# Investing in an Inflationary Environment

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PREPARED BY

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# **Abstract**

Given the amount of fiscal and monetary stimulus enacted to revive the United States economy, many investors are concerned about inflation emerging as a credible threat to their portfolios, as inflation can reduce the real rate of return. While high inflation is not foreseeable in the near future, it is prudent to understand how to preserve a portfolio's real rate of return during times of rising prices. Several asset classes can protect against higher than expected inflation, with varying degrees of statistical proof. The following paper examines the potential asset classes suitable for periods of high inflation, both on a qualitative and quantitative basis.

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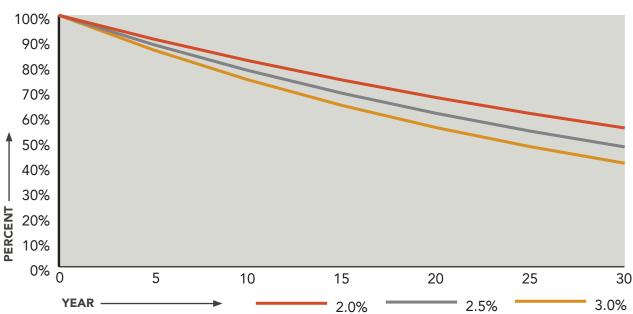
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### What is Inflation?

Inflation refers to an increase in the general price level of goods and services over time. When the general price level rises, each dollar buys fewer goods and services. Inflation is a decline in the real value of money and consequently a loss of purchasing power. The rate of inflation affects the real rate of return an investment. For example, if a stock returned 9% and the inflation rate was 4%, then the real rate of return on the stock would be only 5%.

Over a long-term horizon, the cumulative loss of purchasing power from even a small rise in inflation is quite significant. For instance, over thirty years, purchasing power declines by 45% if inflation averages 2% per annum, 53% if inflation averages 2.5% and 60% if inflation averages 3%.



**Exhibit 1:** Cumulative percent loss of purchasing power over 30 years

Central banks attempt to limit severe inflation in an attempt to keep excessive growth of prices to a minimum. Most countries' central banks will try to sustain an inflation rate of 2-3%.

## How is inflation measured?

The government attempts to measure inflation through the use of price indices which compare how price levels differ between time periods. Inflation in the U.S. is widely measured by the Consumer Price Index (CPI)<sup>1</sup>. It is a measure of the average change over time in prices paid by urban consumers for a typical market basket of goods and services. The percent change in CPI over a period of time is a measure of inflation.



<sup>&</sup>lt;sup>1</sup> For additional information, refer to the Marquette Associates paper titled Understanding CPI.

# How do I protect my investments against inflation?

Not all asset classes can preserve an investor's real rate of return. For example, a bond paying a fixed interest rate of 4% would actually lose money if inflation is greater than 4% over the life of the bond (recall that the real rate of return is nominal rate of return minus the rate of inflation). Given this fact, we have sought to identify the most appropriate asset classes to protect against the adverse effects of high inflation. In the following, we first describe each asset class and how it can protect against inflation; we then perform a statistical analysis of each asset class to validate (or disprove) each asset classes' utility during times of high inflation. The compiled data assesses the effectiveness of each asset class as an inflation hedge by regressing the actual inflation as measured by the CPI against returns of that asset class. The following asset classes are examined:

#### **TIPS**

Treasury Inflation-Protected Securities (TIPS) are a special type of note or bond issued by the U.S. Treasury that offer protection from inflation. These securities are often referred to as inflation-indexed or inflation-linked bonds. Just like any other Treasury bond, TIPS pay interest every six months and the principal at maturity. The difference is that the coupon payments and principal are adjusted to compensate for inflation using the Consumer Price Index. TIPS are the most direct form of hedging against inflation.

The real rate of return on TIPS, which represents the growth in purchasing power, is guaranteed, making it one of the safest investments possible. In exchange for this safety, they offer a lower rate of return than some of the other securities in this study. TIPS are offered in maturities ranging from 5 to 20 years.

#### **Commodities**

Commodities are another example of an inflation-sensitive investment. Commodities are priced as a function of the supply and demand in the market. They generally include basic resources and agricultural products such as iron ore, coal, oil, ethanol, aluminum, wheat, and gold. They are typically traded through futures contracts on exchanges that standardize the quantity and quality of the commodity being traded.

