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Inflation Risk and Asset Class Performance

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Abstract

This paper investigates the historical relationship between inflation rates and asset class returns in order to give perspective on which classes perform best when inflation rates are high. This is important to investors as the monetary base has tripled since July 2008, which may be "sowing the seeds" for future above normal inflation levels. Several Federal Open Market Committee members have expressed concern about monetary policy recently and believe that the Federal Reserve needs to focus more on inflation and less on economic recovery. Our research suggests that gold is not only an excellent inflation hedge, but it also improves Sharpe ratios when added to traditional stock/bond portfolios.

JEL classification numbers: G11, G14
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1 Introduction

Gold prices have ascended rapidly over the past five years. The SPDR Gold Shares exchange traded fund (ETF) had an annualized 5-year return ending in December of 2011 of over 20%, which has been driven in large part by a weak U.S. dollar and fear of inflation. While it is true that the U.S. dollar has faltered over this period, inflation has not approached alarming levels. The CPI was up only 3.2% for the 12-month period ending December 2011. Thomas Hoenig, the former President of the Kansas City Federal Reserve Bank, was initially the only voting member on the Federal Open Market Committee (FOMC) that seemed concerned with the Fed's liberal monetary policy stance. In fact, the Fed's December 2010 post-meeting statement explains Mr. Hoenig's lone dissenting vote on a continuation of low rates and bond buying. The Kansas City Fed commented on its website:

> "In light of the improving economy, Mr. Hoenig was concerned that a continued high level of monetary accommodation would increase the risks of future economic and financial imbalances and, over time, would cause an increase in long-term inflation expectations that could destabilize the economy."

Hoenig rotated off the FOMC at the end of 2010 along with three other members. Two of the four members that replaced this group are generally thought of as "hawkish" and thus are pushing for a more conservative monetary policy. These two members are Charles Plosser and Richard Fisher.

Much of the inflation concerns that people like Hoenig, Plosser, and Fisher have are driven by the Federal Reserve's unprecedented actions. According to the St. Louis Federal Reserve Bank, the monetary base has risen dramatically from around $900 billion in July 2008 to about $2.7 trillion in December 2011. One may anticipate inflation to accompany such a large increase in the monetary base, but due to the weak recovery from the last recession and banks' unwillingness and/or inability to lend, inflation rates have been moderate. Normally, banks hold virtually no excess reserves, but through much of 2011, excess reserves exceeded $1 trillion. In essence, the Fed has purchased bonds from banks, and banks have been willing to keep the funds on reserve at the Fed instead of lending them out and expanding the money supply exponentially. If banks do begin to lend their reserves, the money supply could increase by a multiple of ten. However, the Fed has assured market participants that it will reduce the monetary base when the time is right, so this fear may be unfounded.

While hyperinflation is unlikely, it is very plausible that inflation could run above 3%-4%. There are several reasons why the Federal Reserve may allow this. First, higher rates of inflation would make it easier for federal, state and local governments to repay their debts. Second, higher inflation rates would help the real estate market, as many homeowners would likely see an increase in the price of their homes. This would expand their equity positions and make them feel

wealthier.

A question that some investors ponder is "How do I protect my portfolio from the possibility of higher inflation rates?" One has to go back over 20 years ago to 1991 to see the last instance of annual inflation rates above 4%; therefore, many of today's money managers have not dealt with above average inflation rates. Many investors believe that gold is a good inflation hedge and may wonder if a gold ETF should be added to their portfolio. Alternatively, real estate investment trusts (REITs) may offer better inflation protection along with providing current income. Perhaps Treasury bills (T-bills) are the best solution, as they have very short maturities and their yields quickly reflect higher inflation rates.

In this paper, we examine how the following five asset classes have performed in different inflationary environments: T-bills, long-term Treasuries, stocks, gold, and REITs. We do not include Treasury Inflation Protected Securities (TIPS) because of limited empirical data. The findings give perspective on inflation and asset class performance.

