

Characteristics and performance of real return funds

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Abstract

U.S. Treasury Inflation-Protected Securities (TIPS) are the primary security in real return mutual funds. This article focuses on a key question for investors: Do real return mutual funds add value to a portfolio or are they just redundant securities? We find that while some real return funds do provide a return in excess of the rate of inflation, their absolute and risk-adjusted returns are rarely better than a TIPS Index. Further, few of these funds provide investors with positive alpha after controlling for either their benchmarks or macroeconomic and systematic factors. © 2013 Academy of Financial Services. All rights reserved.

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1. Introduction

In 1997, the U.S. Treasury Department issued a new series of inflation-hedging securities called Treasury Inflation-Protected Securities (TIPS). The objective of this security class was to provide risk-averse investors with a return free of credit risk that was also indexed to consumer price inflation (Shen, 1998). Even though individual investors can purchase TIPS directly through the U.S. Treasury auction or in the secondary market, mutual funds investing in TIPS quickly proliferated, with assets growing 35-fold in the first five years, and 300-fold in 15 years.¹

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2. TIPS explained

Similar to U.S. Treasury notes and bonds, TIPS are securities issued by the U.S. Treasury with coupon payments every six months. TIPS differ from traditional Treasuries, however, in that their principal varies directly with the nonseasonally adjusted Consumer Price Index for all Urban Consumers (CPIU), published by the Bureau of Labor Statistics. The coupon *payment* also varies with the CPIU, although the coupon *rate* is fixed; the payment is based on the coupon rate times the underlying adjusted principal. For instance, on a \$1,000 face value bond with a 4% coupon during a six-month period with 1.5% inflation, the principal amount would rise to \$1,015 ($= \$1,000 \times (1 + 0.015)$), and the coupon payment to \$20.30 ($= \$1,015 \times (0.04/2)$), based on that adjusted principal. The investor would earn \$15 price appreciation and \$0.30 of additional interest income, for a return of 1.5% ($= [(\$1,015 + 20.30)/(\$1,000 + \$20.00)] - 1$) that compensates for inflation, and thus maintains constant purchasing power.

Principal adjustments are made semiannually, on coupon dates, but with a three-month lag to the CPIU. TIPS pay the greater of the adjusted principal or par at maturity, which affords some downside protection in deflationary periods (Shen, 1998). TIPS are not a perfect hedge against inflation, because of the lag in the coupon adjustment and the basis risk of price increases not captured by the CPIU, but investors should earn close to the real interest rate and suffer less erosion of purchasing power on their principal in a period of rising commodity prices.

Thus, the yield associated with TIPS includes both the real rate of return and an inflation premium. The real rate of return is the actual purchasing power of the yield component. Since TIPS, like all other Treasury securities, are backed by the U.S. Government, the real return component is credit-risk free. Premiums for uncertainty about future inflationary expectations and uncertainty about the direction of real rates of return are, however, built into the TIPS yield (Dudley, Roush, and Ezer, 2009).

Current market conditions, low interest rates, and low inflation expectations contribute to the small size of the TIPS market compared with the overall Treasury market. Since inception, the TIPS market has been 5.8% of the size of the U.S. Treasury market on average, with a low of 2.8% in 2009 and a high of 16.4% in 1998.² Another factor contributing to the lack of participation in the TIPS market is tax treatment. Current IRS policy taxes both the semiannual coupon payments received and any increase in principal, which is accrued, but not received in cash (similar to the tax treatment of zero coupon bonds). The illiquidity of the TIPS market, because of its relative size and infrequent trading, results in an additional yield premium (Grishchenko and Huang, 2012).

3. TIPS and real return funds

While investors can participate in the TIPS market directly, they can also invest indirectly through conventional mutual funds and ETFs. As Fig. 1 shows, the number and volume of real return funds increased rapidly after the first TIPS issue in 1997.

Neither the TIPS market nor inflation-protected mutual funds have gone through a

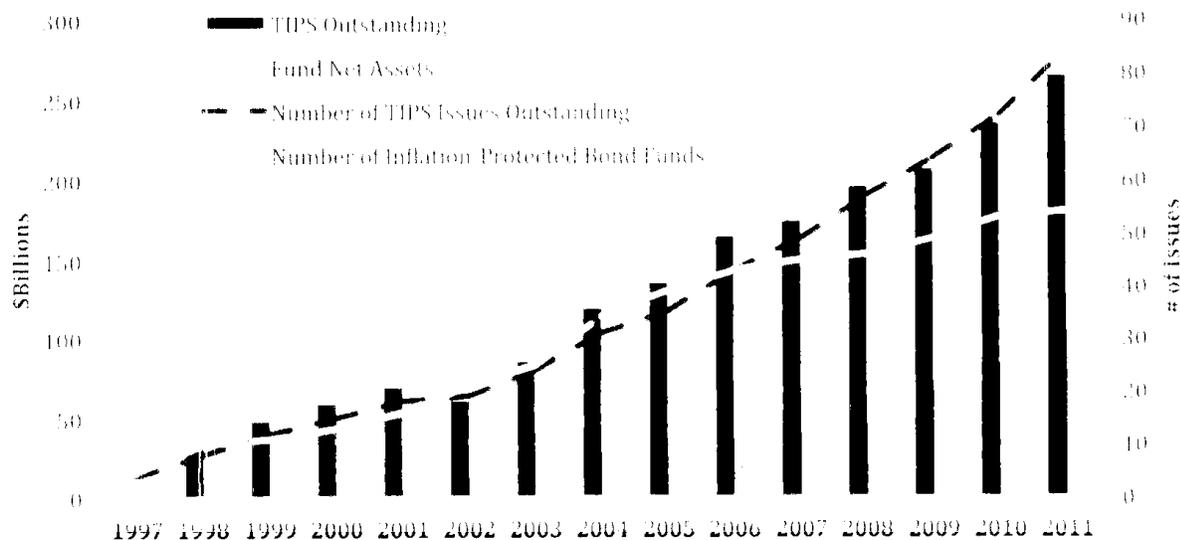


Fig. 1. Growth of Treasury Inflation-Protected Securities (TIPS) and Inflation-Protected Bond Funds. *Source:* U.S. Department of the Treasury, Morningstar Direct.

prolonged period of inflation, so it is difficult to gauge their ability to deliver a sustained return above a rising rate of inflation. Further, while TIPS are inflation-protected, investors still face interest rate risk. Thus, TIPS will underperform if interest rates rise faster than inflation. Conversely, if there is a phase of deflation—a decrease in the average prices of goods and services—then investments promising a real return could be unattractive investments. This would be particularly true of funds that may invest in securities that do not have the same minimum principal feature as TIPS.

The contribution of this article is to provide descriptive statistics of real return funds; compare the funds with their benchmarks; and analyze their real risk-adjusted returns. Thus analysts will be able to make a more informed investment decision given a clearer understanding of the risk and return characteristics of real return funds.

4. Literature review

The literature on real return funds per se is limited. However, the general TIPS literature addresses two major concerns relevant to fund investors in this sector: (1) the components of TIPS returns and (2) the efficiency of TIPS in portfolios.

4.1. TIPS yield, return, and risk measurement

Dudley et al., (2009) break down TIPS yield into several components: the real yield; an inflation risk premium; a liquidity premium; and a tax component. The real yield reflects the yield level on comparable-maturity nominal Treasuries, less inflation expectations. Because the increase in principal from a rising CPIU is taxable, but not paid to the investor in cash, the after-tax real yield typically is lower than the pretax yield (Betty and Bhanot, 2002; Shen, 1998).

Hunter and Simon (2005) find that the returns from TIPS and nominal Treasuries are more highly correlated when the yield curve is flat and when the spread between TIPS and nominal Treasuries is increasing. This suggests that when inflation expectations are high, and/or general uncertainty is low, TIPS and Treasuries tend to show similar performance.

