in this type of environment, their permanent inclusion in the bond portfolio in place of nominal bonds could prove damaging.

EXHIBITS

EXHIBIT 1

CUMULATIVE WEALTH OF NOMINAL BONDS, TIPS, UNPROTECTED TIPS AND U.S. EQUITIES

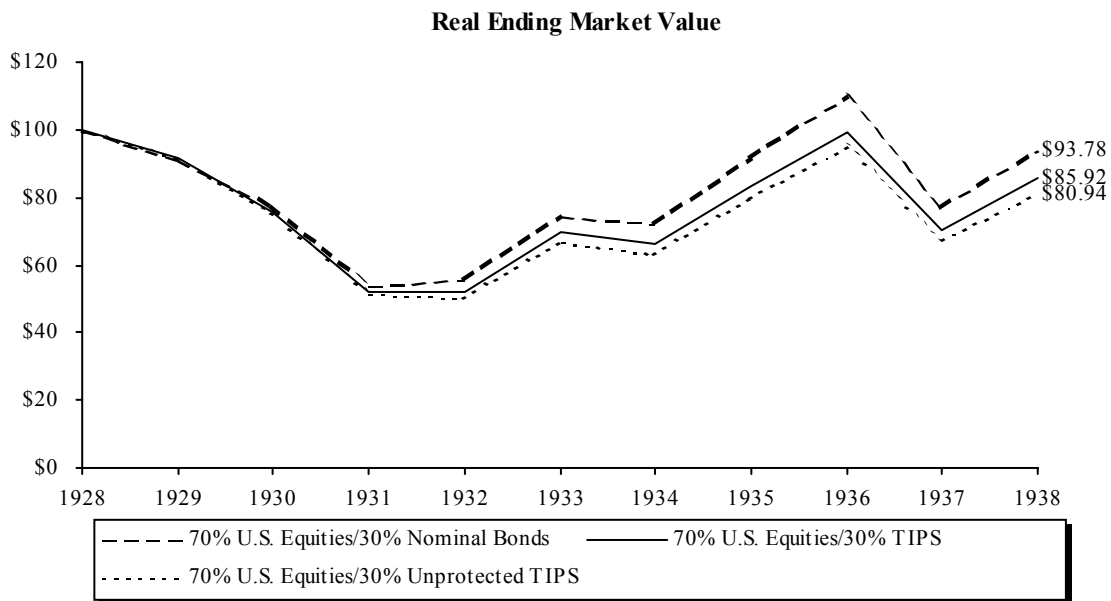
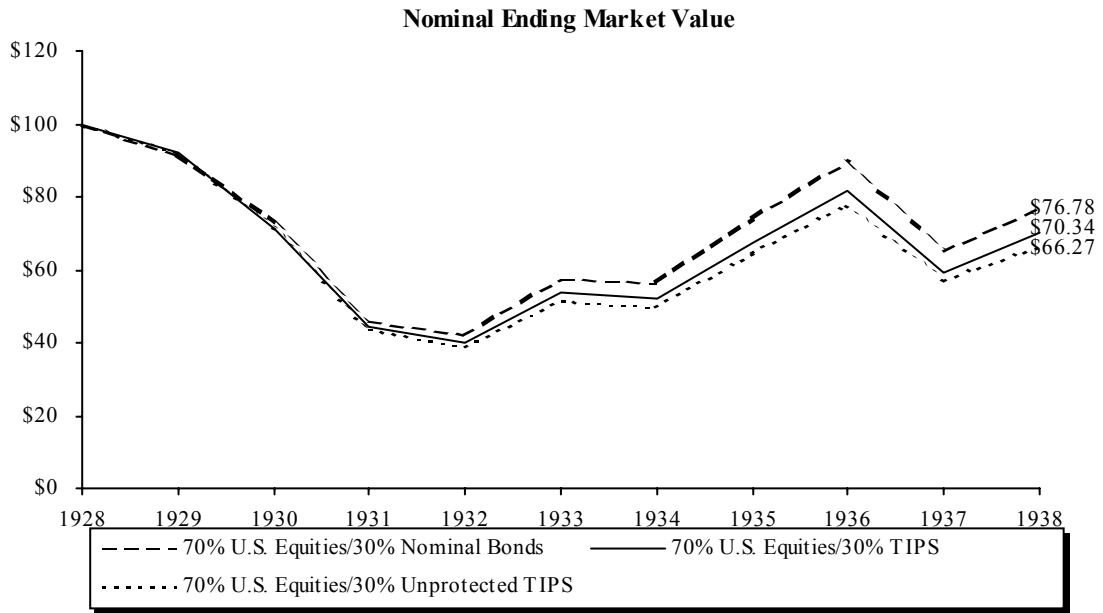


Sources: Salomon Smith Barney, Bureau of Labor Statistics, and Standard & Poor's.

