HIGHLAND

Examining Inflation and Its Effect on Investment Portfolios

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Abstract

Often overlooked, inflation can have devastating effects on an investment portfolio and could end up limiting its ability to meet the investor's objectives. Even when investors take into account the effects of inflation on their portfolio, it has been difficult to structure a portfolio that enables the investor to be shielded from unexpected changes in inflation while also growing capital to achieve the objectives of the portfolio over the long-term. This study will look at the history of inflation, the effect it has on different investments, and how portfolios can be structured in order to protect the purchasing power of the investor while also maintaining the portfolio's ability to achieve long-term growth objectives.

Most sophisticated investors approach asset allocation/portfolio construction in a very deliberate manner, in which they set out specific portfolio objectives and constraints. They outline risk management techniques that will allow them to achieve their objectives in the most efficient manner. However, when it comes to protecting the portfolio from the effects of inflation[1], most investors simply overlook it. The investors that do specifically address inflation usually state that the portfolio must achieve its objective in real terms, but they do not put any provisions in place to allow the portfolio to achieve this objective.

The understatement of inflation as a risk to the portfolio is not intentional, as most investors simply focus their attention on the other risks associated with investment portfolios (liquidity, security concentration, cross-correlation, etc.); therefore, the effect of inflation simply falls into the background. The investors that do recognize inflation as a threat to their portfolio see themselves as long-term investors; therefore the strategic asset allocation of the portfolio will allow them to keep up with inflation over the long-term. Many investors see the equity allocation in their portfolio as an "inflation hedge" and feel no need to directly hedge the inflation risk.

Charles Ellis (1993) points out that inflation is the largest risk to a portfolio. He illustrates that with a 5 percent inflation rate, the investor's purchasing power is cut in half every 14 years. The effect of inflation at a 7 percent is even more daunting as the purchasing power of an investor is decreased to 25 percent in approximately 21 years. In order to just keep up with the general level of prices, portfolios should be set up to provide a return above and beyond that of the inflation rate. This study will examine inflation and how it affects investments and portfolios. The study will also look at which investments are more efficient

[1] This study examines the effects of inflation on investment portfolios from the U.S. point of view; therefore unless otherwise stated, inflation will refer to inflation in the Consumer Price Index (non-seasonally adjusted) in the U.S.

at hedging inflation risk, and how a portfolio can be constructed in order to provide the investors the opportunity to achieve their real return objectives.

History of Inflation

The most widely used definition of inflation is the increase in prices due to a rising money supply relative to goods in an economy. In other words, inflation occurs when money supply increases at a faster rate than the expansion of goods in an economy (since there are two pieces to the equation, the level of goods decreasing at a faster rate than the money supply can also cause inflation). Although it is often taught that the world has been dealing with inflation since trading began, George Cooper (2008) illustrates that inflation is a more modern concept in his book *The Origin of Financial Crises: Central Banks, Credit Bubbles, and the Efficient Market Fallacy*. Cooper illustrates that the world has operated under several different monetary exchange systems:

1. Barter Exchange;
2. Gold Exchange;
3. Gold Money (Coins);
4. Gold Certificates; and
5. Fiat Money.

In the era of barter exchange, there was no inflation, as people were exchanging goods for goods. In the gold exchange, the world's money supply was solely dependent on the level of gold in the world; therefore, inflation only occurred when new gold discoveries were made and a flood of new gold hit the market. This resulted in short periods of high inflation followed by long lengths of time with zero inflation.

The next big innovation in regards to money occurred when gold was taken and minted into coins. This allowed goods to be exchanged with greater ease because coins were standardized and merchants did not have to weigh each individual transaction. The inflation level in the world was very similar to the era of gold exchange; however, coinage did add one additional concept: currency debasement. Since coins were issued by governments and governments have an insatiable need for money (to finance wars, border expansion, palaces, etc.), rulers from time to time would recall all of the coins and re-mint with less gold per coin (thus increasing the number of coins that could be minted). Just as with a gold discovery, the level of inflation in the economy would increase rapidly with a re-coinage and would settle back down to zero when the number of coins in circulation was absorbed by the economy. As Cooper points out in his depiction of the history of money and banking, the debasement of a national currency was obvious to market participants because the government had to announce the re-coinage of the currency; therefore, the market could prepare for increasing levels of inflation during the re-coinage. Current market participants are not as lucky, as the devaluation of a currency is more of a guessing game due to the constant adjustments to the money supply made by central banks.

Gold certificates work in the same manner as gold coins except the amount of gold backing the money is no longer contained in the actual currency. This allows governments to change

the amount of gold backing the currency without having to re-mint the currency. This is the gateway to modern money; however, it is still obvious to market participants when a government begins the devaluation process as they would have to announce the new level of gold backing the currency. Again, no steady inflation during this period just money supply shocks as the government required additional funding.

The true era of continuous inflation occurred with the advent of the fiat money supply. This occurred in the U.S. when Richard Nixon closed the gold window permanently in 1971. In this environment, the only commodity backing the valuation of the currency is faith. Faith that the value of the currency is worth what the government says it is. Today the devaluation of the currency happens behind closed doors and the level of money supply can be changed at a moments notice just by cranking up the printing presses. This leaves the market participants out of the loop and continually guessing when the next round of currency devaluation will begin. As a result, the era is now one in which inflation is constant and periods of unexpected (and undetected) inflation shock are persistent.

Up to this point, the discussion has been about the level of money supply explicitly isolated to the actual level of currency in the marketplace. There is an added level of detail that also needs to be discussed: the credit creation cycle. Cooper also discussed the credit cycle[2] and its effect on the level of inflation. He points out that when credit is created, it produces an increase in spending, creating inflation as a by-product. Credit creation is not sustainable; therefore, once credit becomes over burdensome for the economy, credit destruction will begin. During this credit destruction, the deflationary spiral is persistent. Credit in and of itself is not inflationary as the credit creation and destruction cycles cancel each other out over the long-term.

Measuring Inflation

Understanding the background of inflation is important, but in order to understand the effects of inflation on investments and portfolios, inflation must be quantifiable. As stated earlier, inflation is "too much money chasing too few goods", so intuitively measuring inflation could be done by simply calculating the growth of the money supply[3]. While acceleration in this growth could be a predictor for future inflation, it is by no means a definite measure of inflation because it only measures one side of the inflation equation. The velocity of money (the number of times money turns over in the economy) could also be an indicator for future inflation as it is the output of the economy (GDP) divided by the

[2] Loans are created based on loan-to-asset value (LTV) and as credit is created and spending increases, asset prices also increase. This produces lower LTVs thus increasing the ability to borrow more debt, which begins the credit/asset price bubble. Once the debt level is not sustainable, assets are sold to cover loans, putting pricing pressure on asset prices. This increases LTVs, thus making the debt burden too great and starting the deflationary spiral.

[3] This is usually done by differing levels of money supply. Most common are M1 Money Stock, M2 Money Stock, and MZM (Zero Maturity) Money Stock.

money supply; however, it is more of a measure of the efficiency of money and is not a good quantification of inflation in the economy. In general, measures that quantify the expansion of money in an economy are usually helpful in determining potential inflationary environments, but they are not useful in quantifying inflation or the effect inflation has on investments.

In order to determine the effects of inflation on purchasing power, price indices are the best measure. In the U.S., there are several measures that calculate the level of prices in the economy. Each one of the measures examines the price level in its own unique way. **Figure 1**[4] lists the most commonly used indices and their characteristics.

[4] Key definitions:

- **Deflator –** statistical factor or device designed to adjust the difference between real or constant value and value affected by inflation.
- **Laspeyres Index –** a price index in which the reference period is the same as the base period.
- **Paasche Index –** a price index in which the base period is the same as the current period.
- **Fisher-Ideal Index –** an index that uses the geometric average of a Laspeyres Index and a Paasche index.