2 Literature Review

There have been several recent studies that focus on inflation and alternative asset classes. Dempster and Artigas (2010) find that gold is a better portfolio diversifier than commodities, REITs, and TIPS. Their results suggest a 4%-6% allocation to gold in a traditional diversified stock/bond portfolio. They use various sample periods with the shortest related to REITs and TIPS (1997- 2009). Trevino and Yates (2010) investigate returns on stocks, bonds, and T-bills over the period of 1954 to 2007 and find that T-bills outperform the other two asset classes during periods of high inflation (inflation rate > 6%). Grelck et al. (2011) consider adding real assets to a portfolio of stocks and bonds in order to earn higher risk-adjusted rates. Their sample period spans 11 years (1999-2009). Real assets are represented sequentially by commodities, real estate, infrastructure, and shipping. They conclude that shipping is the best diversifier over the entire period and in the vast majority of sub-periods.

Irving Fisher (1930) was instrumental in developing interest rate theory. He espoused that the risk-free rate was composed of a real rate of return and an inflation premium. T-bills are perceived by many to be risk-free, and holding the real rate of return constant, should respond directly to changes in the rate of inflation. Consequently, the real rate of return on T-bills should be unaffected by changes in price levels. Alternatively, long-term Treasury bonds may have a real return that is inversely related to unexpected changes in inflation. If actual inflation is higher than anticipated, the real rate of return will be forced downward. In essence, it may take 20 years for a Treasury bond's coupon to be adjusted upwards to reflect higher inflation. Until this adjustment happens, the market price of the bond will be below par, holding all else equal.

Stocks are better insulated from higher levels of inflation than bonds because many companies have the power to raise prices to counteract inflation. This power depends on the price elasticity of demand and the time to respond. Lower price elasticity means that consumers are less sensitive to changes in the price of the product or service. Thus, a cigarette manufacturer may be able to pass inflation completely on to its customers. Also, it takes many companies a little time to adjust prices to inflation, so in the short-term, a company's earnings may be depressed when inflation rises unexpectedly. Over brief periods, the real return on stocks may be inversely related to inflation.

Some experts view gold not as a wealth-creating asset, but rather as a wealth-preserving asset (Mauzy, 2011). There is no standard way to value this metal. Gold bars earn no rent for the owner. Some view it as a speculative asset similar to fine art. If it effectively preserves purchasing power with no risk, than its return would reflect a real return, an inflation premium, and any carrying costs. Its price should also adjust quickly to changes in the price level.

REITs are broken into three categories. The first type of REIT invests in properties such as strip malls or apartment complexes. It manages and operates the properties and collects rent from tenants. A second type of REIT is one that purchases mortgages, referred to as mortgage REITs. A third type is a hybrid REIT, which may own some properties while also investing in mortgages. Specialty REITs fall in the hybrid category although they specialize in a particular type of property such as tanker cars or storage buildings. The short-term response to unanticipated inflation may be similar for all REITs. Property owners will likely have contracts being renegotiated on a regular basis which gives the ability to increase rents on some properties immediately while other properties will take longer to re-price at market rates. Mortgage REITs that have a laddered portfolio structure, in essence, do the same thing.

Our study differs from the ones previously mentioned in several ways. First, our sample period starts in 1972, which coincides with the end of the gold standard in the U.S. This regime change in monetary policy marks the beginning of significant inflationary risk for U.S. investors. The other studies mentioned either started prior to 1972 or much later. Second, we look at the association between inflation and real returns on T-bills, T-bonds, stocks, gold and REITs. The other studies either do not include gold and REITs, or focus more on the diversification potential of the alternate asset classes.

3 Data

Our data covers the period of 1972-2011 for all series and is gathered from various sources. We started in 1972 because the U.S. was under the gold standard from 1946 until 1971. During this time, the price of an ounce of gold was fixed at $35, and the money supply was controlled more by the supply of gold than the Federal Reserve.