Grishchenko and Huang (2012) use VAR to approximate that 14 to 19 basis points of TIPS' yields during the 2004–2008 period account for a premium attributable to illiquidity and to the three-month lag between the reporting of CPIU and the adjustment to TIPS' principal. In an earlier study, D'Amico, Kim, and Wei (2008) document the size of the liquidity premium, which is smaller between 2003 and 2007 than in the 1997–2002 period. As Fig. 1 (and Dudley et al., 2009) shows, this decline in the liquidity premium coincides with a rise in the number and assets under management of funds in the Morningstar Inflation-Protected Bond Fund category.

Grishchenko, Vanden, and Zhang (2011) estimated the value of a deflation option in TIPS arising from the payoff value of the maximum of the indexed principal or par. Christensen, Lopez, and Rudebusch (2012) measured this value to be ~41 basis points for a five-year security.

Other work contrasting the risks of TIPS and Treasuries shows TIPS returns are sensitive to changes in real yields, but not changes in inflation expectations, while nominal Treasuries are responsive to both (Shen, 1998). Rudolph-Shabinsky and Trainer (1999) show that just assigning duration to TIPS based on a real yield beta does not accurately reflect interest rate risk. While Roll (2004) uses regression to estimate yield betas for TIPS, he also demonstrates that TIPS volatility is time-varying.

4.2. TIPS as an asset allocation tool

Many authors have shown that TIPS provide a benefit in a portfolio, either through real return enhancement, risk reduction, or both. Lamm (1998) demonstrates through simulation that the inclusion of TIPS provides diversification benefits by lowering portfolio risk. Kothari and Shanken (2004) use the first six years of TIPS returns to illustrate incremental return employing both an inflation forecasting model and an empirical model. Roll (2004) also shows that TIPS may improve portfolio returns under some inflation assumptions. Mamun and Visaltanachoti (2005) find that both U.S. TIPS and U.K. inflation-linked gilts provide diversification benefits under both unconditional and conditional spanning tests.

Cartea, Saul, and Toro (2011) examine the results investors would have obtained from various weightings of TIPS in a multiasset portfolio using historical asset returns. They find that both short- and long-horizon investors would have benefitted in real terms by including TIPS in their portfolios. The advantage was greater the higher the level of the investor's risk aversion. Shankar (2009) shows TIPS combined with deferred annuities produce a guaranteed real annual withdrawal rate above what could be produced through a portfolio of stocks and bonds, with less risk of financial ruin.

In contrast, some later work suggests that asset allocation with inflation-indexed bonds may not provide a significant diversification benefit. While Hunter and Simon (2005) show that the conditional Sharpe ratios of TIPS are greater than those of nominal Treasuries, they do not conclude that TIPS to afford diversification benefits as an asset class. Briere and

Signori (2009) find that the correlation between the returns of TIPS and nominal Treasuries from 2003 to 2007 was greater than from 1997 to 2002, and consequently, the benefits of diversification had faded. Given the low-rate, low-inflation environment during the 2003–2007 period, these results are consistent with the Hunter and Simon (2005) conditional correlation work.

Huang and Milevsky (2007) point out that retirees' experience of inflation may be different from the CPIU. Citing the experimental CPI-E Index, which covers price changes particular to the spending patterns of the elderly, they show that there is basis risk between the two measures, so that an investment based on CPIU may not be sufficient to hedge future retiree income. Sixty-three percent of mutual fund investors are over 45 years old, compared with 47% in 1994.³ As the average investor continues to age, maintaining purchasing power will only grow in importance. Fifteen years after the inception of TIPS, it is important for aging investors to understand the characteristics and returns of real return mutual funds to date.

5. The funds and benchmarks

Fund information comes from the CRSP Survivor-Free Mutual Fund Database (via Morningstar Direct). The sample consists of 74 funds either in the U.S. Open-End Inflation-Protected Bond Category (58 funds), or with the phrase "real return" in their name (16 funds). The majority of funds are in either the Taxable Bond asset class (58 funds) or the Balanced asset class (six funds). The remaining 10 funds are distributed across seven other asset classes.

We measure the funds' returns, gross of fees, from March 31, 1997 through March 31, 2013. Within fund families, we selected the Institutional class or another class with no loads or 12-b(1) fees. Monthly fund returns are from the CRSP Mutual Fund Database, matching the CRSP Fundno identifier to the fund to capture any name changes over its history.

Of the 74 funds, 19 have fewer than 30 months of returns; 46 have between 30 months and 10 years; and nine have more than 10 years of returns. Although this is not a long history, the asset class has attracted significant cashflow, with 16 funds over \$1 billion in net assets, and nine more between \$500 million and \$1 billion.⁴ The CRSP Database is survivorship bias-free; 12 funds terminate before the end of the sample period (68 funds start after the beginning of the period). Fund returns are included in the study for whatever time period they have available data.

Fund returns are benchmarked in two ways. We compare a fund's returns to its Prospectus Benchmark as listed in the Morningstar database. We used the Barclays U.S. TIPS Index where no benchmark was listed (38 funds), because this was the stated benchmark for a plurality of funds (22 funds), and it is the index holding all outstanding TIPS. The breakdown of funds by their benchmarks is shown in Table 1.

A major problem with the benchmark indices is the paucity of underlying issues. As shown in Fig. 1, until 2004, there were fewer than 30 TIPS issues outstanding; as of December 2011, there were 84 bonds with a total \$264 billion outstanding. Further, the funds

Table 1 Real return fund benchmarks

Fund benchmark	Number of funds with benchmark
Barclays Capital U.S. Treasury TIPS (BCUS TIPS)	60*
Barclays Capital 1–10 Yr U.S. TIPS (BC1–10 TIPS)	5
Barclays Capital Global Inflation-Linked U.S. TIPS (BCGUS TIPS)	1
Barclays Capital U.S. Government Inflation-Linked (BCUS Infl)	2
Bank of America U.S. Treasury Inflation-Linked 1–5 Yr (BoA1–5 TIPS)	1
Citi U.S. Inflation-Linked Securities (Citi U.S. TIPS)	1
Citi Treasury Bill 1-Month USD (CitiTB 1Mo)	1
Barclays Capital U.S. Treasury (BCUST)	2
Dow Jones/UBS Commodity (DJ/UBS Comm)	1

*Includes 38 funds with no stated benchmark.

Source: Morningstar Direct.

themselves are likely to be heavily invested in TIPS. For example, as of March 31, 2013, the PIMCO Real Return Fund was 95% invested in U.S. TIPS.⁵ This suggests that the funds' returns will closely mimic both the indices and TIPS themselves, which leads to the question of why investors should use a mutual fund to access TIPS.

We compare the benchmarks and funds with the CPIU and the Personal Consumption Expenditure Deflator (seasonally adjusted) (PCED). The data are from the Bureau of Labor Statistics (BLS) and U.S. Department of Commerce, respectively. The differences between the two indices are because of differences in their formulas and the pricing, weighting, and scope of the goods included in each index (McCully, Moyer, and Stewart, 2007).

A key question is whether the funds' returns hedge against inflation. Fig. 2 illustrates the relation between the CPIU and two possible hedging measures. Panel A shows the monthly percentage change in the CPIU compared with the monthly return of the Barclays U.S. TIPS Index. The majority of the funds in the study use this benchmark, which contains all outstanding U.S. Treasury Inflation Protected securities, across all maturities. However, this index has a correlation of only +0.25 with CPIU. Its monthly return is also much more volatile than the CPIU. Initial examination suggests that managers attempting to track this benchmark may not produce desirable inflation- and risk-adjusted returns. Panel B compares CPIU with the Inflation Premium, measured by the difference in the return of the five-year U.S. Constant-Maturity Treasury Index and five-year U.S. TIPS. This difference is often used to represent the premium investors place on bond yields because of inflation expectations. This measure has a correlation of +0.52 with CPIU, with both a higher return and a slightly greater standard deviation. Comparing Panels A and B suggests that once interest rate risk is hedged out, a single TIPS may provide a better inflation hedge than a portfolio containing all TIPS, but at the sacrifice of diversification.

To understand the hedging properties of the funds further, we will analyze their returns controlling for inflation and other systematic factors. Lockwood (1996) finds a relation between bond funds and both Industrial Production and the equity risk premium; Xu (2009) finds that TIPS returns are related to interest rates and credit spreads. This article extends the analysis to real return funds.