Commodities protect against inflation because as tangible goods, their prices tend to rise in tandem with broad economic activity. Specifically, energy sources such as oil and natural gas as well as base metals are commodities that function as production inputs. Therefore any pricing movements due to supply disruptions or demand shocks tend to impact the input cost of goods, which eventually make their way to the CPI. This provides a positive relationship between commodities and general price levels of material sold in the market. Investors can gain access to commodity markets via commodity indexes or active commodities managers using futures.

### Infrastructure

Infrastructure investments consist of basic physical systems of a nation such as transportation (toll roads, airports, railroads), communication, sewage, water, and electric systems.

As an asset class, infrastructure investments protect against inflation because of their tangible nature and consumers' relative insensitivity to price movements stemming from a lack of better, less expensive or cost-effective substitutes. The extent of the hedge is also largely impacted by the extent to which these systems allow for a full and timely pass-through of price increases to consumers. These highly regulated assets, such as the Commonwealth Edison (ComEd) electric utility company, operate on concessions from the government which often explicitly tie prices to an inflation index such as the CPI.



Infrastructure is fairly new as an investable asset class. Consequently, there is not a universal index to track performance. Furthermore, due to its recent introduction, the performance data would have very few observations to be statistically significant. However, some sectors of the S&P 500 index may provide a reasonable proxy to track the correlation of this asset class with CPI. While a true infrastructure index may contain additional sectors with appropriate sector exposures, we believe that analyzing the relevant sectors of the index provides a proxy for the asset class's performance as a hedge against inflation. In particular, the Utilities sector of the S&P 500 is relevant to the discussion and will be analyzed for the sake of this paper.

#### **Real Estate**

Real Estate is typically defined as land including any other asset permanently affixed to it. Unlike other investments, real estate is most affected by the condition of the immediate area and location of the property.

Our analysis examines the private real estate market, as measured by the NCREIF index. It is important to distinguish private and public real estate investments, as the latter mainly consists of REITs and can be impacted by daily market liquidity. Thus, we stress that our analysis focuses on private real estate investments, as achieved through separate accounts or commingled funds.

Real Estate returns normally track inflation based on the assumption that property owners can raise rents to offset higher input costs. Real Estate provides insulation from inflation over a longer investment horizon because the long-term nature of contracts implies the pass-through will be slower than in other asset classes.

## **Equities**

Equities, especially of companies in cyclically sensitive sectors such as mining, materials, and energy companies are more likely to be positively correlated with inflation. These sectors tend to respond positively to inflation, as the prices of their goods rise with inflation. This is based on the assumption that over the long term these companies can pass higher cost of raw materials to buyers in the interest of preserving profit margins.

## **Analysis**

We regressed the annual returns for each of the asset classes described above using the relevant indexes against the annual percent change in CPI. We used the annual percent change rather than a quarterly or monthly change because, as also noted above, the inflation indicator CPI is reported on an annual basis. All data has been provided by Bloomberg.

The following regression analysis can be interpreted using independent variable's coefficient, R<sup>2</sup>, and visual inspection. The coefficient of CPI in the regression equation indicates how strongly the asset class's returns move with changes in CPI. For example, a CPI coefficient of 1 means that for every 1% increase in CPI, the corresponding asset class would return 1%.

There are additional ways to interpret the regression analysis. Asset classes that provide the highest inflation protection will have a high R<sup>2</sup> value. R<sup>2</sup> is a measure of how well the regression line fits the data. It indicates how likely knowledge of the independent variable (changes in CPI) will help in predicting the value of the dependent variable (asset class returns). R<sup>2</sup> varies between 0 and 1, with 0 indicating that knowledge of the independent variable does not help predict the dependent variable while 1 indicates that knowledge of the independent variable helps perfectly predict the dependent variable. Visually, the more clustered and evenly distributed the points around the best-fit regression line, the better the asset class's performance in high inflation environments.