EXHIBIT 2

**COMPARISON OF PORTFOLIO MARKET VALUES AFTER SPENDING
DURING A PROLONGED ECONOMIC CONTRACTION**

Nominal and Real Market Values of Portfolios Comprised of 70% U.S. Equities and 30% Nominal Bonds, TIPS and Unprotected TIPS, Respectively



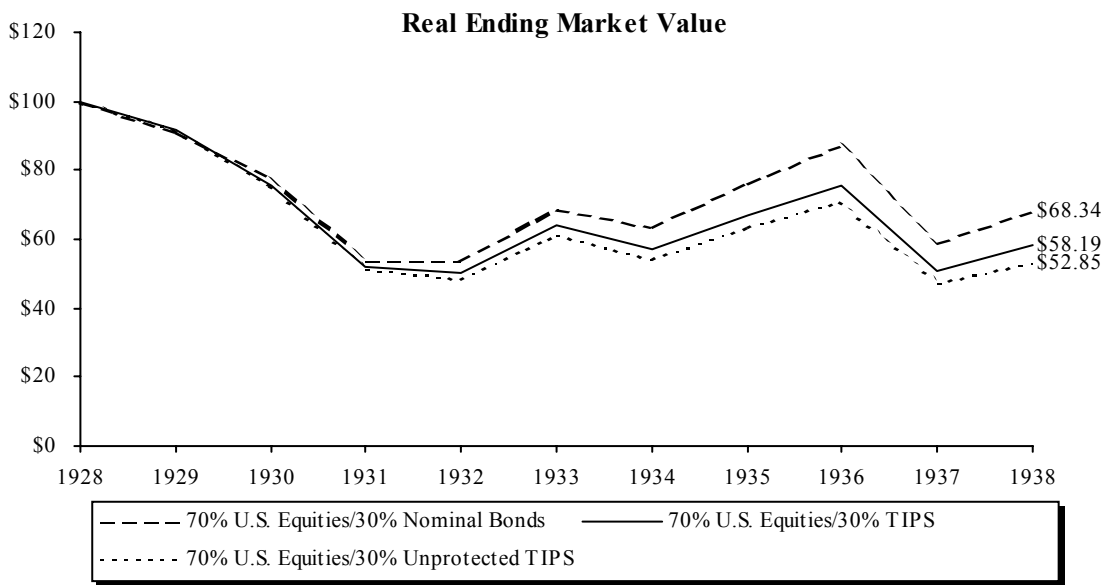
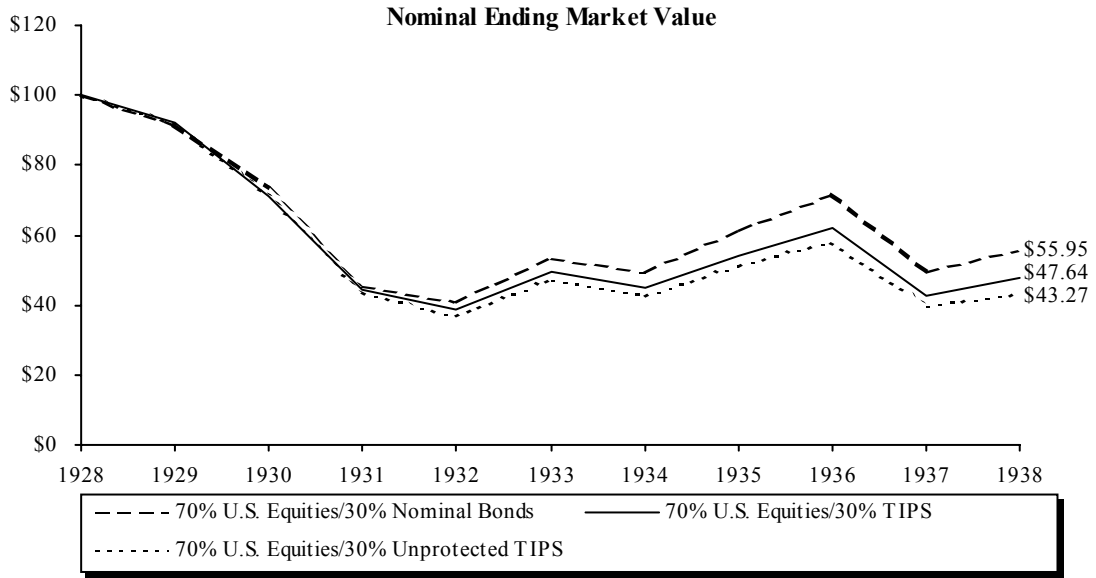
Sources: Salomon Smith Barney, Bureau of Labor Statistics, and Standard & Poor's.

Notes: Assumes a spending rule of 5% of trailing 12-quarter average market value. Quarterly rebalancing is applied.