T-bill returns, long-term Treasury returns, stock returns, and inflation rates were all obtained from the 2011 Ibbotson SBBI Classic Yearbook. These data were monthly, and we converted them to a quarterly rate by taking the product of one plus the monthly returns and then subtracting one. All monthly data in this study were converted this way.

In the Ibbotson data set, T-bills have 30-day maturities and long-term Treasury bonds have 20-year maturities. Stock returns were computed using the Standard and Poor's Composite 500 Index. Inflation rates were computed based on the quarterly change in the Consumer Price Index (CPI).

Average quarterly gold prices were obtained from the World Gold Council, and returns are calculated by taking the ratio of the ending price to the beginning price and subtracting one. The spot prices are reported on a per ounce basis and quoted in U.S. dollars.

To qualify as a REIT, a company must distribute at least 90% of its taxable income each year to shareholders. The Financial Times Stock Exchange's (FTSE) National Association of Real Estate Investment Trusts (NAREIT) U.S. index represents all U.S. property, mortgage and hybrid REITs. The index started at 100 in 1972 and has grown to 3,711 as of December 2011. There are currently about 150 companies in the index.

4 Analysis

Table 1 shows descriptive statistics for the various asset classes and inflation. Nominal T-bill returns were 1.37% per quarter over this period, which beat inflation by an average of 29 basis points. It is interesting that an investor in the 28% tax bracket would have earned an after-tax real return of -9.4 basis points [1.37% * (1 - 0.28) - 1.08%]. Thus, there is a penalty for holding T-bills for extended periods. Returns for stocks, gold, and REITs were all nearing a 2.80% quarterly rate of return. Over long periods, these asset classes build real wealth.

The range of returns is rather small for T-bills and rather large for gold and REITs. REITs have the largest standard deviation, and the return distribution is skewed to the right and characterized by fat tails. Stocks and bonds have Sharpe ratios that are higher than both gold and REITs, and long-term investors would favor these asset classes. While Sharpe ratios cannot be relied on when the return distributions are non-normal, Grelck et al. (2011) find very high correlation between rankings based on Sharpe ratios and those based on Sortino and Omega ratios.

Next, we analyze the relationship between quarterly inflation and quarterly asset returns on the various asset classes by running simple linear regressions. Inflation is the independent variable in all regressions. Results from five regressions are shown in Table 2. The second column shows the intercept, slope, and R^2 for T-bill real returns. The slope coefficient of -0.606 indicates that a 100 basis point increase in inflation is associated with a 60.6 basis point reduction in

T-bill real returns. The intercept is the expected return when the inflation rate is zero. Thus, in an inflation-free quarter, the expected real return on T-bills is only about 1 basis point. Lastly, the R^2 of 45.9% indicates that inflation explains almost half of the variability in real T-bill returns.

Table 1: Mean quarterly total returns (1972-2011)

	T-Bills	Bonds	Stocks	Gold	REITs	Inflation
Nominal Return	1.37%	1.93%	2.78%	2.75%	2.78%	1.08%
Real Return	0.29%	0.85%	1.70%	1.67%	1.70%	---
Minimum	0.01%	-6.35%	-25.16%	-36.54%	-19.69%	-3.91%
Maximum	3.81%	16.56%	22.94%	35.95%	57.92%	4.31%
Std Dev	0.77%	3.18%	8.47%	9.77%	10.70%	---
Skewness	0.55	1.05	-0.52	-0.30	1.79	---
Excess Kurtosis	0.57	3.18	0.85	2.89	5.65	---
Sharpe	---	0.18	0.17	0.14	0.13	---

Table 2: Regression of real returns on inflation

	T-Bills	Bonds	Stocks	Gold	REITs
Intercept	0.009*	0.27*	0.036*	0.005	0.033*
Slope	-0.606*	-1.709*	-1.788*	1.079	-1.51
R^2	45.9%	23.0%	4.3%	1.1%	2.4%

*Significant at the 1% level

The real returns on bonds, stocks, and REITs are all negatively associated with inflation and are significantly different from zero at the 1% level. In the short-term, high inflation is extremely detrimental to investors holding these three asset classes. The R^2 is much higher for bonds (23%) than for either stocks (4.3%) or REITs (2.4%), which indicates factors other than inflation tend to influence real returns for these assets.