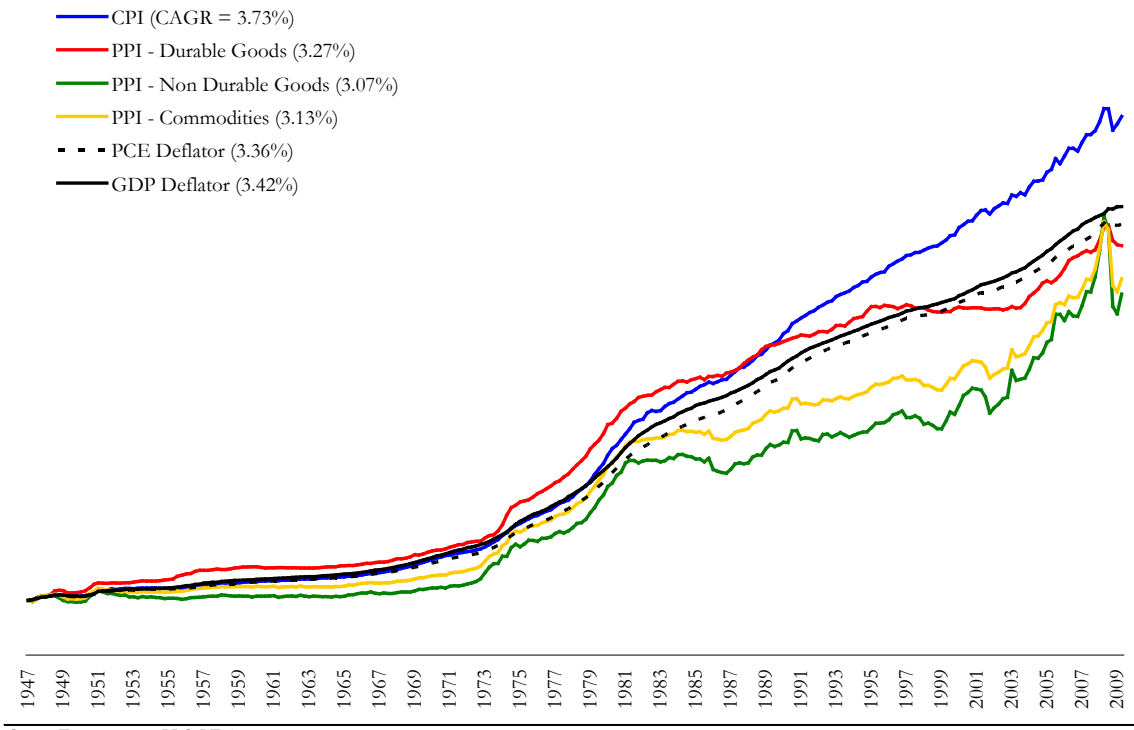
Figure 1: Types of Inflation Indices

			Deflators	
	Consumer Price Index (CPI)	**Producer Price Index (PPI)**	**Personal Consumption Expenditures (PCE)**	**Gross Domestic Product (GDP)**
Index Provider	Bureau of Labor Statistics (BLS)	Bureau of Labor Statistics (BLS)	Bureau of Economic Analysis (BEA)	Bureau of Economic Analysis (BEA)
Measures	Inflation in the out-of-pocket expenditures of all urban households.	Inflation in the expenditures paid by producers of goods and services within the U.S.	Inflation paid on goods and services paid by households within the concept of the U.S. national income and product accounts.	Inflation paid on goods and services within the concept of the U.S. national income and product accounts.
Calculation Methodology	Laspeyres formula to average the price changes across categories of items.	Laspeyres formula to average the price changes across categories of items.	Fisher-Ideal formula to average the price changes across categories of items.	Fisher-Ideal formula to average the price changes across categories of items.
Calculation Periodicity	Monthly	Monthly	Quarterly	Quarterly
Index Utilization	As an economic indicator; as a means to adjust income payments; as a means of preventing inflation-induced tax changes; as a deflator for certain economic series.	As an economic indicator; as a deflator of other economic series; as a basis for contract escalation.	To deflate nominal PCE to real PCE in order to estimate the growth of consumer spending in the U.S. national income and product accounts.	To deflate nominal GDP to real GDP in order to estimate the growth of in the U.S. national income and product accounts.
Major Components:				
	Housing (43.4%)	Nondurable goods (38.7%)	Housing and Utilities (18.7%)	Personal Consumption of Services (48.1%)
	Food (15.8%)	Nonmanufacturing Capital Equipment (20.6%)	Health Care (16.2%)	Personal Consumption of Goods (22.6%)
	Transportation (15.3%)	Processed Consumer Foods (16.9%)	Other Services (9.4%)	State and Local Government Spending (12.7%)
	Medical Care (6.4%)	Durable Goods (16.1%)	Financial Services and Insurance (8.3%)	Gross Private Fixed Investment (12.3%)
	Education and Communication (6.3%)	Manufacturing Capital Equipment (5.9%)	Other Nondurable Goods (7.9%)	Federal Government Spending (8.0%)
Inception Date	January 1913	January 1947	January 1947	January 1947
Reference Year	1982 - 1984	1982	2005	2005

Sources: BLS; BEA

Each of the price indices listed in **Figure 1** calculate the price level (and inflation) in the economy in different ways. **Figure 2** examines how each of the indices differ in measuring overall inflation. Although most of the indices are close to one another, only the consumer price index and the deflators monitor the final price level in the economy.

Figure 2: Comparison of Inflation Indices
January 1913 - June 2009 (Quarterly Periodicity): Index March 1947 = 100



Sources: Economagic.com; BLS; BEA

While no measure of inflation is perfect, this analysis will concentrate on the U.S. Consumer Price Index (CPI) in order to determine how individual investment asset classes react to inflation due to the index's broad range of uses (i.e. contractual adjustments, inflation-linked bonds' price adjustments, etc.).

Effects of Inflation on Traditional Investments/Portfolio

Living in an era of persistent inflation, investors should be aware of the effects inflation has on their investment portfolio. Understanding not only how the investments react to constant inflationary environments, but also understanding how investments react during periods of unexpected inflation is extremely important. This section will look at the most widely utilized asset classes and determine how they were historically affected by inflation.

In determining the effects inflation has on investments, this study will examine how investments[5] have reacted during inflationary environments defined as:

1. three consecutive months of increasing inflation;

[5] Refer to **Figure A1** in the appendix for a complete list of the indices utilized in this analysis.

2. six consecutive months of increasing inflation;
3. twelve consecutive months of increasing inflation; and
4. ten year inflationary environments[6]

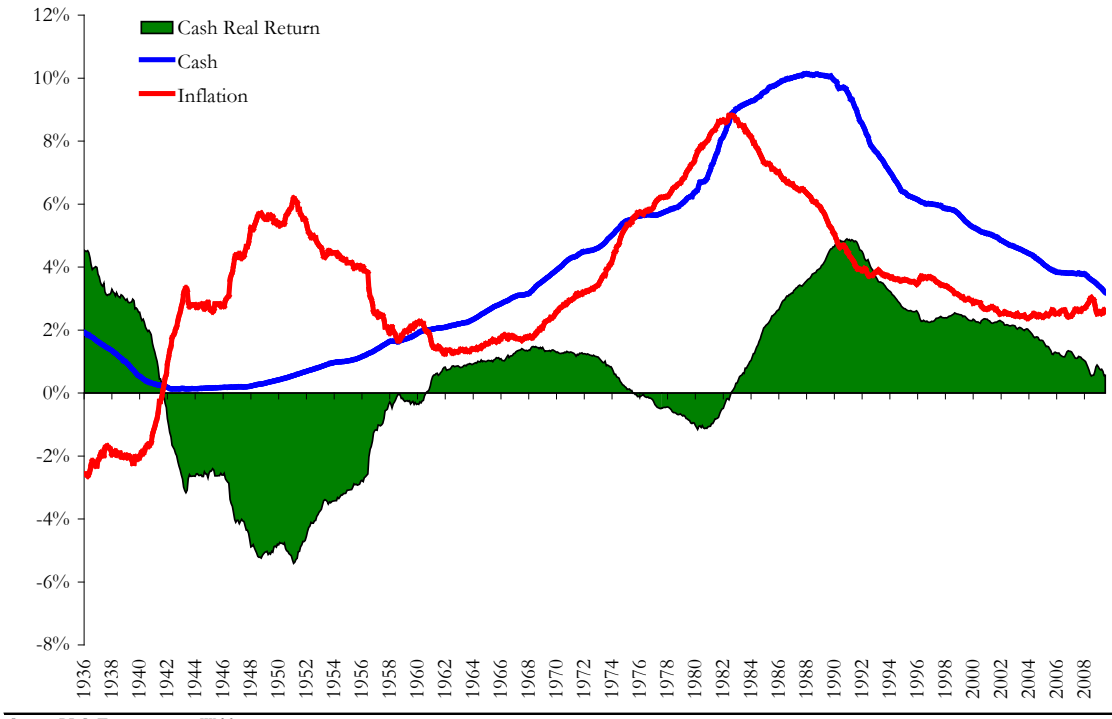
This study will also examine the drivers of each investments performance in order to understand the historical relationship with inflation and determine if that relationship will hold going forward. It is important to note the non-traditional asset classes examined have abbreviated histories; therefore, more significance is placed on the return drivers and specific inflationary environments[6] within their brief history. This is vital to understand how these asset classes will behave in future inflationary environments, especially since the past twenty-five years have been dominated by declining or low levels inflation.

Cash

Typically cash is held in a portfolio to satisfy short-term (generally less than one year) liquidity needs of the investor above and beyond the level generated by the income earned in the portfolio (i.e. interest, dividends, etc.). In theory, the yield on cash should track closely with the current level of inflation because of its short duration; therefore, cash should be a good inflation hedge. However, the primary driver of performance for cash instruments is the monetary policy employed by the U.S. Federal Reserve Board of Governors. **Figure 3** illustrates the return profile of cash investments versus inflation, and **Figure 4** plots the historical correlation (since inception and rolling ten year periods) between cash investments and inflation.

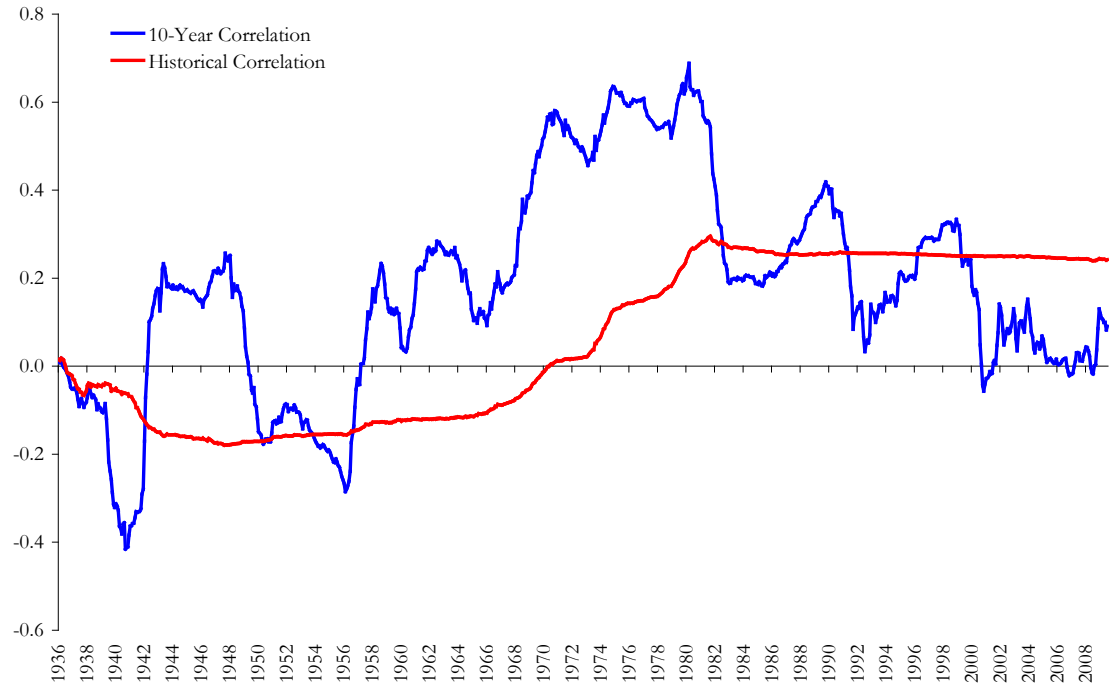
[6] An inflationary environment is defined as a ten year period in which CPI (non-seasonally adjusted) is one standard deviation above the historical inflation (based on the beginning of the period). A total of 223 rolling ten-year periods were examined (see **Figure A2**).