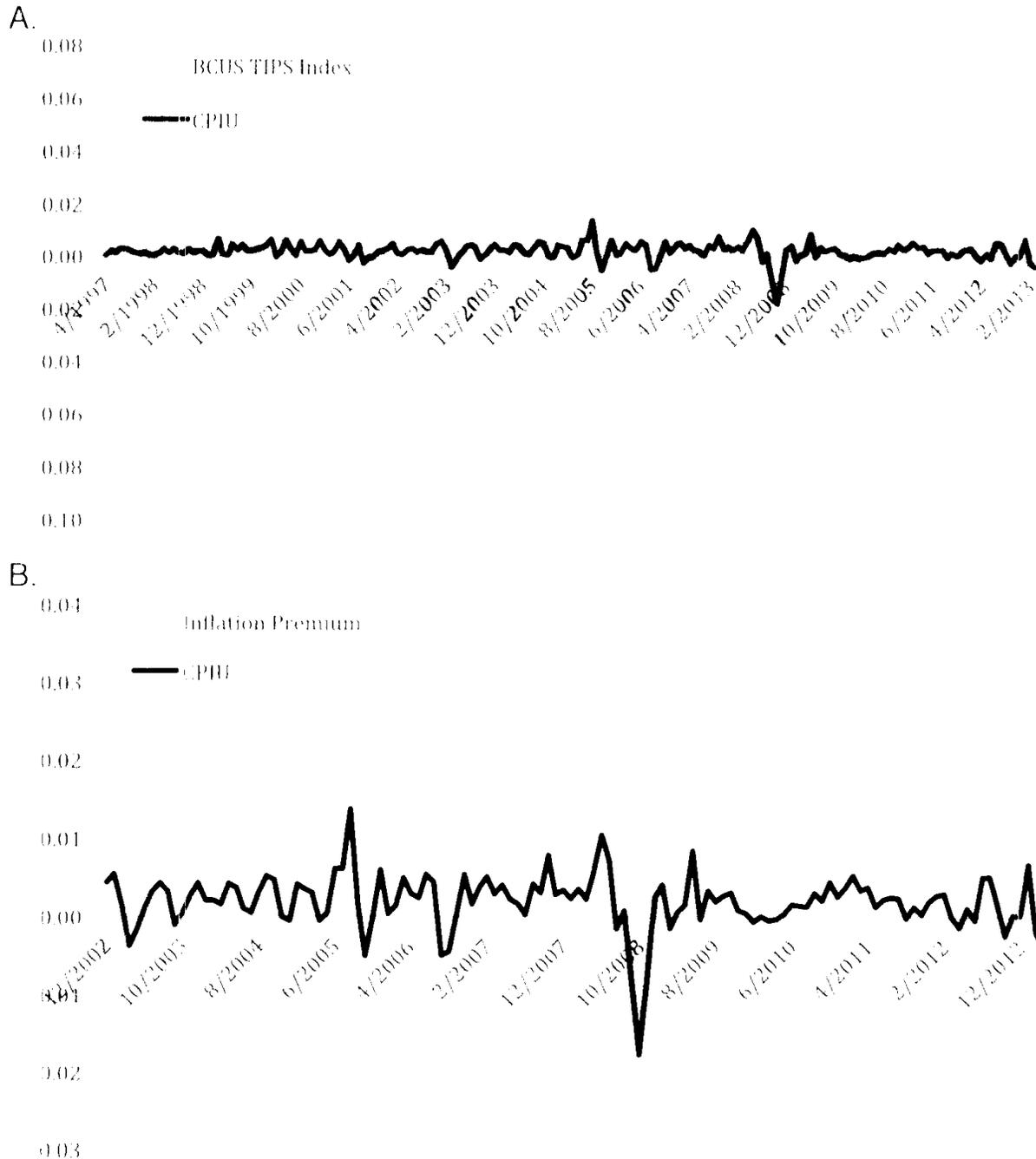


Fig. 2. Monthly percentage changes for TIPS and CPI. Panel A. Monthly percentage changes for Barclays Capital U.S. TIPS Index and CPI, all Urban Consumers (CPIU), March 31, 1997–March 31, 2013. Panel B. Monthly percentage changes for U.S. five-year Treasury Inflation Premium (five-year Treasury return–five-year TIPS return) and CPI, all Urban Consumers (CPIU), December 31, 2002–March 31, 2013.

We use the following systematic factors:

- The equity risk premium: the return on the stock market minus the one-month U.S. Treasury Bill rate (Fama and French, 1992) (ERP);⁶
- The inflation premium: the yield spread between the five-year U.S. Treasury and TIPS yields (INFPREM); and

- The credit risk premium: the yield differential between the Moody's Baa-rated and Aa-rated Indexes (CRSPD).⁷

Table 2 displays the correlation of monthly returns between the fund benchmarks, systematic factors, and the two inflation measures between 1997 and 2013. While the benchmarks are somewhat correlated with each other, most have low correlation with inflation. For example, the Barclays U.S. TIPS Index has a correlation with the Barclays 1–10 Year TIPS Index of +0.96 (the Barclays 1–10 TIPS Year Index is a subset of the full index). However, the correlation of the full TIPS Index with the CPIU and the PCED is +0.25 and +0.24, respectively. Nominal Treasuries, measured by the Barclays U.S. Treasury Index, have a correlation with the TIPS Index of +0.64, and a correlation with the inflation measures of –0.13 and –0.15, respectively (significantly different from zero at 10% and 5%, respectively). On the other hand, the systematic measures of the ERP, INFPREM, and CRSPD have correlations with CPIU of +0.22, +0.52, and –0.28, respectively, but are not highly correlated with the TIPS benchmarks.

6. Fund returns

6.1 Cumulative and absolute returns

Fig. 3, Panels A, B, and C shows the cumulative monthly returns (i.e., growth of \$1 equals $[(1 + r_1) \times (1 + r_2) \times \dots \times (1 + r_n)]$) for the 74 funds and their benchmarks over the period beginning March 31, 1997, 10 years, and five years through March 31, 2013. The bottom part of each chart displays the number of funds outstanding by year.⁸

The Average Fund is the arithmetic mean return of all funds outstanding in a given month. In all three periods, the cumulative return of the Barclays U.S. TIPS Index outperformed the Average Fund. The Best-Performing fund by cumulative (gross) return does outperform the TIPS benchmark in all three periods. The Worst-Performing fund provides a cumulative return greater than inflation in only the full sample and 10-year periods, underperforming inflation in the five-year period. Because the fund returns are gross of fees, the funds' net outperformance or underperformance is actually understated.⁹ Depending on an investor's time horizon and fund selection, his return and risk experience can vary widely.

Table 3 shows the descriptive statistics for gross monthly returns for the funds and benchmarks. The average monthly return for all funds was 0.49%; the median return was 0.51%. This compares with the mean and median for Barclays Capital U.S. TIPS Index (the benchmark for 60 of the 74 funds) of 0.58% and 0.55%, respectively. The average fund return was less than the returns for all the other benchmarks except the Bank of American one to five year Treasury Inflation-Linked Index, Citi U.S. One-month Treasury Bill Index, and Dow Jones/UBS Commodity Index. By category, funds in the Inflation-Protected Bond category ($N = 58$) had a higher mean, lower standard deviation, and more normally distributed returns (mean of 0.52%; median of 0.49%; and standard deviation of 0.0183), while the funds in the Other Real Return category ($N = 16$) had lower returns and more

Table 2 Correlation between monthly returns of real return fund benchmarks and inflation measures over the period March 31, 1997–March 31, 2013