EXHIBIT 3

COMPARISON OF PORTFOLIO MARKET VALUES AFTER SPENDING WITH SPENDING FLOOR DURING A PROLONGED ECONOMIC CONTRACTION

Nominal and Real Market Values of Portfolios Comprised of 70% U.S. Equities and 30% Nominal Bonds, TIPS and Unprotected TIPS, Respectively



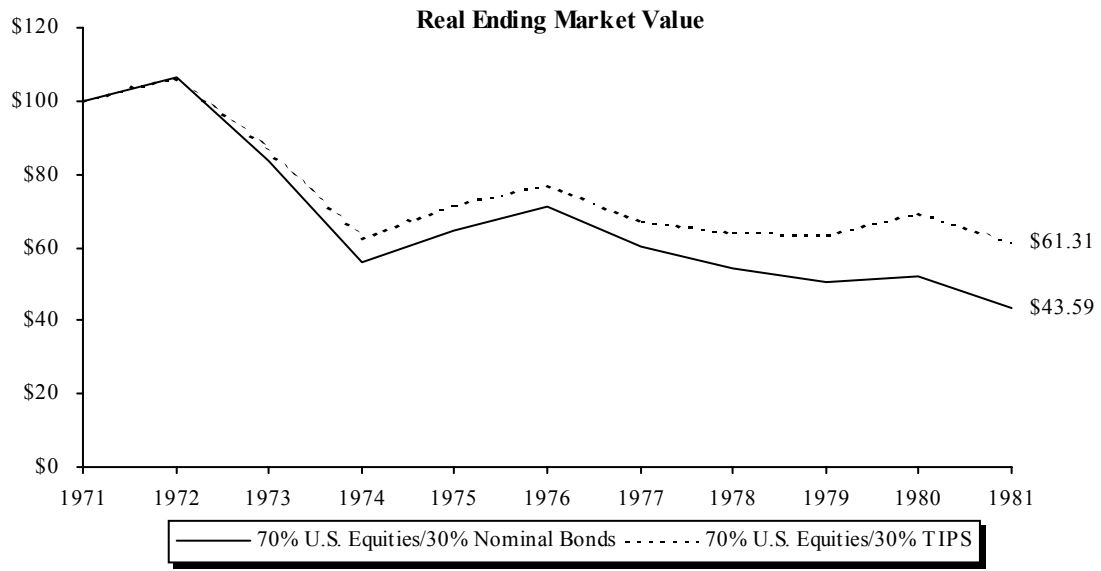
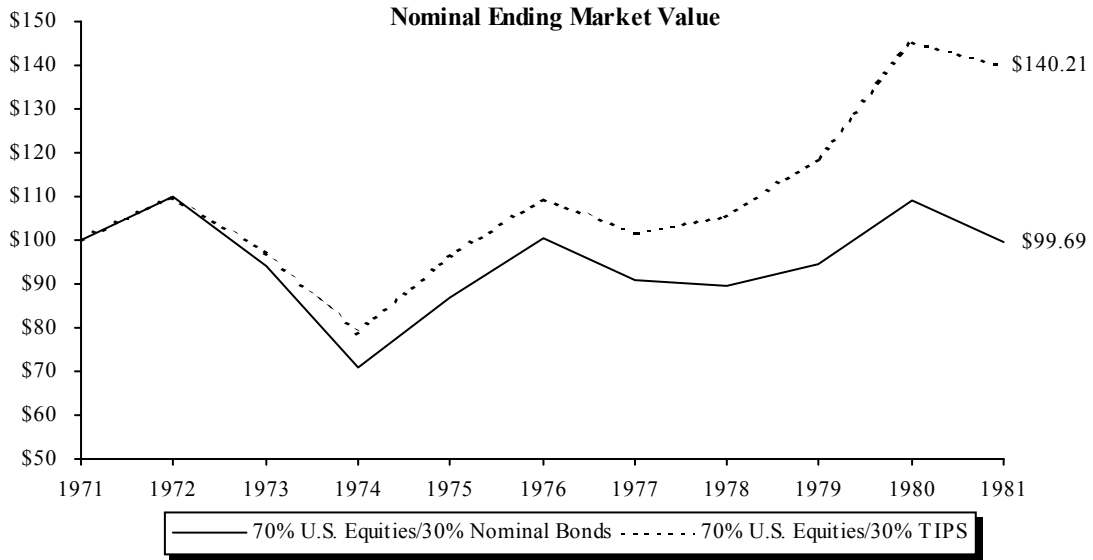
Sources: Salomon Smith Barney, Bureau of Labor Statistics, and Standard & Poor's.

Notes: Assumes a spending rule of 5% of trailing 12-quarter average market value. Spending must be at least equal to last year's nominal spending. Quarterly rebalancing is applied.

EXHIBIT 4

COMPARISON OF PORTFOLIO MARKET VALUES AFTER SPENDING WITH SPENDING FLOOR DURING A PROLONGED INFLATIONARY PERIOD

Nominal and Real Market Values of Portfolios Comprised of 70% U.S. Equities and 30% Nominal Bonds and TIPS, Respectively



Sources: Salomon Smith Barney, Bureau of Labor Statistics, and Standard & Poor's.

Notes: Assumes a spending rule of 5% of trailing 12-quarter average market value. Spending must be at least equal to last year's nominal spending. Quarterly rebalancing is applied.