Figure 3: Cash Returns Compared with Inflation
January 1926 - July 2009 (Rolling 10-Year Periods)



Sources: BLS; Economagic.com; Wilshire

Figure 4: Cash Correlation with Inflation
January 1936 - July 2009



Sources: BLS; Economagic.com; Wilshire

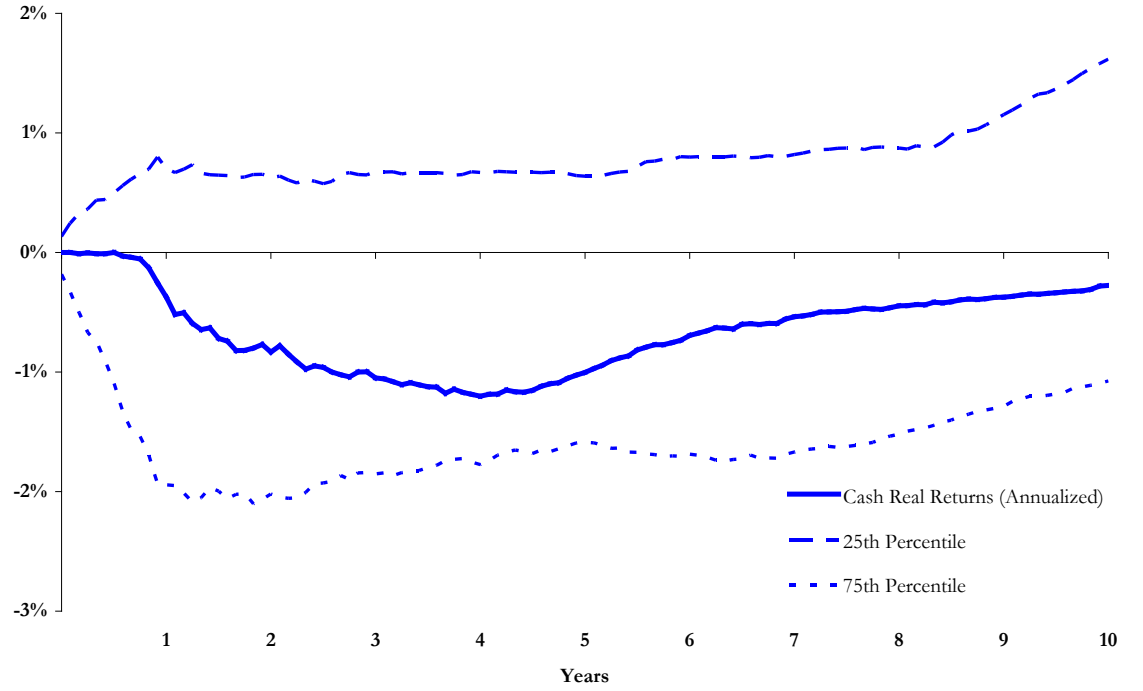
A quick examination reveals that the return profile of cash investments typically lags during increasing inflationary environments. This finding is in agreement with Attié and Roache (2009), who found that cash returns are mainly determined by monetary policymakers' targeted real interest rate.

Examining how cash returns react to inflationary environments should determine the effectiveness of cash investments to hedge inflation on both a short and long-term basis. **Figure 5**[7] illustrates the effectiveness of cash investments during inflationary periods. The vertical axis represents the real return of the asset class and the horizontal axis is the time passed during the period. As a note, all periods under one-year are cumulative and greater than one-year are annualized. This graph shows how the asset class performs throughout the entire inflationary period and can reveal both the short-term and long-term hedging capabilities of the asset class. For example, cash investments performed poorly during the beginning of the inflationary environment, losing purchasing power during the first four-years, reaching a bottom at -1.2 percent per annum. As the inflationary period persists, cash

[7] The graph plots the median annualized real return of the asset class (solid blue line) during inflationary environments (all periods under one-year are cumulative, not annualized). The graph also plots the twenty-fifth and seventy-fifth percentile returns (annualized real) in order to illustrate the dispersion of returns in the sample.

begins to pass through the higher interest rates and slowly recover some of the purchasing power lost in the early years, ending the period -0.3 percent per year. Although these investments seem to adjust to the higher levels of inflation, they do not typically make up the ground lost in the beginning of the period. This slow reaction to inflation by cash also confirms the research performed by Attié and Roache (2009), which concluded that cash returns react gradually to increasing inflation and typically suffer negative returns at the onset of inflation shocks.

Figure 5: Cash Real Return (Annualized) During Inflationary Periods
10-Year Periods



Sources: BLS; Economagic.com; Wilshire

While cash is an insufficient hedge against inflation in the short-term, the ability of monetary policymakers to sustain a positive real yield in the economy is the ultimate return driver of this asset class. Therefore, the ability of the policymakers will determine the likelihood of this asset class being a good inflation hedge going forward.

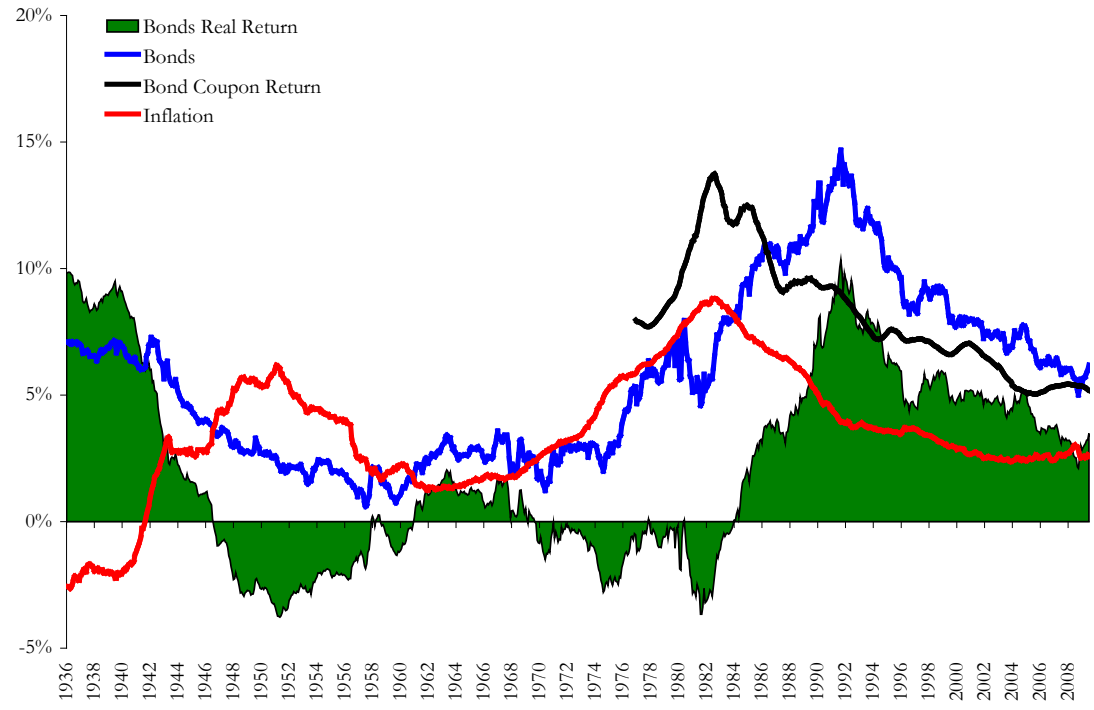
Fixed Income (Bonds)

Fixed income investments[8], bonds, are generally held in the portfolio in order to provide a safe, steady stream of income. High quality bonds (i.e. U.S. government bonds) also add protection in a portfolio during times of crisis, as investors generally flee riskier assets (a.k.a flight to quality). Due to their fixed payment structure, the two primary drivers of performance are the coupon rate of the bond (compared to the prevailing interest rate in the market) and the credit worthiness of the issuer. The structure also lends itself to these securities performing poorly in times of inflation and also offering protection during times of deflation. While this performance notion in relation to inflation is a correct statement for a single bond held to maturity, it overlooks the functionality of a portfolio of bonds that re-invest the proceeds of the coupon payments. When a portfolio of bonds re-invests the coupon payments, the portfolio's yield gradually begins to increase in inflationary environments; therefore, a portfolio of bonds will gradually begin to pass through inflation in the form of higher coupons and yield-to-maturities.

In **Figure 6**, this pattern is illustrated as the real return for bonds is negative during rising inflation periods and positive when inflation is declining. The pass-through of inflation can be observed during the 1970 – 1982 time period. During this time, inflation was steadily increasing and bonds had a negative real return. Although the real return was negative, the total return on bonds was positive and was increasing (just at a slower rate than inflation). This negative return was entirely due to price declines (due to sharply rising interest rates and the duration of the bonds included in the index) as the one-year coupon return for bonds was 13.7 percent versus 5.9 percent for inflation.

[8] Fixed income investments in this study will refer to securities included in the Barclay's Capital Aggregate Bond Index. As of June 30, 2009, the breakdown of the index was approximately: 26% U.S. Treasuries; 10% U.S. Agencies; 23% Investment Grade Credit; 38% U.S. Agency Mortgage Backed Securities; and 3% Commercial Mortgage Backed Securities and Asset Backed Securities (Source: Barclays Capital and Loomis Sayles).

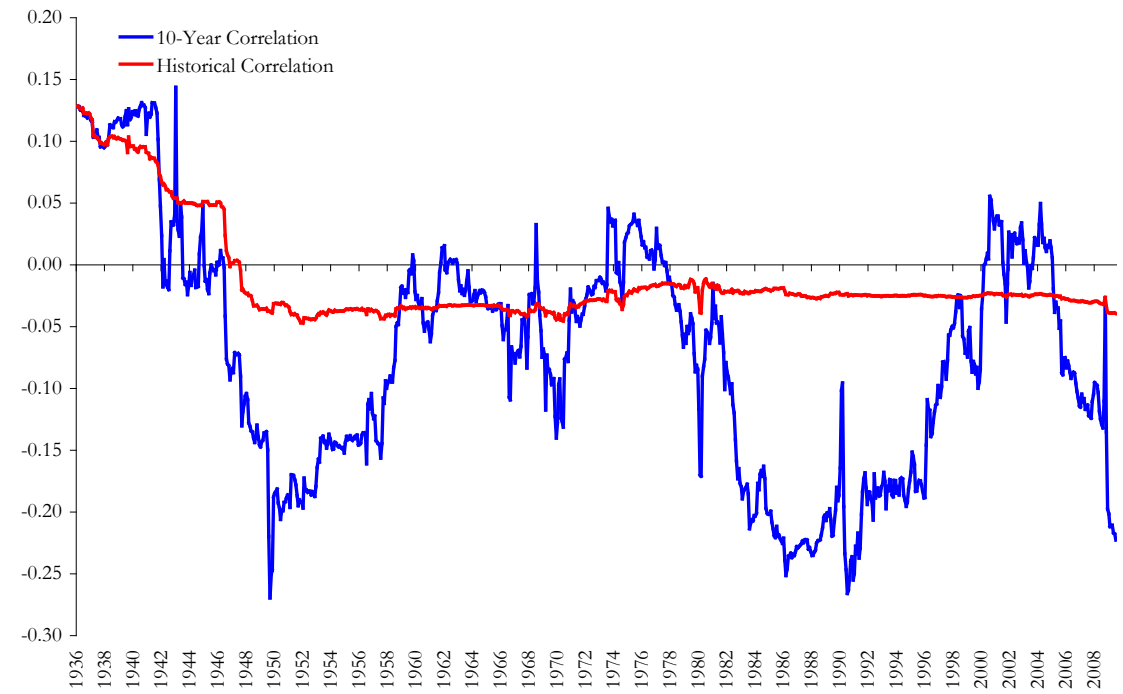
Figure 6: Bond Returns Compared with Inflation
January 1926 - July 2009 (Rolling 10-Year Periods)



Sources: BLS; Economagic.com; Wilshire; Barclays Capital

The correlation for bonds was also negative for the majority of the time (see **Figure 7**); however, it was not strongly negative, reaching -0.2 over rolling periods.