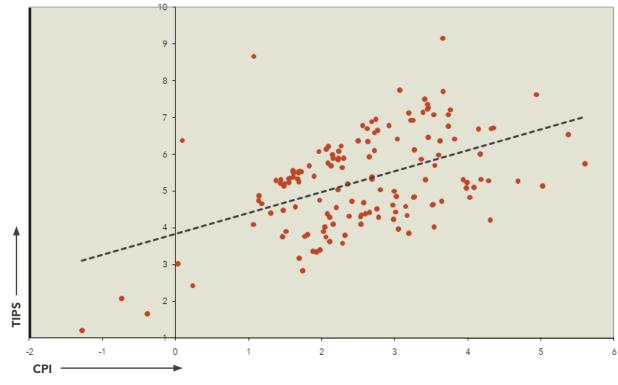


# TIPS vs. CPI

TIPS have been available as an investable asset class since January 1997. We use the TIPS inception date as the starting point in the regression.

We regressed the moving annual yield of TIPS against the CPI. The model shows that changes in CPI have a very high positive correlation with changes in the TIPS yield. The graph also supports the claim that TIPS yields moves in unison with CPI.

Exhibit 2: TIPS vs. CPI



Regression Equation: TIPS = 3.8432 + 0.5671 CPI

R<sup>2</sup>: 0.2366

Next: Commodities vs. CPI



### Commodities vs. CPI

The benchmark for tracking investments in the commodities market is the Standard and Poor Goldman Sachs Commodity Index (S&P GSCI). It also measures the performance of the commodity market over time. The earliest available data on this benchmark is from March 1971, so we use the S&P GSCI inception date as the starting point in the regression.

The regression shows that changes in CPI have a small positive correlation with changes in the returns provided by the S&P GSCI, supporting that commodities can protect against high inflation. It should be noted that the S&P GSCI is a very volatile index, as it represents a long only approach to investing in commodities, and has a disproportionate weighting to energy. Most commodity investments are done via managed futures, which tend to be less volatile, more actively managed, and not consistently overweighted towards energy sources. If a similar analysis was conducted against an index of managed futures, we would expect to see higher correlation and lower volatility.

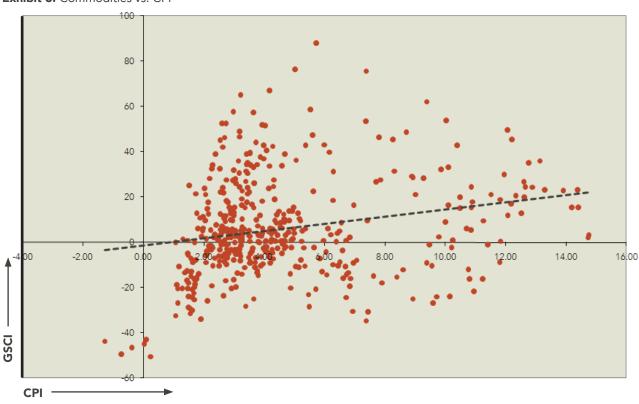


Exhibit 3: Commodities vs. CPI

Regression Equation: GSCI = -1.2026 + 1.5829 CPI

 $R^2: 0.0514$ 

Next: Infrastructure vs. CPI

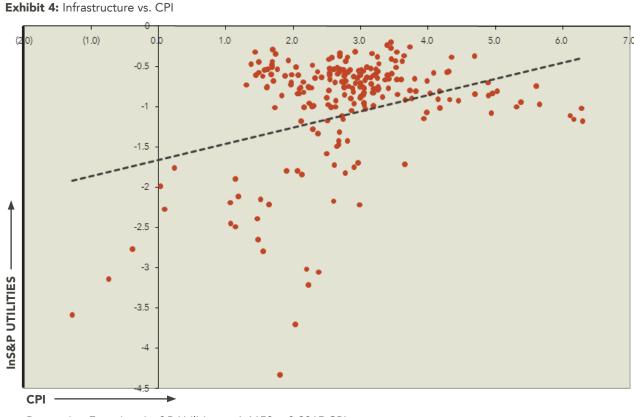


### Infrastructure vs. CPI

Due to the novelty of infrastructure as an investable asset class, there is a lack of both a true index to track its performance and statistically significant observations. However, the Utilities sector of the S&P 500 index provides a reasonable proxy to track the correlation of this asset class with CPI, since many infrastructure investments are made in utility assets.