	BCUS TIPS	BC1- 10TIPS	BCUS Infl	BoA1-5 TIPS	BCUST TIPS	BCGUS TIPS	CitiTB 1Mo	CitiUS TIPS	DJ/UBS Comm	Equity Risk Prem	Infl Prem	Credit Spd	CPIU	PCED
BCUS TIPS	1.00													
BC1-10TIPS	0.96***	1.00												
BCUS Infl	1.00***	0.95***	1.00											
BoA1-5 TIPS	0.89***	0.97***	0.87***	1.00										
BCUST	0.64***	0.57***	0.66***	0.46***	1.00									
BCGUS TIPS	1.00***	0.96***	1.00***	0.89***	0.65***	1.00								
CitiTB 1Mo	-0.02	0.04	-0.02	0.04	0.10	-0.02	1.00							
CitiUS TIPS	1.00***	0.95***	1.00***	0.87***	0.66***	1.00***	-0.02	1.00						
DJ/UBS Comm	0.30***	0.34***	0.29***	0.48***	-0.07	0.29***	0.02	0.29***	1.00					
Equity Risk Prem	0.00	0.03	0.00	0.09	-0.30***	0.01	-0.05	0.00	0.35***	1.00				
Infl Prem	0.11	0.17*	0.10	0.23***	-0.21*	0.11	0.46***	0.10	0.37***	0.27***	1.00			
Credit Spd	0.06	0.03	0.07	0.00	0.10	0.06	-0.50***	0.06	-0.12*	-0.23***	-0.86***	1.00		
CPIU	0.25***	0.33***	0.23***	0.42***	-0.13*	0.25***	0.10	0.23***	0.62***	0.22**	0.52***	-0.28***	1.00	
PCED	0.24***	0.33**	0.22**	0.42***	-0.15**	0.24***	0.07	0.22**	0.62***	0.23**	0.55***	-0.27***	0.93***	1.00

***, **, *Correlation is significantly different from zero at 1%, 5%, and 10%, respectively.

Source: Morningstar Direct, http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html#Research, U.S. Treasury, Moody's via <http://research.stlouisfed.org/fred2/>, BLS, Commerce Department.

A.

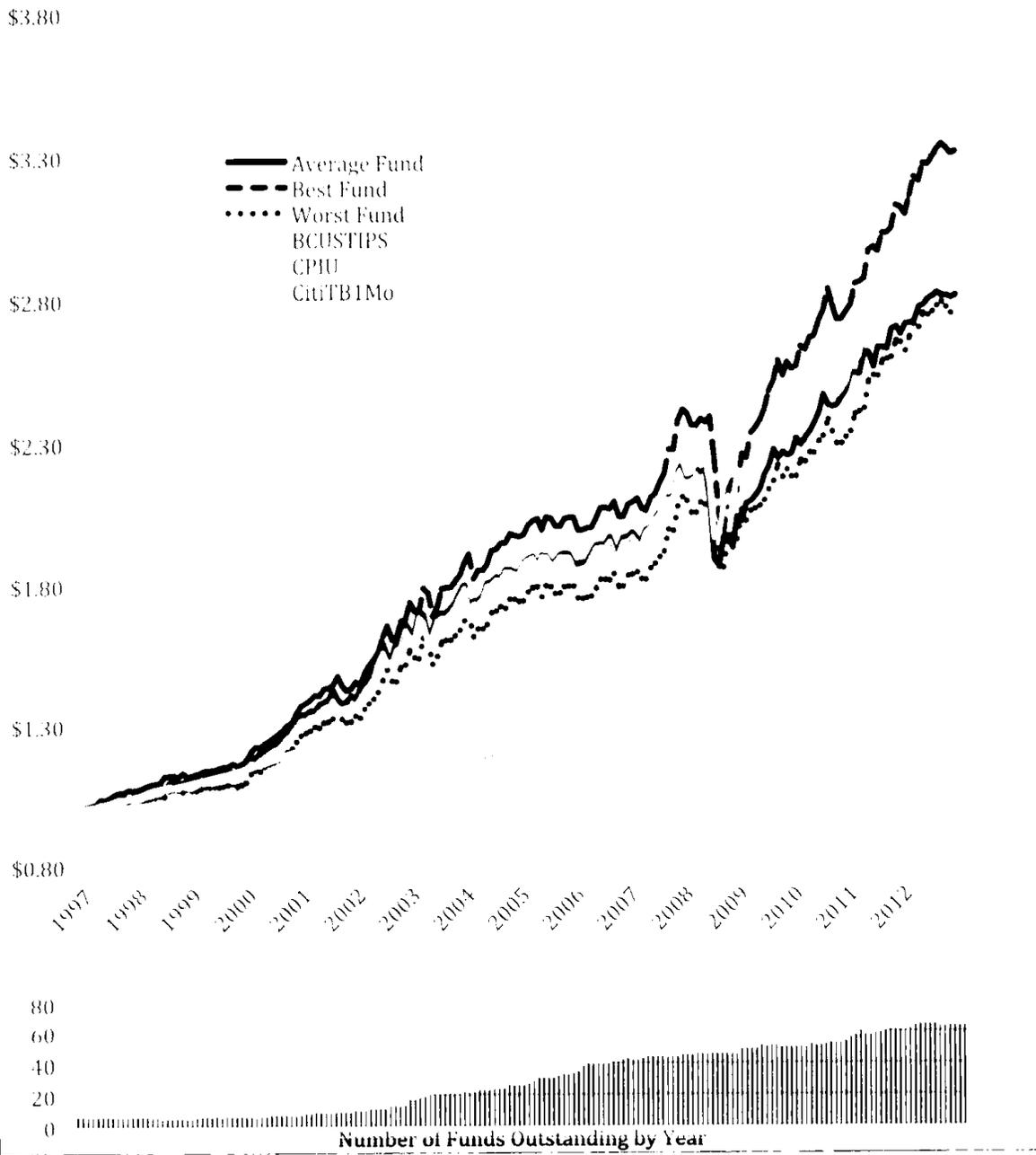


Fig. 3. Cumulative monthly returns for real return funds (average, best, and worst); Barclays U.S. TIPS Index (BCUSTIPS); Citigroup 1-month Treasury Bill Index (CitiTB1Mo); and inflation (Consumer Price Index–All Urban Consumers, CPIU). Panel A. Cumulative monthly returns, March 31, 1997–March 31, 2013. *Source:* CRSP Mutual Fund Database, Morningstar Direct.

variability, but were also more negatively skewed (mean of 0.0039; median of 0.0081; and standard deviation of 0.0290).

We constructed a 95% confidence interval around each fund’s mean return.¹⁰ The confidence interval for 19 of the 74 funds contained zero, suggesting that these funds’ average returns were not significantly different from zero at the 5% level. The remaining funds had mean returns that exceeded the upper limit of the confidence interval.

B.