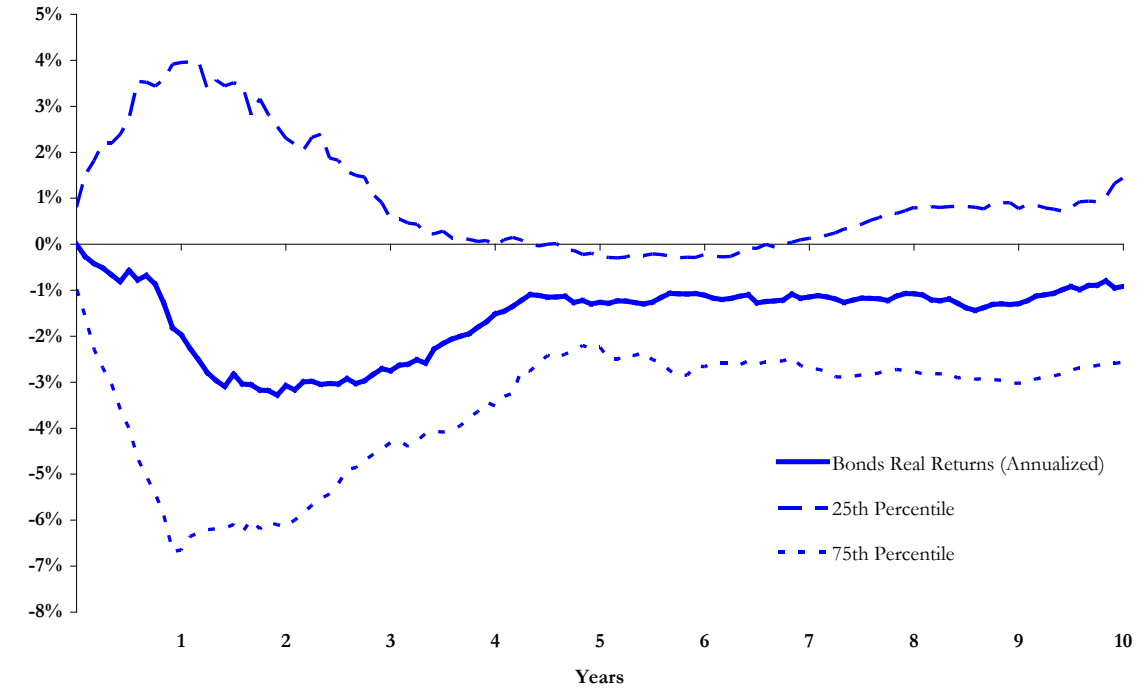
Figure 7: Bond Correlation with Inflation
January 1936 - July 2009



Sources: BLS; Economagic.com; Wilshire; Barclays Capital

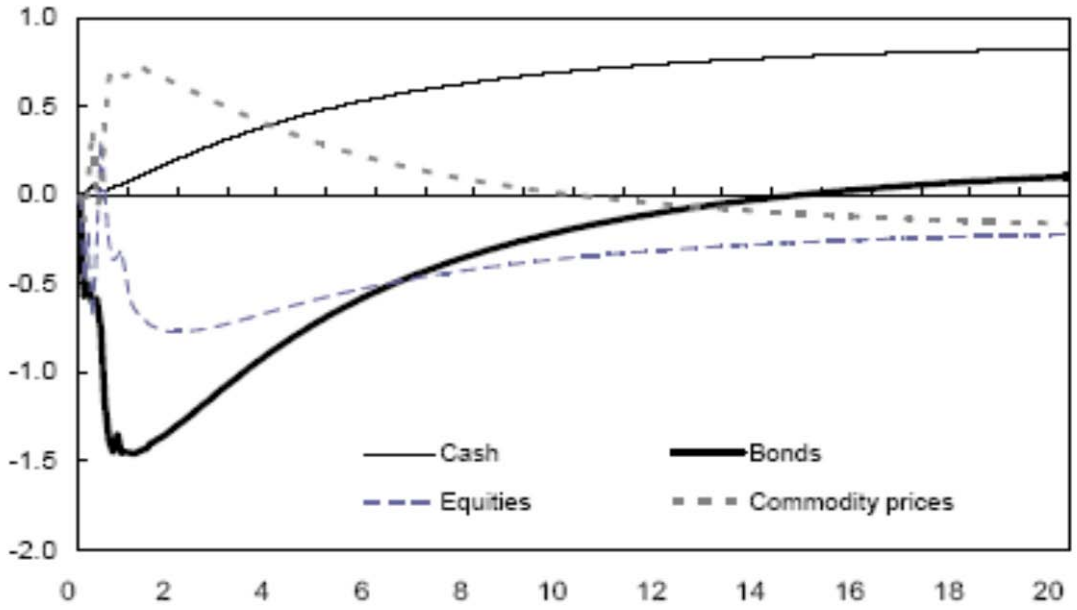
Looking at the performance of bonds during inflationary periods (see **Figure 8a**), the return pattern is very similar to that of cash. This confirms the research of Attié and Roache (2009) who found that bonds take long periods of time (approximately 14 to 15 years) to gain back the initial losses incurred by sudden increases in inflation. However, their analysis (based on a Vector Autoregressive Regression Model and not based on historical data) concluded that bonds begin to off-set losses during the 18-month to five year time frame due to higher yields (see **Figure 8b**).

Figure 8a: Bond Real Return (Annualized) During Inflationary Periods
10-Years After Inflation Shock



Sources: BLS; Economagic.com; Wilshire; Barclays Capital

Figure 8b: Inflation Shock Elasticities 1/
Attie and Roache (2009)



1/ Defined as the percent change in the asset class total return or price index (Δlog z) divided by the percent change in inflation
Source: IMF; Attie and Roache (2009)

Similar to cash, bonds are not an efficient hedge against inflation in the short-term. This is mainly due to the inverse relationship bond prices have with interest rates and the time it takes for the coupon rates on new issues to adjust upward to the new prevailing level of inflation in the economy.

Publicly Traded Equity (Stocks)

In a traditional approach to asset allocation, publicly traded equities[9] (stocks) are the growth engine of a portfolio. They are there to provide long-term growth and capture the inherent economic activity of the country (U.S. GDP; U.K. GDP, Japan GDP, etc.) over long periods of time. There are differing theories over what ultimately drives the long-term performance of stocks. According to Ibbotson and Chen (2007) the primary drivers of stock market returns are dividends, earnings, and capital gains (price-to-earnings multiple expansion). All of these factors are constrained or related to the level of overall economic growth within the economy. Jeremy Siegel (1998) concludes that stock returns are dependent on the present value of future cash flows, which are ultimately driven by the payment of dividends, repurchase of shares, retirement of debt, and reinvestment for future growth. While he theorizes that earnings per share can exceed the overall growth of the economy for longer

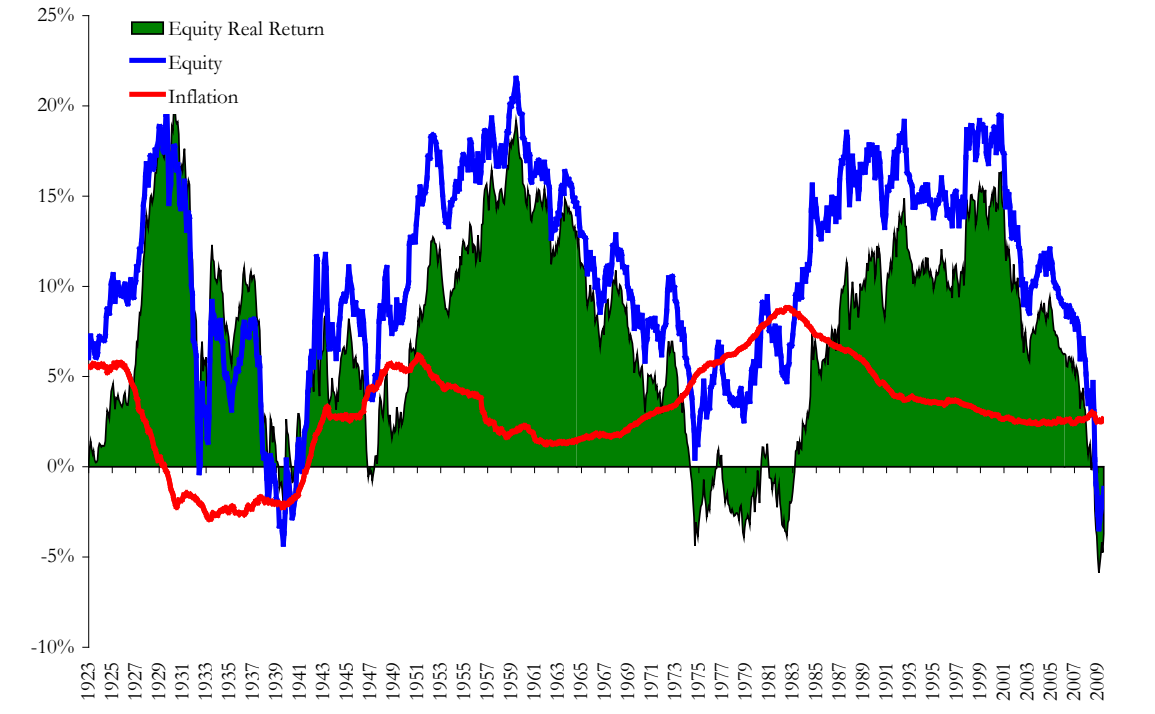
[9] Publicly traded equities in this study will refer to common stocks traded on U.S. exchanges.

periods of time, the aggregate earnings of the corporate sector of an economy must fall in line with the overall economic growth.

There are numerous theories about how stocks react to changing levels of inflation. The most common view is that stocks will pass along inflation through the dividends paid out to shareholders and through higher earnings due to increased prices. According to this line of thinking, stocks should have a positive real return; however, higher inflation coupled with poor stock performance in the 1970s caused academics to begin questioning the inflation hedging capabilities of stocks. Modigliani and Cohn (1979) proposed that investors have trouble thinking in "real" (inflation adjusted) terms and tend to utilize nominal interest rates in their analysis; therefore, they do not properly take into account inflation. This can lead to ineffective pricing of stocks in reference to inflation, thus leading to negative correlation to inflation. Siegel (1998) points out the return on stocks are a good hedge against future inflation, as stocks are claims on the earnings of real assets that keep up with inflation due to changes in labor and capital.

The data in **Figure 9** shows that equities have historically provided positive real returns. In fact, there have only been six periods in which equities have failed to keep up with inflation over rolling ten-year periods (three of which were during the 1970s).