Real returns on gold are not impacted by inflation, as the slope coefficient of 1.079 is insignificantly different from zero. Also, inflation explains only about 1.1% of the variability of real returns on gold. For investors concerned with inflation, gold has historically offered good protection.

Inflation has a dual impact on stocks and REITs. It causes dividend yields to be less appealing and thus drives stock prices down to align the yield with current nominal rates. However, inflation also causes the price of a company's real assets to increase in the aggregate, which puts upward pressure on stock prices. Based on the regression results, it appears that the yield effect dominates, as inflation tends to push stock prices causing negative real returns. Gold is a real asset, and it does not provide a stream of cash flows (i.e. does not have a yield effect), so changes in inflation rates tend to push the underlying value of gold up by approximately the rate of inflation.

Next, we test how these asset classes perform in extreme inflationary environments. Real returns of the various asset classes are sorted by realized inflation. Four inflationary environments are examined. The first is a deflationary environment (inflation $\leq$ 0%). There are 11 deflationary quarters during the sample period. Table 3 shows that stocks performed best during deflationary environments, earning an average real return of 6.48%, while T-bills did the worst earning only 1.42%.

The most common inflationary environment during the sample period, which we classify as low inflation, is an inflation rate between 0% and 1%, and 73 quarters fall in this range. REITs performed best (3.53%), followed by stocks (2.89%). Again, T-bills were the lowest performing asset class (0.64%). The third inflationary range examined was when inflation was between 1% and 2% (48 observations). Bonds performed relatively poorly during these periods, with stocks, gold, and REITs having comparable returns.

Table 3: Quarterly real returns in different inflationary environments

	T-Bills	Bonds	Stocks	Gold	REITs
Inflation $\leq$ 0					
n = 11, avg. = -0.72	1.42%	3.39%	6.48%	4.78%	4.96%
0 < Inflation $\leq$ 1%					
n = 73 avg. = 0.56%	0.64%	2.14%	2.89%	0.99%	3.53%
1% < Inflation $\leq$ 2%					
n = 48 avg. = 1.45%	-0.13%	-0.47%	1.38%	1.22%	1.13%
2% < Inflation					
n = 24 avg. = 2.74%	-0.51%	-1.60%	-3.47%	3.18%	-4.22%

The highest inflationary class included quarters where the quarterly inflation rate was over 2% (24 quarters). The average inflation rate during these quarters was 2.74%. Gold was by far the best performer (3.18%), followed by T-bills (-0.51%). Stocks and REITs each had real returns that were less than -3% and thus do not appear to be good short-term inflationary hedges.

Table 4 regresses various asset class real returns on dummy variables representing the four inflationary environments. The first row of data represents asset class returns during deflationary periods and is identical to the first row of data in Table 3. The second row in Table 4 shows the increase or decrease in returns going from the deflationary period to the low inflationary period. As an example, the expected real return for T-bills during a low inflationary period is 0.64%, which is the sum 1.42% and -0.78%. For T-bills, all coefficients estimates are significant at the 1% level, and the regression explains about 37% of the variability of T-bill real returns.

Table 4: Regression of real returns on inflation dummy variables

	T-Bills	Bonds	Stocks	Gold	REITs
Inflation < 0					
Avg. = -0.72	1.42%*	3.39%*	6.48%**	4.78%	4.96%***
0 < Inflation < 1%					
Avg. = 0.56%	-0.78%*	-1.24%	-3.60%	-3.79%	-1.43%
1% < Inflation < 2%					
Avg. = 1.45%	-1.54%*	-3.86%*	-5.11%***	-3.57%	-3.83%
2% < Inflation					
Avg. = 2.74%	-1.93%*	-4.99%*	-9.96%**	-1.61%	-9.18%*
R^2	37%	22%	8.7%	1.1%	8.1%

*Significant at the 1% level

**Significant at the 5% level

***Significant at the 10% level

Bonds appear to be a very poor hedge against inflation. They perform best during a deflationary environment. Also, the coefficients for the various inflationary environments are all highly significant with the exception of low inflation rates in the 0 to 1% range. The R^2 value is 0.22, so inflation explains a decent portion of the variability of real returns.