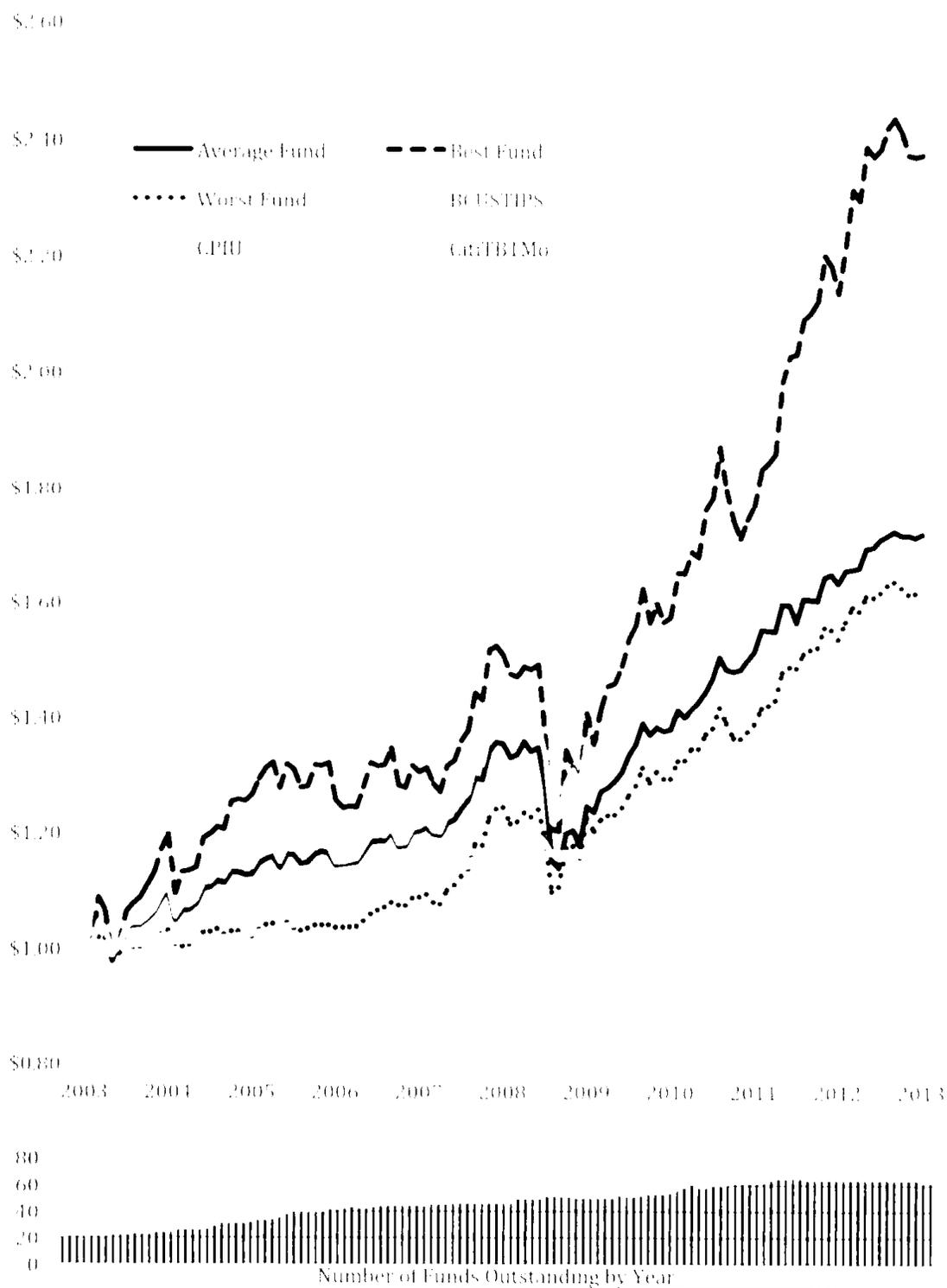


Fig. 3. (Continued) Panel B. Cumulative monthly returns, 10 years ending March 31, 2013. *Source:* CRSP Mutual Fund Database, Morningstar Direct.

However, all but one of the funds' confidence intervals contained the mean return for its respective index. For the funds whose interval did not contain the benchmark mean

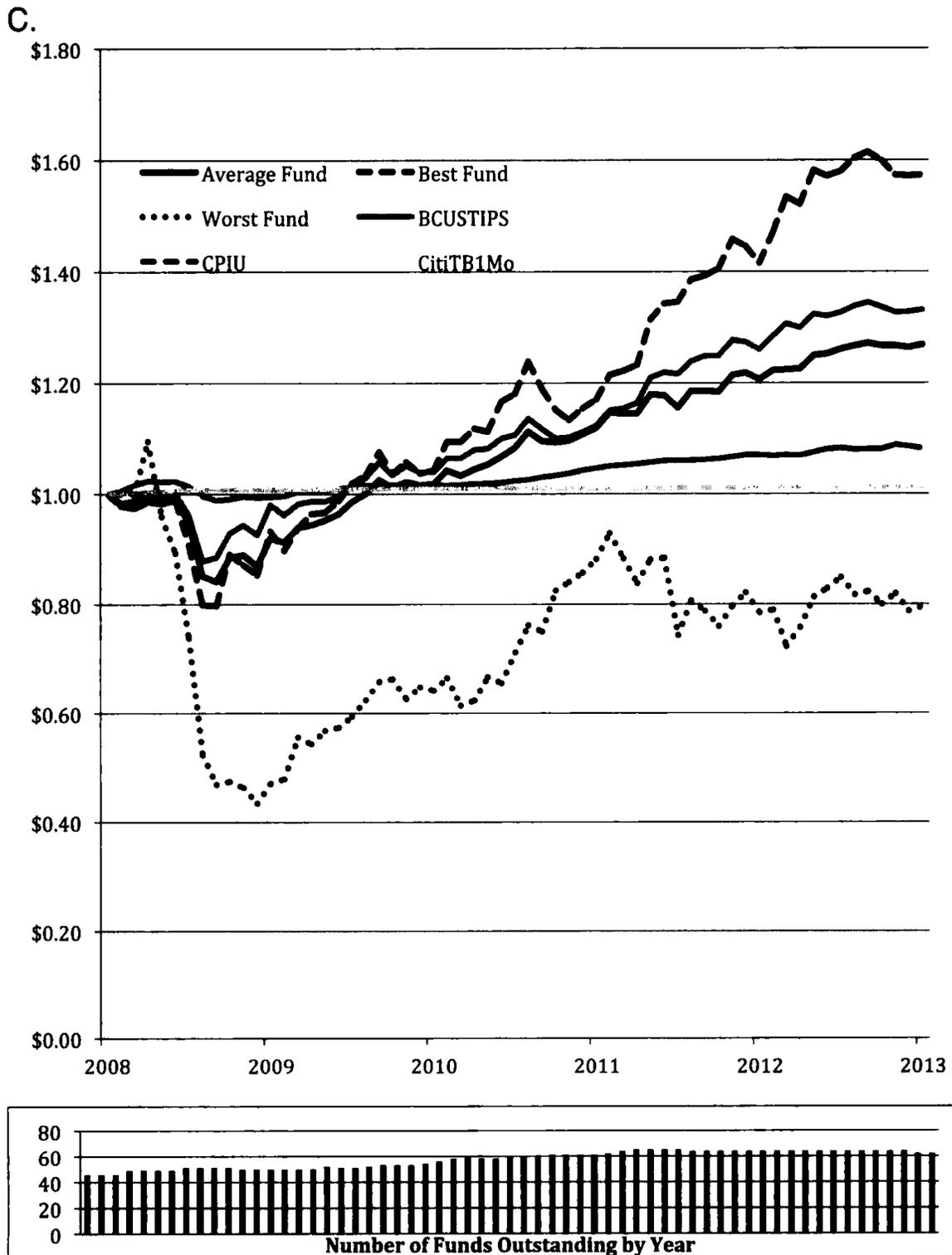


Fig. 3. (Continued) Panel C. Cumulative monthly returns, five years ending March 31, 2013. *Source:* CRSP Mutual Fund Database, Morningstar Direct.

return, the upper bound was below the benchmark mean. These results suggest that the funds on the whole do not outperform their benchmarks on a nominal basis, gross of fees. Next, we look at the funds' performance, adjusted for risk and inflation.

Table 3 Descriptive statistics of monthly returns

Funds	<i>N</i> obs	Mean	Median	Min	Max	SD	<i>N</i> funds
All Real Return Funds	83	0.0049	0.0051	−0.2913	0.1583	0.0206	74
Funds using Barclays Capital U.S. Treasury TIPS Index Benchmark	85	0.0049	0.0052	−0.2913	0.1583	0.0218	60
Inflation-Protected Bond Category	93	0.0052	0.0049	−0.2697	0.1168	0.0183	58
Other Real Return Category	45	0.0039	0.0081	−0.2913	0.1583	0.0290	16
Benchmarks							
Barclays Capital U.S. Treasury TIPS	192	0.0058	0.0055	−0.0869	0.0585	0.0166	
Barclays Capital 1–10 Yr U.S. TIPS	170	0.0054	0.0050	−0.0792	0.0452	0.0136	
Barclays Capital U.S. Government Inflation-Linked	185	0.0059	0.0054	−0.0869	0.0584	0.0169	
Bank of America U.S. Treasury Inflation-Linked 1–5 Yr	134	0.0042	0.0034	−0.0566	0.0279	0.0107	
Barclays Capital Global Inflation-Linked U.S. TIPS	192	0.0059	0.0055	−0.0828	0.0589	0.0166	
Barclays Capital U.S. Treasury	192	0.0050	0.0052	−0.0439	0.0531	0.0132	
Citi Treasury Bill 1-Month USD	192	0.0020	0.0016	0.0000	0.0049	0.0017	
Citi U.S. Inflation-Linked Securities	192	0.0059	0.0055	−0.0854	0.0586	0.0166	
Dow Jones/UBS Commodity	192	0.0039	0.0078	−0.2128	0.1301	0.0492	

Source: CRSP Mutual Fund Database, Morningstar Direct.