The earliest available data for the Utilities sector index is from September 1990. We therefore use the inception of the sector index as the starting point in the regression.

The regression<sup>2</sup> shows that changes in CPI have a positive correlation with changes in the S&P 500 Utilities sector. This result is a start towards justifying the hypothesis that infrastructure is an appropriate investment to protect against high inflation. Note that most infrastructure investments will also contain exposure to other sectors than just utilities. As more data becomes available, we expect further proof that infrastructure successfully protects against inflation.



Regression Equation: Ins&P Utilities = -1.6650 + 0.2015 CPI

 $R^2: 0.0106$ 

Next: Real Estate vs. CPI

<sup>&</sup>lt;sup>2</sup> For this regression we used the natural log of returns for the S&P Utilities sector ("In). See appendix for details.



## Real Estate vs. CPI

The NCREIF Property Index (NPI) provides returns for institutional grade real estate held in a fiduciary environment in the US and is the primary index used by institutional investors for benchmarking the performance of real estate. We were only able to regress NPI against CPI during the tail end of the hyper-inflationary period that began in April 1973 and ended in October 1982 because the NPI was conceived in January 1979. Therefore, the NPI inception date has been used as the start of the regression.

The regression shows that changes in CPI have a very high correlation with changes in NPI. Further analysis including all years of the NCREIF suggests a similar trend, though the correlation is not as high.

Exhibit 5: Real Estate vs. CPI 24.0 22.0 20.0 18.0 16.0 14.0 12.0 NCREIF 10.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 13.0 14.0 15.0 Regression Equation: NCREIF = 7.4962 + 0.9405 CPIQuart R<sup>2</sup>: 0.7859



### Conclusion

In the table below, we summarize the goodness of fit statistic ( $R^2$ ), the correlation between CPI and the asset class, as well as the CPI coefficient (measures how much the return of the asset class moves given a 1% increase in CPI). The higher the  $R^2$  and correlation metrics, the greater the degree of protection from inflation offered by each asset class.

Asset Class	R <sup>2</sup>	Correlation	CPI Coefficient
TIPS	0.2366	0.4864	0.5671
S&P GSCI	0.0514	0.2267	1.5829
S&P Utilities	0.0106	0.1029	0.2015
NCREIF (Real Estate)	0.7859	0.8865	0.9405

From the analysis, it is clear that these asset classes can offer some protection from high inflation; since the returns are positively correlated with CPI, returns will be positive when changes in CPI (i.e. inflation) are positive. However, each asset class has its own unique characteristics which can positively or negatively impact the overall performance of a portfolio, so investors should not blindly choose the asset class with the highest R<sup>2</sup> and correlation statistics. Plan sponsors should carefully analyze the risk tolerance, liquidity needs, diversification benefits / drawbacks, and investment policy guidelines. If a decision is made to pursue one of more of the above asset classes, Marquette Associates encourages thorough due diligence of the asset class and the potential managers for the allocation(s). Allocations to any of these asset classes offer a lot to overall portfolio performance, but a thorough understanding must be shared by all decision makers before making a final conclusion.

# **Appendix - Methodology**

For each asset class the rolling year over year change was calculated on a monthly basis with the exception of the NCREIF Property Index which publishes its performance quarterly. CPI was measured on a non-seasonally adjusted basis over the respective time horizon. Data was obtained from Bloomberg and Morningstar Direct. Some other important notes about the data used:

- TIPS: Barclays Capital USTIPS Yield Index. Data is available since February 1997. The analysis can be extended
  to include the total return to account for the capital appreciation of the investment in addition to the income
  provided by the yield.
- Commodities: S&P GSCI Commodity Index. Data for the index is available since February 1970.
- Infrastructure: Regression was performed by taking the natural logarithm of the returns on the S&P Utilities sector index against CPI because the original model exhibited a linear regression issue called heteroskedasticity. In simple terms, this means that points in the data set were not evenly distributed along the best-fit regression line. Analyzing the regression model using the natural logarithm of the dependent variable (returns of the S&P Utilities sector index in this case) fixes this issue. Data for the index is available since August 1990.
- Real Estate: NCREIF Property Index (NPI). Data is available on a quarterly basis since January 1979.



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