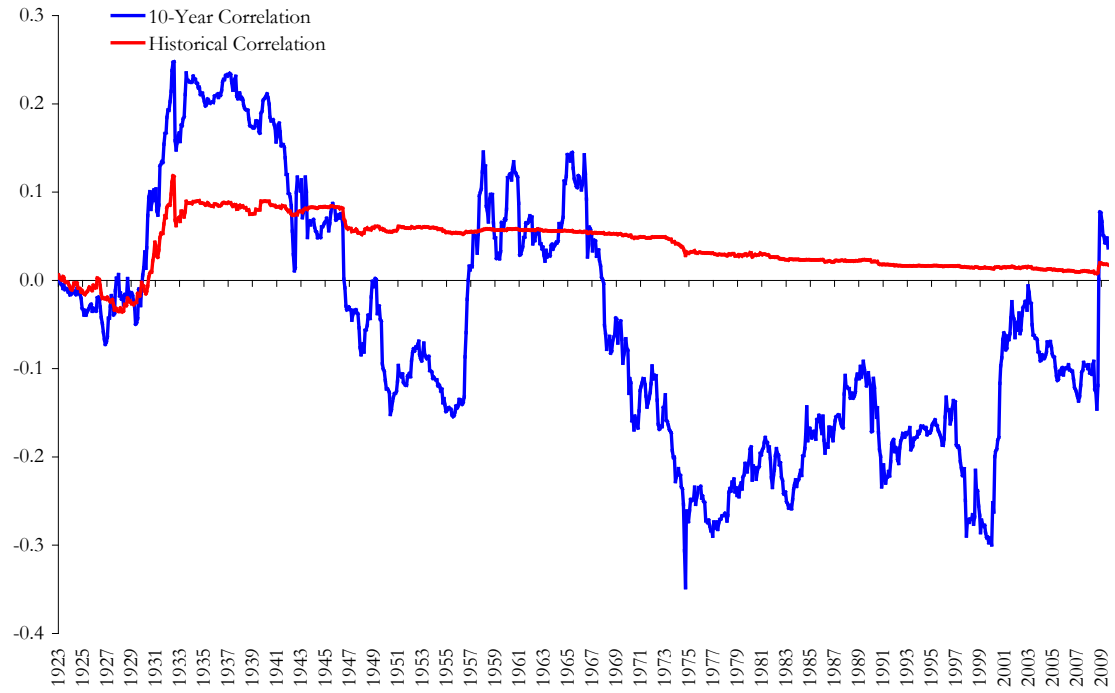
Figure 9: Equity Returns Compared with Inflation
January 1913 - July 2009 (Rolling 10-Year Periods)



Sources: BLS; Economagic.com; Shiller; Standard and Poor's

Figure 10 graphically represents the correlation between equities and inflation. While there has been some volatility associated with the correlation (see the rolling ten-year periods), the overall historical correlation with inflation has been low.

Figure 10: Equity Correlation with Inflation
January 1913 - July 2009

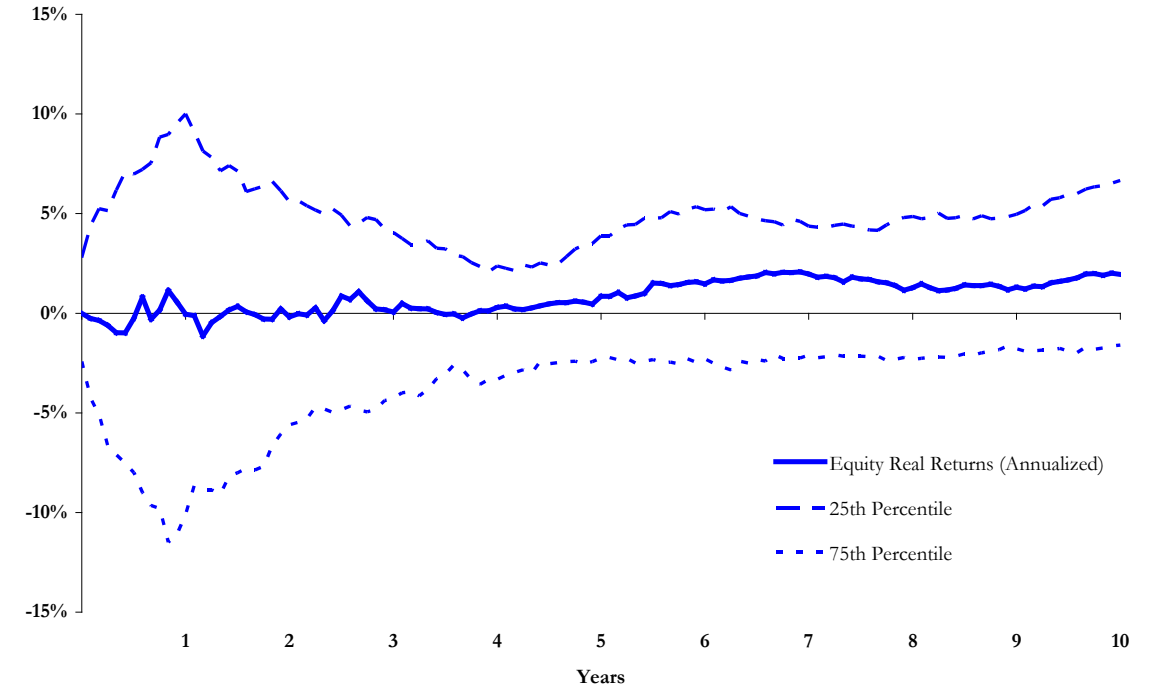


Sources: BLS; Economagic.com; Shiller; Standard and Poor's

When examining inflationary periods, the correlation shifts to negative over all periods. This data coincides with the conclusions of Bodie (1976) and Modigliani and Cohn (1979). These studies concluded that equities exhibited a negative correlation to inflation and that the common acceptance of stocks for inflation hedges needed to be re-examined.

When studying stock returns during inflationary periods (see **Figure 11**), it appears that stocks are a poor short-term hedge; however, they are effective as long-term inflationary hedges. This data contradicts the work of Attié and Roache (2009), who concluded that stocks were not able to overcome the value lost during the initial inflationary shock (see **Figure 8b** on page 11).

Figure 11: Equity Real Return (Annualized) During Inflationary Periods
10-Year Periods



Sources: BLS; Economagic.com; Shiller; Standard and Poor's

Taking into account all of the studies and historical evidence, it appears that stocks have been a poor short-term hedge against inflation; however, they have been historically a good long-term inflationary hedge. The history of returns for stocks (since 1913) have been dominated by decreasing periods of inflation, leading to a decline in interest rates and propelling stock returns higher. Given the level of interest rates today, any threat of inflation could possibly lead to an extended period of increasing rates (similar to the 1970s). The effectiveness of stocks (during the 1970s) to provide a hedge against inflation was limited, leading to negative real returns. While it is hard to override the data in **Figure 11**, the ability of stock returns to rebound from inflationary pressures will most likely be muted and take much longer to overcome the negative real returns in the early years.

Publicly Traded Real Estate

Incorporating real estate into investment portfolios has been regarded as beneficial because of its non-correlative returns (versus stocks and bonds) and its inflation hedging capabilities. The way most investors have implemented real estate into their portfolios has been through publicly traded real estate, more commonly known as real estate investment trusts[10] (REIT).

[10] This analysis will focus on U.S. equity only REITs.

REITs are publicly traded companies that own real estate and pass through the profits of the underlying real estate to its shareholders without paying taxes. In order to be considered a REIT, a company must:

- Have more than 99 shareholders
- Have 75% of its assets invested in:
  - Real Estate
  - Cash
  - Government Securities
- Have 75% of its income derived from real estate
- Distribute 90% of its income to its shareholders in the form of dividends

Considering that REITs are real estate companies, the drivers of performance are vacancy levels, lease renewals, property valuation, etc. However, because these companies are publicly traded, REIT returns can also be driven by investor sentiment which can cause a dislocation between the market price of the REIT and the value of the underlying real estate (known as net asset value or NAV).

Figure 12 illustrates the historical performance of REITs compared to inflation. Due to the abbreviated history of REITs (the NAREIT index inception date is January 1972), it is difficult to draw any definite conclusions about their inflation hedging capabilities when examining the historical returns. In their history, REITs have provided a substantial real return, however, over their tenure, they have benefited from a declining inflation rate (over rolling 10-year periods), which increased property prices[11] and lowered borrowing costs at the corporate level.

The declining of interest rates has also had an affect on the corporate structure of REITS. In general, REITs have approximately half of the capital structure in debt issuance. This issuance can be broken down into: (1) 40 percent in unsecured bonds; (2) 25 percent in commercial mortgage-backed debt; (3) 20 percent in non-commercial mortgage-backed debt; and (4) 15 percent bank debt[12]. Most of the debt is callable and is typically issued with maturities of five to ten-years.

Understanding the structure of the debt is important because the debt could be either beneficial or detrimental during a falling interest rate environment. For instance, a fixed rate non-callable bond would be detrimental to a REIT (or any company for that matter) because falling interest rates would cause the market value of the bond to increase. This would decrease the mark-to-market NAV and affect the price-to-NAV of the REIT. Floating rate

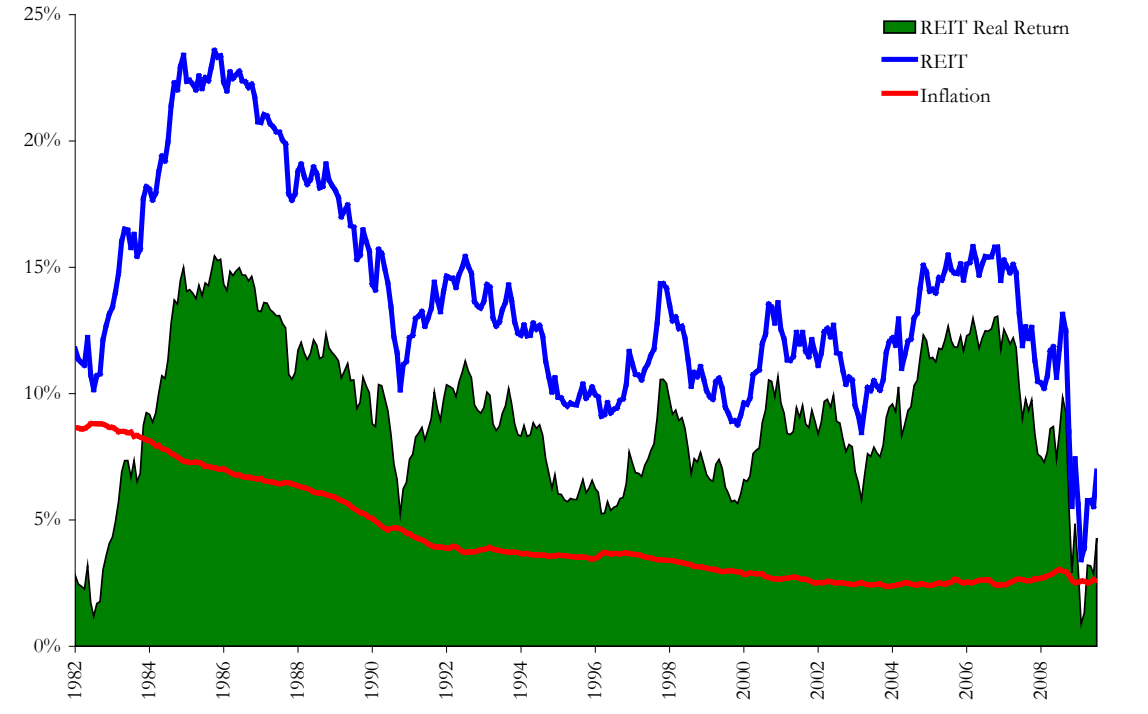
[11] Commercial real estate property prices have an inverse relationship because the properties are valued based on a discounted cash flow model where the net operating income is discounted to the present. Therefore, as interest rates decline, the present value of the future cash flows will increase as long as all other factors remain constant.