6.2. Risk-adjusted real returns

As shown in Table 4, the average monthly return in excess of Consumer Price inflation ($r_{it} - CPIU_t$) was 0.32%; the median excess return was 0.33%. The average real return for the funds in the Inflation-Protected Bond category was 0.34%, while the Other Real Return funds average was 0.23%. The Other Real Return category funds' returns were much more negatively skewed, with a median of 0.49%. The mean return for Inflation-Protected funds was above the average real return of the benchmarks, of 0.29%, but below the return of the Barclays Capital U.S. TIPS Index mean real return of 0.39%.

Twenty-seven of the funds have 95% confidence intervals whose lower bound exceeds zero, suggesting that these provide a positive real return, on average (not tabulated). All but two of the funds' confidence intervals contain its benchmark mean, however, and the upper

Table 4 Descriptive statistics of monthly returns net of Consumer Price Index (CPIU)

Variable	Mean <i>N</i> obs	Mean	Median	Min	Max	SD	<i>N</i> funds
All Real Return Funds	83	0.0032	0.0033	−0.2736	0.1499	0.0197	74
All Benchmarks	182	0.0029	0.0035	−0.1951	0.1216	0.0169	
Barclays Capital U.S. Treasury TIPS	192	0.0039	0.0036	−0.0692	0.0578	0.0161	
Funds by Category							
Inflation-Protected Bond	93	0.0034	0.0032	−0.2520	0.1142	0.0174	58
Other Real Return	45	0.0023	0.0049	−0.2736	0.1499	0.0280	16

Source: CRSP Mutual Fund Database, Morningstar Direct, BLS.

Table 5 Sharpe ratios computed using Consumer Price Index

Variable	Mean <i>N</i> obs	Sharpe ratio	Number with Sharpe statistically significant from 0	Number with Sharpe statistically significant from benchmark	Funds
All Real Return Funds	83	0.1934	26	3	74
Benchmarks	85	0.1946	7	N/A	
Barclays Capital U.S. Treasury TIPS	192	0.2425	1	N/A	
Funds by category					
Inflation-Protected Bond	93	0.2142	25(+)	2(-)	58
Other Real Return	45	0.1178	1(+)	1(-)	16

Sharpe ratio is $\overline{SR} = (r_{it} - c_{it})/\sigma$, estimated with $r_{it} - c_{it}$ = mean of monthly gross fund return minus the corresponding month's percentage change in the CPIU, and SD of the series of N months of $r_{it} - c_{it}$. A 95% confidence interval for each fund was calculated around the mean monthly Sharpe ratio using an IID SE (assumes the returns are independent and identically distributed, as in Lo (2002)) $SE(\overline{SR}) = \sqrt{(1 + \frac{1}{2}\overline{SR}^2)/T}$. Sharpe ratio is statistically significantly from zero or the benchmark Sharpe ratio if the confidence interval does not contain the respective number.

Source: CRSP Mutual Fund Database, Morningstar Direct, BLS.

bound is below the benchmark mean for those two. Other Real Return funds underperform the Inflation-Protected Bond funds, but the funds largely underperform their benchmarks overall on a real return basis. This further undermines the efficacy of using a fund rather than investing in a TIPS portfolio for preserving purchasing power.

We also compute real, risk-adjusted returns for the funds using the CPIU. We measure the risk-adjusted return using the Sharpe ratio, but with inflation instead of the risk-free rate:

$$SR = \frac{r_{it} - c_{it}}{\sigma}, \quad (1)$$

where

r_{it} = mean monthly return of fund, gross of fees

c_{it} = mean monthly percentage change in inflation index (CPIU),

σ = standard deviation of $r_i - c_i$ over the period.

Our rationale for using the inflation measure to compute excess return is that if investors are trying to maintain their purchasing power; and if the funds' stated objective is to achieve real return; then an investment should achieve a risk-adjusted return above inflation.

Table 5 shows risk-adjusted real returns for the funds and benchmarks using the Sharpe ratio computed in Eq. (1). The mean monthly real Sharpe ratio was 0.19 for the funds and the benchmarks on average, and 0.24 for the Barclays Capital U.S. TIPS Index. The Sharpe ratios for Inflation-Protected funds and Other Real Return funds were 0.21 and 0.12, respectively.

We constructed a 95% confidence interval around the Sharpe ratio for each fund. All but three of the funds had confidence intervals that contained the Sharpe ratio of their respective benchmarks, and the upper bounds of the three were below their benchmarks' Sharpe ratios. This indicates that none of the funds outperformed its index on a real, risk-adjusted basis,

Table 6 Single-index models

Funds by benchmark	Number of funds with benchmark	Number Significant		Average significant
		α_i	β_1 BENCH	β_1 BENCH
Barclays Capital U.S. Treasury TIPS	60	4	59	1.27
Barclays Capital 1–10 Yr U.S. TIPS	4	0	4	0.95
Barclays Capital U.S. Government Inflation-Linked	2	0	2	0.98
Bank of America U.S. Treasury Inflation-Linked 1–5 Yr	2	0	2	1.28
Barclays Capital Global Inflation-Linked U.S. TIPS	1	0	1	0.93
Barclays Capital U.S. Treasury	1	0	1	0.74
Citi Treasury Bill 1-Month USD	1	0	0	N/A
Citi U.S. Inflation-Linked Securities	1	1	1	0.99
Dow Jones/UBS Commodity	1	0	1	0.14
Funds by category				
Inflation-Protected Bond	57	3	57	1.16
Other Real Return	16	2	14	1.39

Parameter estimates for single-index models of fund returns. The first model is $R_{it} = \alpha_i + \beta_1 I_{1t} + \varepsilon_i$, where α_i is the intercept, β_1 is the fund return's sensitivity to the excess return of its stated benchmark (BENCH). The null hypothesis is that the coefficient is equal to zero.

Source: CRSP Mutual Fund Database, Morningstar Direct.

with a statistical significance of 5%. Only three of the 60 funds benchmarked against the Barclays U.S. TIPS Index outperformed it based on the confidence interval. Further, just 26 funds (25 Inflation-Protected, one Other Real Return) had confidence intervals that did not contain zero, suggesting that the other 48 funds had no statistically significant real risk-adjusted return at the 5% level of significance.¹¹ In general, the funds do not fare well on either an absolute or relative basis when adjusted for risk and inflation. Next, we turn to examining the basis for the funds' returns.

6.3. Return attribution

To better understand how the funds' returns relate to their benchmarks, we first use the approach in Blake, Elton, and Gruber (1993). Table 6 shows the results of regressions using the Eq. (2):

$$R_{it} = \alpha_i + \beta_1 I_{1t} + \varepsilon_i, \quad (2)$$

where

R_{it} = excess return of fund i in month t (measured as r_{it} minus the one-month U.S. Treasury Bill rate)

α_i = manager risk-adjusted excess return of fund i

β_1 = sensitivity of fund i to its stated benchmark

I_{1t} = excess return of the benchmark in month t

ε_i = unexplained excess return for fund i .

As Table 6 illustrates, the funds are closely related to their benchmarks, but do not provide significant excess return beyond the benchmark return. All but two of the funds had significant beta to their benchmarks.¹² The average beta of all funds with significant beta was +1.21, suggesting that a one percentage point change in the index would result in a 121 basis point increase in the fund return, on average. The average beta for the Inflation-Protected funds to their benchmarks was +1.16; for the Other Real Return funds was +1.39.