Stocks and REITs have results that are very similar to one another. They both perform well during deflation and poorly during high inflation. However, returns for each asset class are impacted by many factors other than inflation, as evidenced by the low R^2 numbers. There is no evidence to suggest that these two asset classes would protect a portfolio from inflation in the short term.

The results for gold indicate that inflation has no significant influence on real returns as all coefficient estimates are insignificantly different from zero, and the R^2 is very low (1.1%).

The analysis indicates that gold is a good hedge against inflation, and a logical question is whether or not investors should add gold to their portfolio. Theoretically, an investor would add an asset class to an existing portfolio if the Sharpe ratio of the asset class were greater than the product of the Sharpe ratio of the existing portfolio and the correlation between the returns on the existing portfolio and the returns on the asset class (see Blume (1984) and Elton and Gruber (1987)). The equation below shows this comparison, and if it is true, the asset class should be included in the portfolio.

$$\frac{E(r_{new}) - R_f}{a_{new}} > \frac{E(r_p) - R_f}{a_p} * Corr(r_p, r_{new})$$

Table 5 displays the results of the above equation for three traditional stock/bond portfolio allocations. Panel A reports the Sharpe ratio for gold as 0.141. In all three portfolios, the investor should add gold because the minimum Sharpe (right hand side of equation 1) is less than the Sharpe ratio for gold. These results are largely driven by gold's negative correlation with the three portfolio allocations. This result is in line with Dempster and Artigas (2010) who using portfolio optimization recommended around a 6% portfolio allocation to gold.

Panel B of Table 5 focuses on REITs instead of gold, and the decision here depends on the investor's current asset allocation. If the investor has a balanced portfolio (50% stocks/50% bonds), REITs do not expand the efficient frontier upward. Alternatively, if the investor has a 75% stock/25% bond allocation or 25% stock/75% bond allocation, it would be appropriate to add REITs to the portfolio.

Table 5: Whether to add Gold or REITs to various portfolio structures

	25 Bond/75 Stock	50 Bond/50 Stock	75 Bond/25 Stock
Panel A: Gold			
Sharpe		0.141	
Minimum Sharpe	-0.160	-0.019	-0.020
Decision	Add	Add	Add
Panel B: REITs			
Sharpe		0.132	
Minimum Sharpe	0.121	0.135	0.109
Decision	Add	Don't add	Add

Figure 1 compares the Sharpe ratios for a base portfolio of 50% bonds and 50% stocks to Sharpe ratios of portfolios that include reasonable allocations to gold and REITs. The Sharpe ratio of a portfolio that consists of 47.5% bonds, 47.5% stocks, and 5% gold (bar 1) is higher than the Sharpe ratio of a portfolio of 50% bonds and 50% stocks (bar 4). The Sharpe ratio continues to increase as reasonable levels of gold are added to the portfolio (bars 2 and 3).