[12] Debt characteristics of the REIT market were provided by Cohen & Steers.

debt would be beneficial because the cost of funding would decrease, increasing the dividend (as 90% of the income has to paid out in dividends). This could also raise the stock price as investors move in to capture the higher income, pushing the stock price higher. Callable debt would take on the characteristics of the fixed rate debt up to the first call date, and then would have the potential to look more like floating rate debt after the call date.

Falling interest rates have had a much more dramatic effect on the price-to-earnings multiples applied by investors to the publicly traded equity and the cap rates used to value the underlying real estate. This lowering of the discount rates (both by purchasers of stocks and on the underlying properties) has allowed the stock prices to escalate and give these securities more stock like return profile and less like a typical inflation hedge.

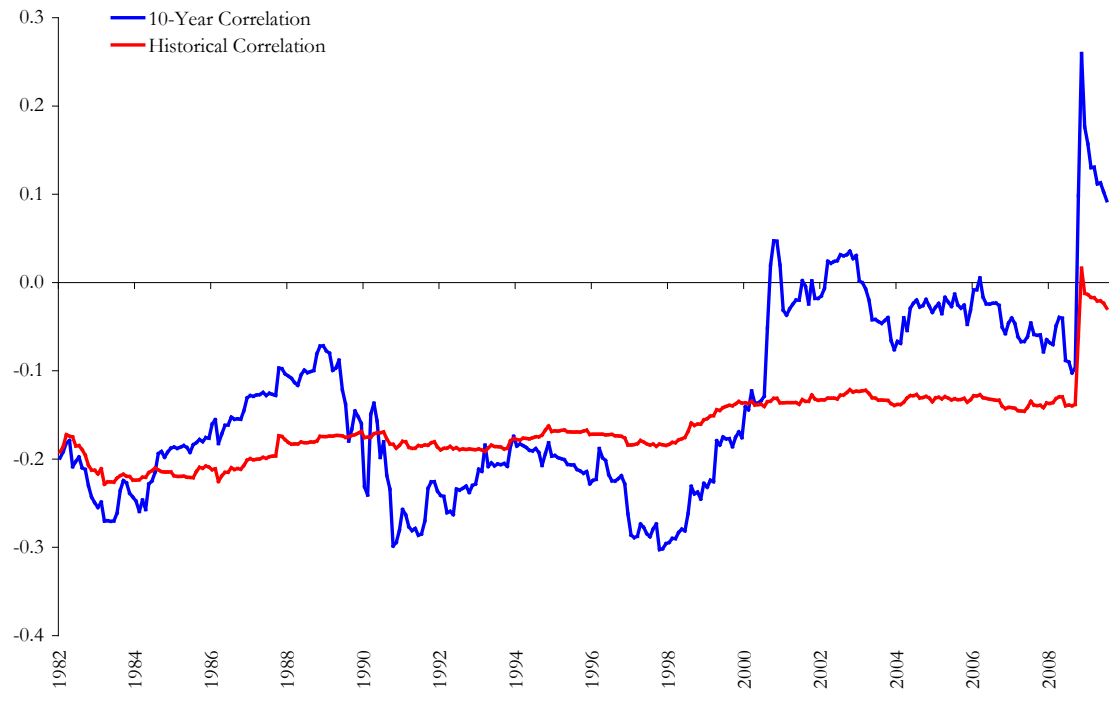
Figure 12: REIT Returns Compared with Inflation
January 1972 - July 2009 (Rolling 10-Year Periods)



Sources: BLS; Economagic.com; FTSE NAREIT

Historical REIT correlations with inflation have been slightly negative (see **Figure 13**), which leads one to believe that the overall structure of REITs (publicly traded) overrides the inflation hedging characteristics of the underlying real estate and replaces it with the negative correlative attributes of stocks.

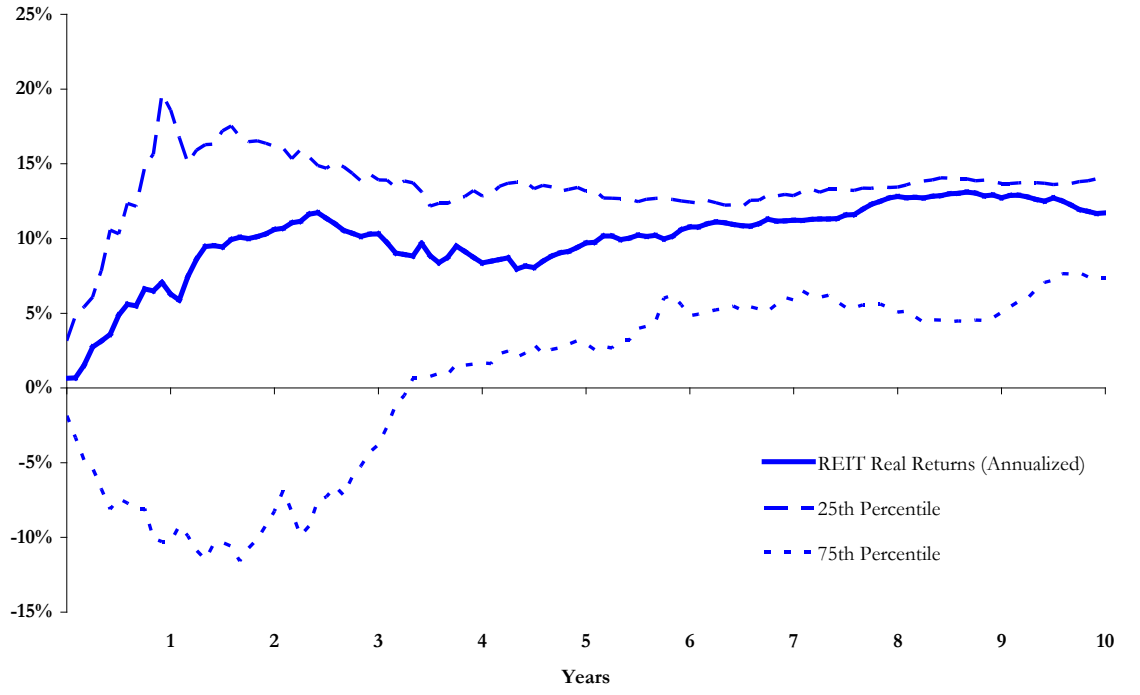
Figure 13: REIT Correlation with Inflation
January 1972 - July 2009



Sources: BLS; Economagic.com; FTSE NAREIT

While the shortened time frame makes drawing any conclusions difficult, **Figure 14** illustrates the ability of REITs to react to inflationary environments in the economy. The data illustrate that REITs have been able to protect during higher inflationary environments.

Figure 14: REIT Real Return (Annualized) During Inflationary Periods
10-Year Periods



Sources: BLS; Economagic.com; FTSE NAREIT

Even though REITs are directly invested in real estate and are passing on the returns associated with the properties, the inflation hedging characteristics of these securities closely resemble stocks and should react to inflation in the future in a similar fashion. The one caveat is that by law, REITs must pass on 90% of the income to the investors through dividends; therefore, investors will benefit from the reinvestment of higher income during inflationary periods. Therefore, investors should view these securities as a higher income producing equity and not as an efficient short-term inflation hedge.

Traditional Portfolio

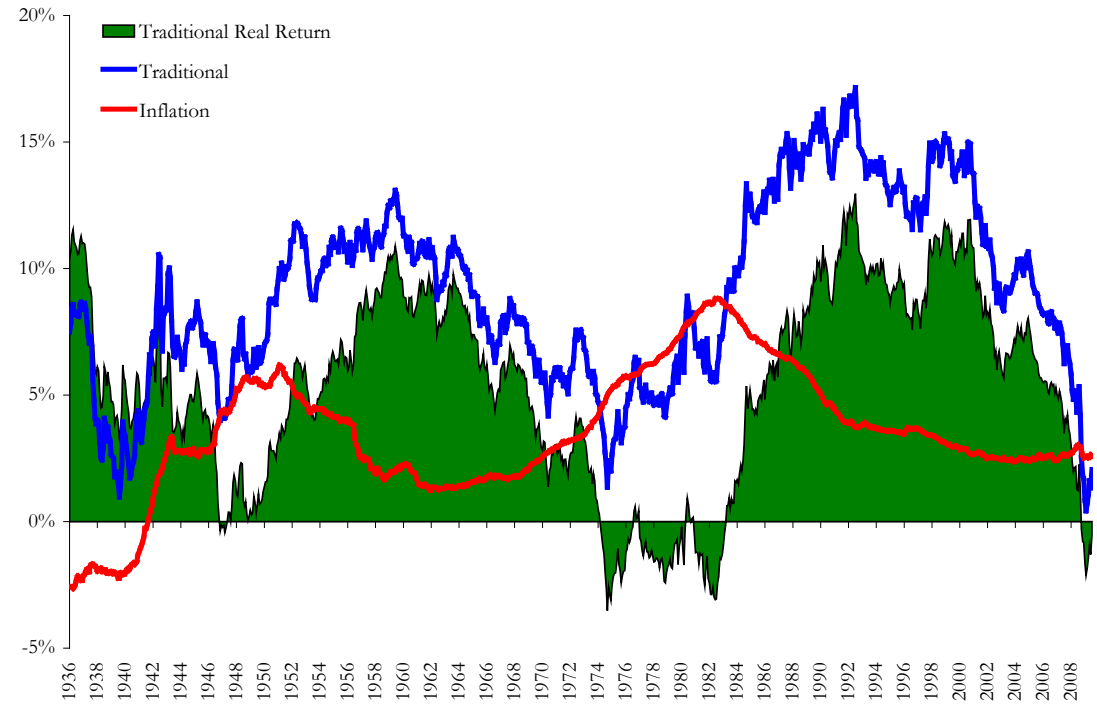
Analyzing the underlying investments is extremely beneficial; however, examining how these investments react to inflation within the portfolio context will shed additional light on the ability for the traditional portfolio allocation[13] to protect purchasing power.

Figure 15 illustrates the real return pattern of a traditional portfolio. Over the long term, this allocation has been able to consistently sustain positive real returns (over rolling 10-year

[13] This study focuses on a 60% stocks and 40% bonds allocation to illustrate a traditional asset allocation.

periods); however, the time horizon has been dominated by two long periods in which both inflation and interest rates were falling.