Only five funds produced alpha significantly different from zero, none of which were positive. Four of the funds benchmarked against the Barclays U.S. TIPS Index had coefficients significantly different from zero to that index, as did the one benchmarked against the Citi U.S. Inflation-Linked Securities Index. Three of the funds with significant alpha were in the Inflation-Protected Bond category, and two were in the Other Real Return category.

If we assume that the true objective of an investor in a real return fund is to obtain a positive inflation-adjusted return, the question of whether the funds provide an inflation hedge is critical. To test the hypothesis of positive inflation-adjusted return, we regress the funds' excess returns (measured as the monthly gross return minus return of the one-month U.S. Treasury Bill) on a set of macroeconomic and systematic variables, using Eq. (3):

$$R_{it} = \alpha_i + \sum_j \beta_{ij} I_{jt} + \varepsilon_i, \quad (3)$$

where

R_{it} = excess return of fund i in month t

α_i = manager risk-adjusted excess return of fund i

β_{ij} = sensitivity of fund i to factor j

I_{jt} = factor j in month t

ε_i = unexplained excess return for fund i .

We tested this model with a variety of combinations of CPIU and other macroeconomic variables, including Industrial Production, which was significant for general bond funds in Lockwood (1996). We tested systematic variables including the five- and 10-year Treasury note excess return; yield spread between one-year and five-year and one-year and 10-year Treasuries; excess return on five-year TIPS; and five-year inflation premium, as measured by the difference between five-year TIPS and Treasuries. We also tested models including each fund's benchmark as one of the variables. We tested for collinearity within the models, and found that there was no significant collinearity, based on the Durbin-Watson statistic and the VIFs. The results presented in Table 7 were the models with the best fit, based on Adjusted R^2 and AIC.¹³

The first model includes the following macroeconomic and systematic factors: monthly percentage change in Consumer Price Index for all Urban Consumers (CPIU); excess return on the 10-year U.S. Treasury note (exTSY10); and month-end yield spread between Moody's Baa-rated Index and Aa-rated Index (CRSPD). We use the 10-year Treasury excess return to account for interest rate sensitivity, and the credit spread to capture any credit risk of non-Treasury securities included in the funds. The second model adds the equity risk premium (ERP) (Fama and French, 1992) to address any equity risk taken on by the funds.

We would expect the relation between the funds' returns and CPIU to be positive,

Table 7 Regression results

Panel A: Three-factor model							
Funds by category	α_i	β_1 CPIU	β_2 exTSY10	β_3 CRSPD	Adjusted R ²	Jointly significant/total	
Inflation-Protected Bond							
Number Significant	5	48	40	3		48/57	
Average Significant	0.079	2.335	-0.581	-0.886	0.157		
Other Real Return							
Number Significant	4	14	4	1		5/16	
Average Significant	0.079	4.785	-1.920	-4.637	0.120		
Panel B: Four-factor model							
Funds by category	α_i	β_1 CPIU	β_2 exTSY10	β_3 CRSPD	β_4 ERP	Adjusted R ²	Jointly significant/total
Inflation-Protected Bond							
Number Significant	6	47	37	2	11		51/57
Average Significant	0.062	2.149	-0.599	-1.062	0.163	0.185	
Other Real Return							
Number Significant	2	5	2	4	15		15/16
Average Significant	0.076	5.565	-2.104	-0.133	0.403	0.568	

Panel A: Parameter estimates for factor models of fund returns. The factor model is $R_{it} = \alpha_i + \beta_1 I_{1t} + \beta_2 I_{2t} + \beta_3 I_{3t} + \varepsilon_{it}$, where alpha, α_i , represents the manager's contribution to return, β_1 is the fund return's sensitivity to the CPI (CPIU); β_2 is the fund return's sensitivity to the excess return on the 10-Year U.S. Constant Maturity Treasury (exTSY10); and β_3 is the fund return's sensitivity to the yield spread between the Moody's Baa and Aa Indices (CRSPD). The null hypothesis is that the coefficient is equal to zero.

Panel B: Parameter estimates for factor models of fund returns. The factor model is $R_{it} = \alpha_i + \beta_1 I_{1t} + \beta_2 I_{2t} + \beta_3 I_{3t} + \beta_4 I_{4t} + \varepsilon_{it}$, where alpha, α_i , represents the manager's contribution to return, β_1 is the fund return's sensitivity to the CPI (CPIU); β_2 is the fund return's sensitivity to the excess return on the 10-Year U.S. Constant Maturity Treasury (exTSY10); and β_3 is the fund return's sensitivity to the yield spread between the Moody's Baa and Aa Indices (CRSPD); and β_4 is the fund return's sensitivity to the Fama-French factor for the equity risk premium (ERP). The null hypothesis is that each coefficient is equal to zero.

Source: CRSP Mutual Fund Database, http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html#Research, U.S. Treasury, Moody's via <http://research.stlouisfed.org/fred2/>, BLS.

indicating the hedging property that would be the objective of an investor in a real return fund. The coefficient on the 10-year Treasury should be negative, since rising interest rates should reduce the value of bonds in the funds. We chose the 10-year Treasury since the duration of those funds reporting was in the 7–8 range, on average.¹⁴ To the extent that there are non-Treasury bonds in a portfolio, we would expect a negative relation between the fund's return and the yield spread between lower- and higher-rated securities. Further, Xu (2009) attributes a flight-to-quality impact on TIPS because of investors moving into nominal U.S. Treasuries in times of credit risk fear, although this is a weak contribution to the overall variation in TIPS returns. Finally, if funds hold equity issues, we would expect a positive relation between the equity risk premium and the return on the funds.

Table 7, Panel A, shows summary information for the funds' monthly excess returns regressed against CPIU, exTSY10, and the CRSPD. Only five of the funds in the Inflation-Protected Bond category and four of the funds in the Other Real Return category had alphas

that were significantly different from zero. All except one (in the Other Real Return category) were positive. If alpha represents contribution of a manager's skill to a fund's return, there is not much contribution for these funds, controlling for macroeconomic and systematic factors.

With respect to hedging properties, 48 of the 56 Inflation-Protected Bond Funds had coefficients on CPIU that were significantly different from zero. The average sensitivity to CPIU was +2.34, with a range from +0.78 to +7.68. All but two of the Inflation-Protected Bond Funds had both significant β , and F-statistics, suggesting that the three-factor model was a good fit, and that the Inflation-Protected Bond Funds on the whole provided some inflation-hedging benefit. Forty Inflation-Protected Bond Funds had statistically significant coefficients on the excess return on the 10-year Treasury (average coefficient of -0.58), consistent with past estimates of the sensitivity of TIPS to nominal Treasuries (Lucas and Quek, 1998; Rudolph-Shabinsky and Trainer, 1999). Three had a significant relation to the CRSPD control variable (average of -0.89). This is consistent with the effect found in Xu (2009).

Fourteen of the 17 funds in the Other Real Return category had CPIU coefficients that were significantly different from zero, with an average β of +4.78 (ranging from +0.98 to +14.75). This fits conceptually with the results in Ruff and Childers (2011), which indicate that real assets are a more reliable inflation hedge than inflation-protected bonds. However, of the funds with significant β on CPIU, only five funds had statistically significant F-statistics, (average β , of +7.98) suggesting the overall model was not a good fit for the funds in the Other Real Return category.

The four-factor model in Panel B adds the ERP as a control variable. Only six of the funds in the Inflation-Protected Bond category and two of the funds in the Other Real Return category had alphas that were significantly different from zero. Both of the Other Real Return alphas and all but one of the Inflation-Protected Bond funds' alphas were positive.

In the presence of the equity risk premium, 47 of the 56 Inflation-Protected Bond Funds had coefficients on the CPIU were significantly different from zero. The average sensitivity to CPIU was +2.15, with a range from +0.64 to +5.56. Of the 17 funds in the Other Real Return category, only five CPIU β were significantly different from zero, with an average β of +5.56 (ranging from +1.90 to +10.92). Of the funds with significant β on CPIU, all in both fund categories had statistically significant F-statistics, suggesting the four-factor model was a better overall fit, but the relation to inflation was largely the same for both models.