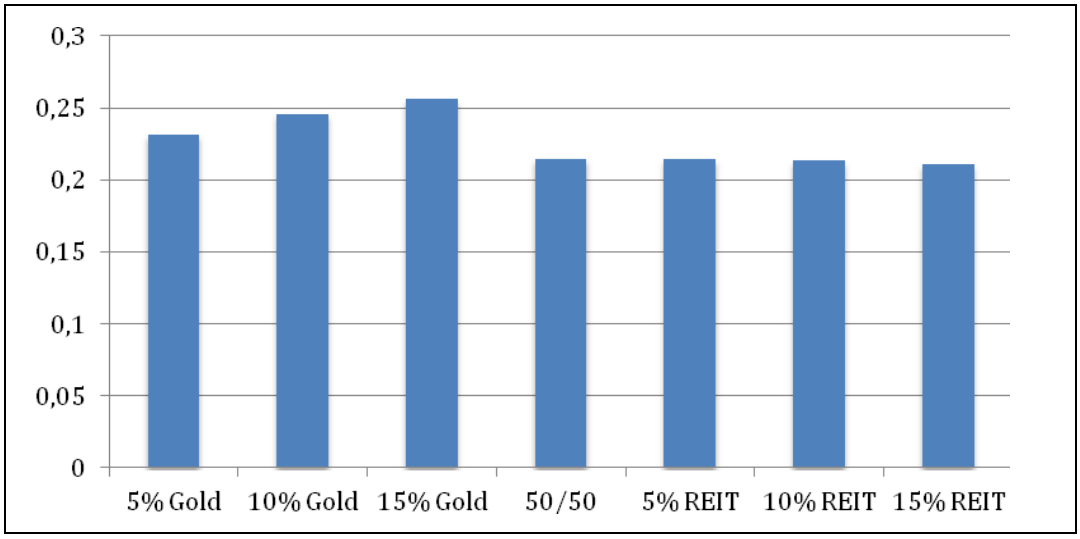

Figure 1: Sharpe ratios for various asset allocations

Next, we consider adding REITs to the 50/50 portfolio instead of gold. The Sharpe ratio does not increase. This is essentially what we concluded in Table 4 and labeled as "don't add." One would expect REITs to increase the Sharpe ratio if an investor either started with a 25% bond/75% stock allocation or 75% bond/25% stock allocation.

5 Conclusion

We examined the historical performance of five asset classes relative to inflation over a 39-year period ending in 2011. Over this time period, stocks and bonds have the highest Sharpe ratios and thus offer high levels of excess return per unit of risk. These two asset classes should make up the core of most investors' portfolios. A potential negative macro economic event confronting investors is inflation. The monetary base has expanded immensely in recent years, and investors should be concerned with inflation risk. Our analysis indicates that during periods of high inflation, T-bills and gold are the best hedges. The real returns on gold are not significantly impacted by inflation. Of the other asset classes, T-bills have the highest real returns when inflation is high. Active investors that are concerned with inflation should consider tilting the portfolio more towards these two asset classes.

Passive investors should also consider adding a modest gold position to their portfolio, perhaps 5% or 10%. We find that for investors with a 50% bond/50% stock allocation adding a gold position improves the Sharpe ratio. This would also be the case at more or less aggressive asset allocations. Investors can take a position in gold through an exchange traded fund or a mutual fund.

Treasury bills are also a steady performer although the returns are never spectacular. The primary drawback is that the net after-tax real return on T-bills over an extended period can be negative and much lower relative to riskier asset classes. Thus, one gains very little purchasing power and could actually lose some by holding T-bills in a taxable account.

Longer-term Treasury bonds perform well when inflation is less than 1% per quarter. However, a low, long-term fixed rate bond is detrimental to a portfolio when inflation is higher than anticipated. If inflation were to average a quarterly rate above 1%, each 10 basis point increase in inflation would likely lead to a 38 basis point decrease in Treasury bond real returns. Investors concerned with inflation should consider reducing their exposure to this asset class.

REITs and stocks react in similar fashion to changes in the price index. They both tend to do well in deflationary or low inflationary environments and poorly in high inflationary environments. Historically, they do not perform well when inflation is above 2%, at least in the short term.

Our analysis suggests that investors should consider building a modest position in gold in order to better position the portfolio for higher inflation. However, higher inflation may not materialize especially if the Federal Reserve is

successful at contracting the money supply as the economy rebounds more strongly. A second factor to consider is the price of gold. Gold prices have had a spectacular run-up and perhaps have already priced in higher future inflation rates. While the price of gold is easy to find, its value is not, so overpaying will always be a concern.

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