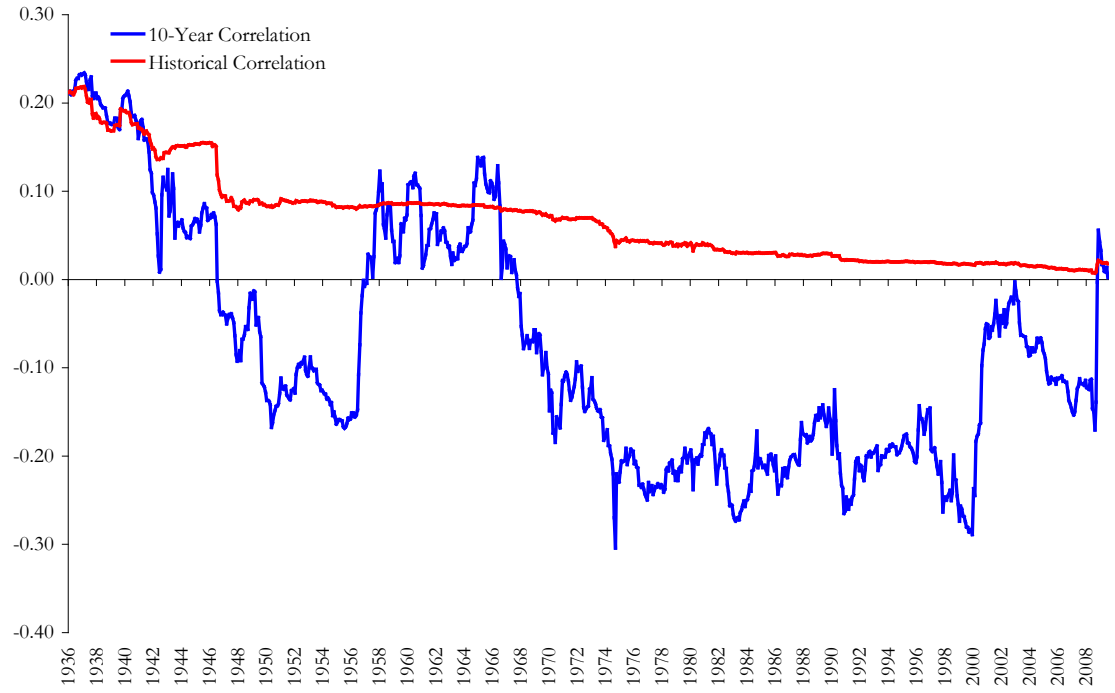
Figure 15: Traditional Portfolio Returns Compared with Inflation
January 1926 - July 2009 (Rolling 10-Year Periods)



Sources: BLS; Economagic.com; Wilshire; Barclays Capital; Robert Shiller; Standard & Poor's

The traditional portfolio's long-term correlation to inflation (see **Figure 16**) has been in steady decline. The rolling 10-year correlation to inflation has been volatile, spending the majority of the time in negative territory.

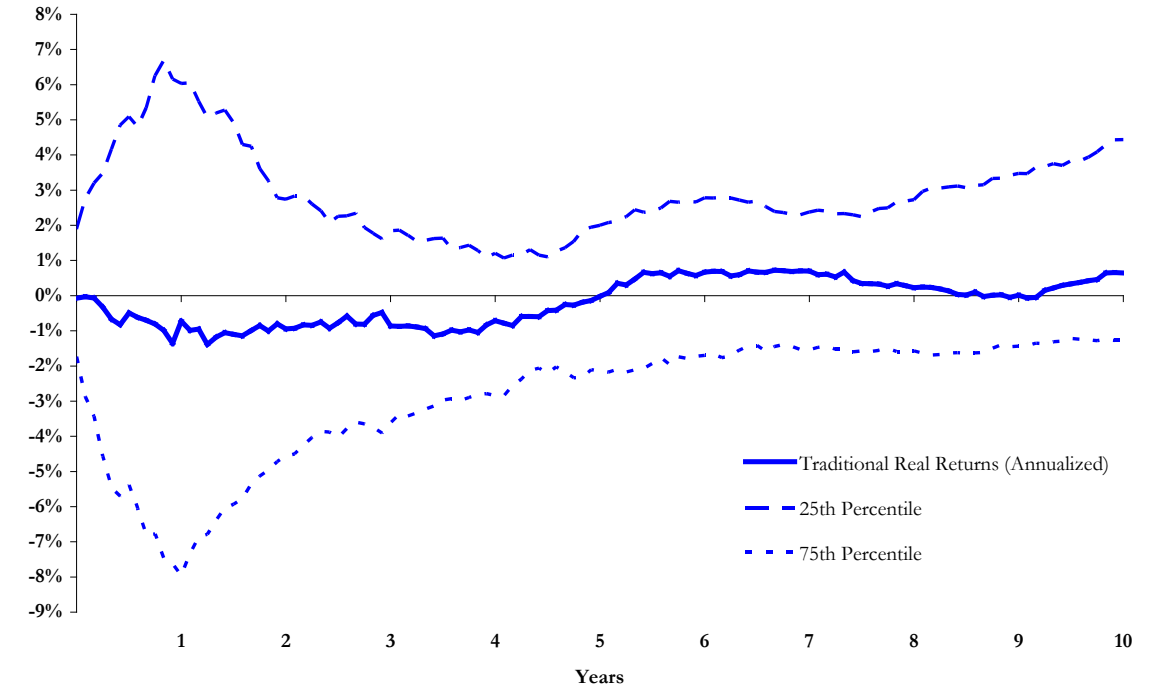
Figure 16: Traditional Portfolio Correlation with Inflation
January 1936 - July 2009



Sources: BLS; Economagic.com; Wilshire; Barclays Capital; Robert Shiller; Standard & Poor's

When analyzing the return pattern of the traditional portfolio during inflationary periods (see **Figure 17**), it becomes quite evident that this allocation struggles to provide real returns. This allocation takes approximately five years to break-even on a real basis, and it does not maintain a level in which the investor can expand purchasing power.

Figure 17: Traditional Portfolio Real Return (Annualized) During Inflationary Periods
10-Year Periods



Sources: BLS; Economagic.com; Wilshire; Barclays Capital; Robert Shiller; Standard & Poor's

Recognizing that the erosion of purchasing power is a major risk to the investor and that the traditional asset allocation lacks the ability to maintain positive real returns during inflationary environments, it becomes apparent that inflationary hedging strategies should be implemented. The next section will identify what investments are considered inflation hedges and will examine how effective their hedging capabilities have been within a historical context.

Types of Inflation Hedges

Recognizing the need for inflation hedging in the portfolio asset allocation, the next step is to identify the different asset classes that have the characteristics to provide effective inflation hedging. Asset classes that are able to maintain their value during inflationary periods are going to be the most effective hedges; therefore, this section will examine several asset classes and lay out the inflation hedging capabilities of these investments. Just as with traditional asset classes, this section will concentrate on the return drivers of each individual

asset class and the historical performance[14] in order to determine the effectiveness of the asset class as an inflation hedge.

[14] In some cases there is insufficient historical data to perform proper historical testing. In these cases, the historical testing will be omitted.

Inflation-Linked Bonds

Inflation-linked bonds are fixed income instruments in which the principal amount adjusts periodically based on the underlying inflation in the economy. The first U.S. inflation-linked bonds were issued to soldiers in the U.S. Revolutionary War by the Commonwealth of Massachusetts (Greer 2006). These inflation-linked securities were issued in order to protect the purchasing power of the soldiers' wages, linking them to a price index of beef, corn, leather, and wool. These securities have come and gone several times in the last 200 years, but have made their way back in recent history. Currently in the U.S., the most common inflation-linked bonds are Treasury Inflation Protected Securities (TIPS) issued by the U.S. government, which has been a regular funding source for the government since 1997.

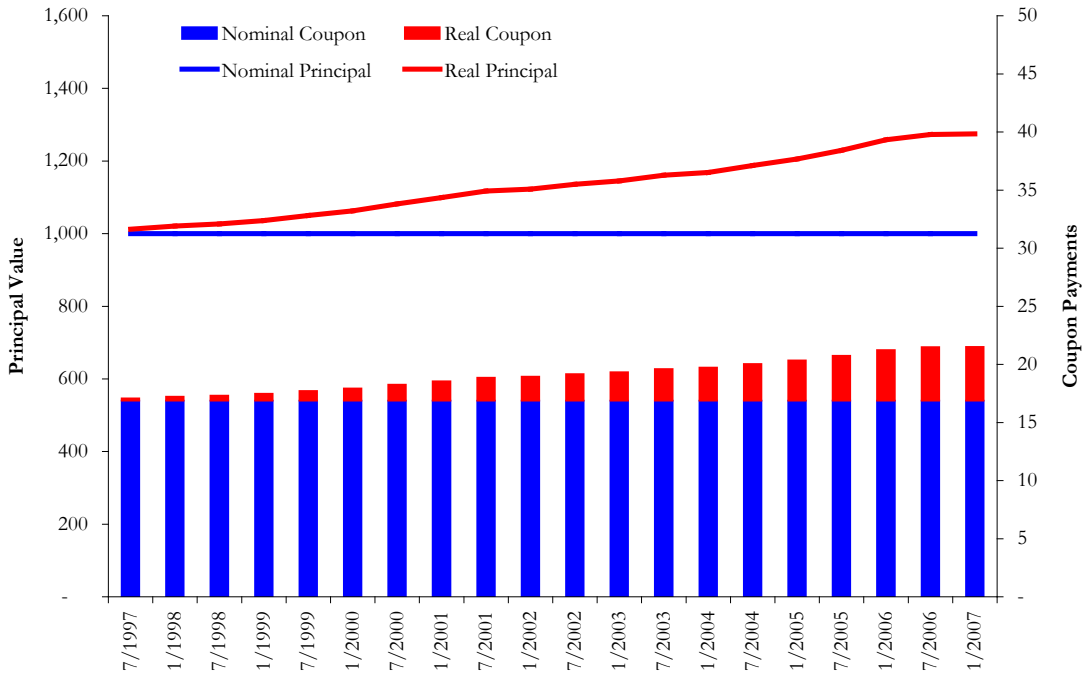
TIPS are bonds in which the principal adjusts based on monthly CPI[15]. The bonds pay semi-annual coupons based on the adjusted principal and on maturity the adjusted principal is returned to the investor (see **Figure 18a**). In the case of a deflationary environment (see **Figure 18b**), the bonds have a floor of par; therefore, the investor's original investment is protected from deflation[16].

The purchasing power protection of US TIPS is illustrated in **Figure 18a**. This graph shows the actual January 1997 US TIPS issued for January 2007 maturity with a 3.375 percent coupon. The purchasing power of the investor was protected in two different ways. First, the principal was protected as the investor paid $1,000 at issue and received $1,275 at maturity. Second, the coupon payments were also protected because the interest paid is on the adjusted principal; therefore, the investor received $45 in additional interest during the ten year period. Over the same period, inflation in the economy increased 27.6 percent (or 2.5 percent per year). In order to have the same purchasing power, the investor needed to be repaid $1,276 (the difference between inflation and the adjusted principal is due to the three month lag and rounding). Purchasing power was protected through the principal adjustments and the investor received a real yield of approximately 38.3 percent over the life of the bond or 3.3 percent per year.