More interesting, all but one of the funds in the Other Real Return category had a significant relation to the ERP, (average β of +0.40). Combined with the results on CPIU, this suggests that these funds are capturing some of the equity risk premium, but they are not effectively hedging against inflation. Eleven of the Inflation-Protected funds had a significant relation to the equity risk premium (average β of +0.16).

With respect to the other control variables, 37 of the Inflation-Protected Bond funds had a significant relation to the exTSY10 (average β of -0.60), while two of the Other Real Return category funds had a significant relation to nominal Treasuries (average β of -2.10). Two funds from the Inflation-Protected category and four funds from the Other Real Return category had significant relations to the CRSPD (average β of -1.06 and -0.13 , respectively). On the whole, the return behavior of the funds in the Other Real Return category seems to be more equity-driven, but this does not seem to provide additional inflation

Table 8 Fund characteristics

Panel A: Fund expenses and turnover							
Average, by fund by category	Expense ratio	Mgmt fee	Mgmt fee excluding rebates	Turnover ratio	N obs		
Inflation-Protected Bond	0.52	0.18	0.34	71%	7		
Other Real Return	0.78	-0.90	0.55	156%	3		
All Real Return Funds							
Average	0.58	-0.06	0.38	90%	6		
Median	0.55	0.31	0.40	87%	6		
Panel B: Asset allocations							
Average, by fund by category	Asset allocation				N obs	Allocation within bonds, reported after Dec. 31, 2009	
	Bonds	Cash	Equity	Other		Government bonds	All other bonds
Inflation-Protected Bond	96%	-1%	1%	4%	25	87%	13%
Other Real Return	67%	4%	18%	11%	15	56%	44%
All Real Return Funds							
Avg	90%	0%	5%	6%	23	81%	19%
Med	96%	2%	0%	1%	24	91%	9%
Min	7%	-68%	0%	-22%		1%	99%
Max	165%	43%	53%	92%		100%	0%

Panel A: Descriptive statistics for funds. Expense Ratio is total operating expenses, including Management and 12-b(1) fees divided by net asset value; management fee is portion of expenses paid to fund manager (negative indicates fee was rebated); turnover is net sales or purchases over net asset value. Data is reported annually, and number of observations is the number of years reported by the funds. Three funds did not report any expense, fee, or turnover data.

Panel B: Data is reported monthly, and number of observations is the number of months reported by the funds. Bonds were a single category until Dec. 31, 2009, then were reported in seven subcategories. Asset allocation above 100% or below 0% indicates leverage (17 Inflation-Protected Bond funds and two Other Real Return funds reported leverage at some point during the sample period).

Source: CRSP Mutual Fund Database.

protection. Neither model indicates that managers make much of a contribution to the fund returns after controlling for inflation, interest rate risk, credit risk, or equity risk.

7. Fund characteristics and alpha

Table 8 summarizes the expenses, turnover, and asset allocation for the funds. This information is somewhat limited: it is only reported annually in the CRSP Database, with three funds reporting 15 or 16 years of data, and 18 funds only reporting one or two years. The paucity of observations does not lend itself to a proper cross-sectional analysis of the relation between fund characteristics and alpha. We can, however, make some observations.

As shown in Table 8, Panel A, the average annual expense ratio for the Other Real Return funds (78 basis points) is greater than for Inflation-Protected Bond funds (52

basis points). The range however (not tabulated), is narrower: it ranges from 20 to 125 basis points and 15 to 148 basis points, respectively. The average management fee is –90 basis points for Other Real Return funds and 18 basis points for Inflation-Protected Bond funds. These averages included months where the management fee was rebated, however. Excluding rebates, the averages were more in line with the expense ratios: 55 basis points and 34 basis points for Other Real Return and Inflation-Protected, respectively. The relative turnover is similarly distributed, with the Other Real Return funds exhibiting an average turnover of 156%, while the Inflation-Protected Bond funds showing 71% average turnover.

The lower fees, expense ratios, and turnover rates in the Inflation-Protected category could be partially attributed to there being three index funds in the category, but the asset allocations illustrated in Panel B indicate a smaller range of investments even for the active funds in that category. For example, 96% of the Inflation-Protected Bond funds are invested in bonds, and of these, 87% on average are government bonds.¹⁵ Given the high weighting of government bonds (likely TIPS), it is unsurprising that this class of funds generally does not outperform the TIPS benchmarks.

On the other hand, just over half of the bonds in the Other Real Return funds were government bonds (38% of the total investments). The average allocation to equities in the Other Real Return funds of 18% (ranging from 0% to 53%), consistent with the attribution results from Table 7. Even with a broader range of investments, however, these funds' Sharpe ratios (as shown in Table 5) also do not exceed their benchmarks, nor do they generally provide positive alpha (as shown in Table 7).

8. Conclusions

Demand for real return funds continues apace: total net assets were over \$113 billion as of July 31, 2013, according to Morningstar. We have shown, however, that these funds do not add much value for investors. In general, the funds do not provide incremental risk-adjusted return. They closely track their benchmarks, which themselves are not highly correlated with measures of inflation. While investors pay an average of 0.38% in management fees, few managers provide positive alpha after controlling for macroeconomic and systematic factors.

An aging investor population seeking purchasing power protection has fueled the growth in mutual funds pursuing inflation protection. These funds suffer from several drawbacks, however. Their investment history tends to be short (seven years, on average), and most have operated during a period of tame inflation. Their universe of securities is limited and largely tied to U.S. TIPS, which also compose the majority of their benchmarks' holdings. Funds that have deviated from this universe have delivered weaker performance than the competition. While real return funds generally outperform inflation over time, our results suggest that investors might do as well or better by investing in a TIPS Index fund, or by creating their own TIPS portfolio.

Notes

- 1 According to Morningstar Direct, assets in the Inflation-Protected Bond category were approximately \$334 million at the end of 1997; \$11 billion at the end of 2002; and \$103 billion at the end of 2011.
- 2 U.S. Department of the Treasury. <http://www.treasurydirect.gov/govt/reports/pd/histdebt/histdebt.htm>.
- 3 2012 Investment Company Factbook, p. 89. http://www.ici.org/pdf/2012_factbook.pdf.
- 4 Fund sizes (all classes) as of August 31, 2012 from Morningstar Direct.
- 5 PIMCO Real Return Fund Portfolio Holdings 795.xls <http://investments.pimco.com/Products/pages/332.aspx>.
- 6 http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html#Research.
- 7 INFPREM–U.S. Treasury; CRSPD–Moody's; via <http://research.stlouisfed.org/fred2/>.
- 8 Comparing the CPIU and PCED statistically, we could not reject the hypothesis $H_0: \mu_{CPIU} = \mu_{PCED}$. For brevity, we present the foregoing analysis using only CPIU. Results using the PCED are available upon request.
- 9 For example, based on data from Morningstar Direct, the average annual expense ratio for the funds in the sample is 58 basis points, which would reduce cumulative return by \$0.04, \$0.10, and \$0.25 over the 5, 10, and full periods, respectively.
- 10 Not tabulated. Results provided upon request.
- 11 A 95% confidence interval for each fund was calculated around the mean monthly Sharpe ratio using an IID standard error (assuming the returns are independent and identically distributed, as in Lo (2002)) $SE(SR) = \sqrt{(1 + \frac{1}{2}SR^2)/T}$. The Sharpe ratio is statistically significantly from zero or the benchmark Sharpe ratio if the confidence interval does not contain the respective number. Roll (2004) shows that TIPS returns have very little autocorrelation beyond five days. Furthermore, we tested for autocorrelation of the returns (that can invalidate the IID assumption), and found that only 12 funds in the Inflation-Protected category and four funds in the Other Real Return category exhibited any degree of autocorrelation to six lags.
- 12 One fund did not have enough observations, so was omitted from all of the regression analysis.
- 13 Other results available upon request.
- 14 *Source*: Morningstar Direct. Twenty-six funds reported between 1 to 117 observations of month-end portfolio durations.
- 15 CRSP began tracking bond allocations across seven subcategories beginning in 2010.

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