[15] Based on the U.S. non-seasonally adjusted CPI lagged by three months.

[16] This is only the case if the investor purchased the bond when issued. If an investor purchases the bond in the secondary market, then the principal paid will be the adjusted principal; therefore, the investor could lose more than the price paid because the deflation floor is only applicable to the stated par of the bond and at maturity.

Figure 18a: 10-Year US TIPS
January 1997 (due January 2007) Issued at 3.375%

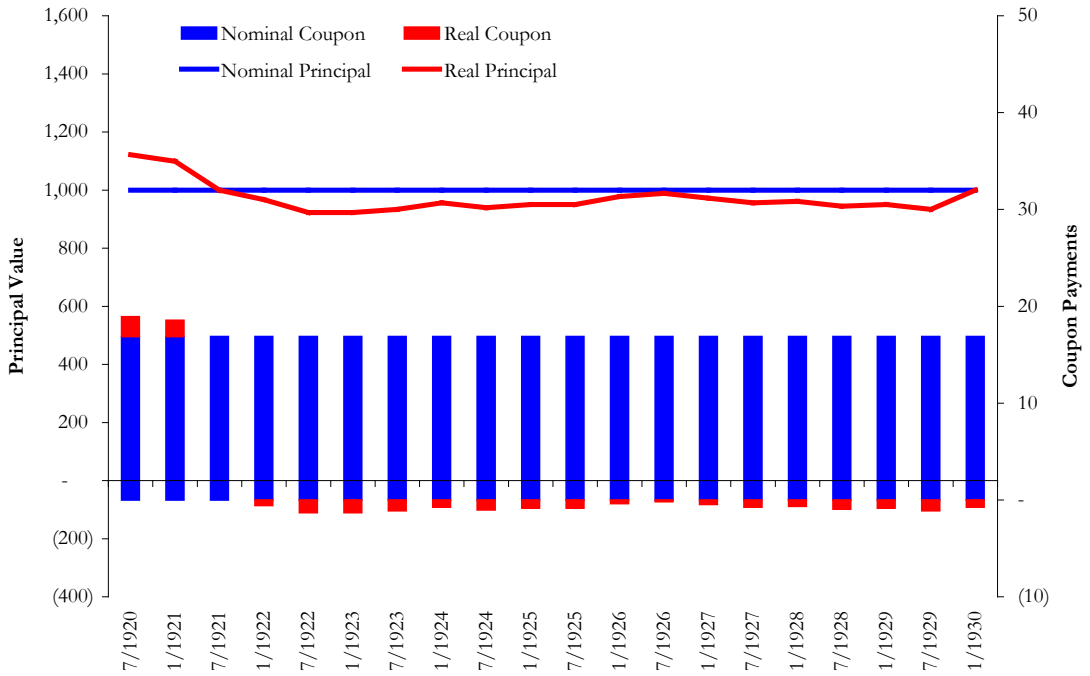


Source: Economagic.com; US Department of Treasury; BLS

US TIPS have a deflation put built into their structure. If the accrued principal is negative at maturity, then the original par is returned back to the investor. During the life of the bond, the coupons are still paid on the adjusted principal which means that the investor could receive a coupon payment based on less than the original par value at issue. **Figure 18b** illustrates how US TIPS also allow for principal protection during deflationary periods[17]. In this hypothetical example, the ten year bond is issued in January 1920. During the life of the bond, deflation is prevalent in the economy and the principal adjusts below par. This lowers the coupons paid to the investor, but the original par value is restored at maturity. Consumer prices during this period declined 9.5 percent (or 1.0 percent annually); however, the original principal was returned (0 percent appreciation). Over the life of the bond, the investor would have received 32.7 percent in coupons (or 2.9 percent annually) which is lower than the stated amount, but still a positive return in a deflationary environment.

[17] In this example, the same ten year US TIPS issued in 1997 was examined as if it were issued in January 1920.

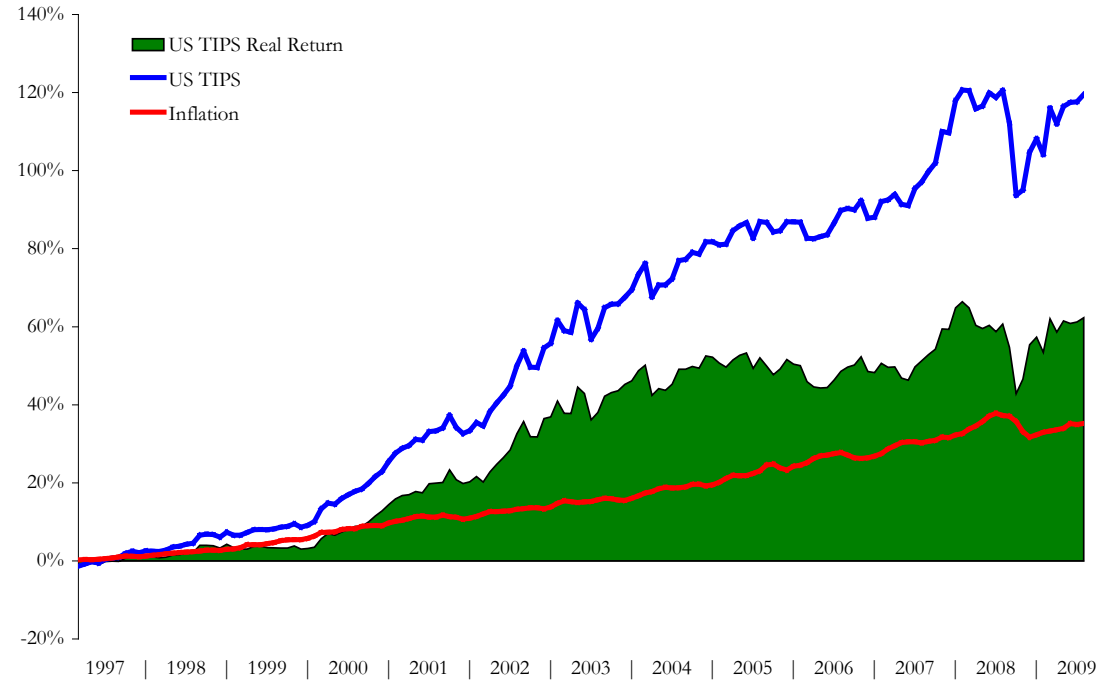
Figure 18b: 10-Year US TIPS During Deflation
10-Year Note Issued at 3.375% in January 1920 (Hypothetical)



Source: Economagic.com; US Department of Treasury; BLS

The two previous examples are based on purchasing the bonds at issuance and holding to maturity. US TIPS are marketable securities; therefore, they are subject to the same factors that affect other investments: liquidity, cash flows, market inefficiencies, etc. **Figure 19** shows the returns for the US TIPS market since 1997. Since March 1997, US TIPS have an annualized return of 6.5 percent compared to an inflation rate of 2.4 percent per annum, which translates into a 4.0 percent real return.

Figure 19: US TIPS Returns Compared with Inflation
March 1997 - August 2009



Source: Economagic.com; US Department of Treasury; BLS

While the underlying mechanics of these securities ensure that the buy and hold investor will achieve an efficient inflation hedge, a static asset allocation to US TIPS will offer a real return that doesn't track inflation as efficiently due to other externalities (see the year 2008 in **Figure 19**). However, these bonds are backed by the full faith and credit of the U.S. government and offer the investor a lower risk way to achieve inflation hedging in the portfolio.

Commodities

Commodities are consumable assets and are generally classified as: energy products, livestock, food, fiber, and industrial and precious metals (Greer 2006). These assets offer inflation protection because their prices actually constitute approximately 40 percent of the CPI (as of December 2008). Investors have three basic ways in which commodity exposure can be added to the portfolio:

1. **Purchase Commodities Directly**: this is achieved by purchasing commodities directly from producers and then selling them to end-users on the open market. For example, purchase barrels of crude oil and sell them to refineries. This method is

difficult to implement and has high carrying costs (costs associated with storing the commodities purchased).

2. **Invest in the Common Stock of Commodity Producers**: the investor gains exposure by investing in the stocks of commodity sensitive public companies (i.e. Exxon Mobil, Dow Chemical, Barrick Gold, etc.). While this method appears to give the investor exposure to commodity prices, it also brings several other factors into play: capital structure, management experience, accounting practices, etc. These non-commodity factors distort the hedging capability of this method of implementation (Greer 2006).
3. **Invest in Commodity Futures**: the investor is able to gain commodity exposure by purchasing commodity futures without taking physical delivery (close out the position by selling at expiration). This method is similar to purchasing commodities directly; however, it also has several other factors beyond commodity pricing that affect the overall total return. Unlike commodity-based equities, the other factors associated with the total return of commodity futures are directly related to the underlying commodity itself. According to Greer (2006), the total return of a commodity future can be broken down into:
    a. **T-Bill:** represents the management of the underlying collateral.
    b. **Risk Premium:** the difference between the expected future spot price and the acceptable profit for the seller of the future contract (the producer of the commodity).
    c. **Rebalancing:** the return generated by rebalancing uncorrelated commodities in a portfolio.
    d. **Convenience Yield:** yield associated with the futures prices relative to the spot price. If there is a low inventory environment for a commodity, then the futures price will be lower than the spot price. Therefore, the investor can roll their contracts from higher price nearby contracts to lower priced distant contracts (a.k.a roll yield and in this case the future is trading in backwardation[20]). In a normal supply market, the futures price would be higher priced than the spot price and the market would be trading in contango[21].
    e. **Expectational Variance:** change in futures prices due to a change in the market's future expectations of inflation and other market influences.

The most efficient method to gain exposure in an investment portfolio is through the use of commodity futures. The use of commodity indices are the most common way in which investors add this exposure to portfolios. The two largest indices utilized are the S&P Goldman Sachs Commodity Index (S&P GSCI) and the Dow Jones-UBS Commodity Index. **Figure 19**[18] shows the differences between these two indices[19].

[18] It is important to note that the weighting of the constituents of the indices changes annually; therefore, the weights as of 12/31/08 can differ from the historical weightings. For example, energy makes up 65.2 percent of the S&P GSCI in 2008; however, this sector was not included in the index until 1982 (Erb and Harvey 2006).
[19] In this analysis, the S&P GSCI will be utilized for historical analysis due to its longer track record.

Most investors stick to the rule of thumb: that it is only beneficial to invest in commodities futures when the markets are trading in backwardation [20] and that one should avoid commodities periods of contango[21]. This is an oversimplification of the commodity futures market that ignores the other underlying drivers of commodity futures (as listed above) and overlooks the strategy of investing in a diversified basket of commodities (in which several commodities could be in contango and other could be in backwardation).

[20] Backwardation is defined as a market condition in which a futures price is lower in the distant delivery months than in the near delivery months.

[21] Contango is a condition in which distant delivery prices for futures exceed spot prices, often due to the costs of storing and insuring the underlying commodity.

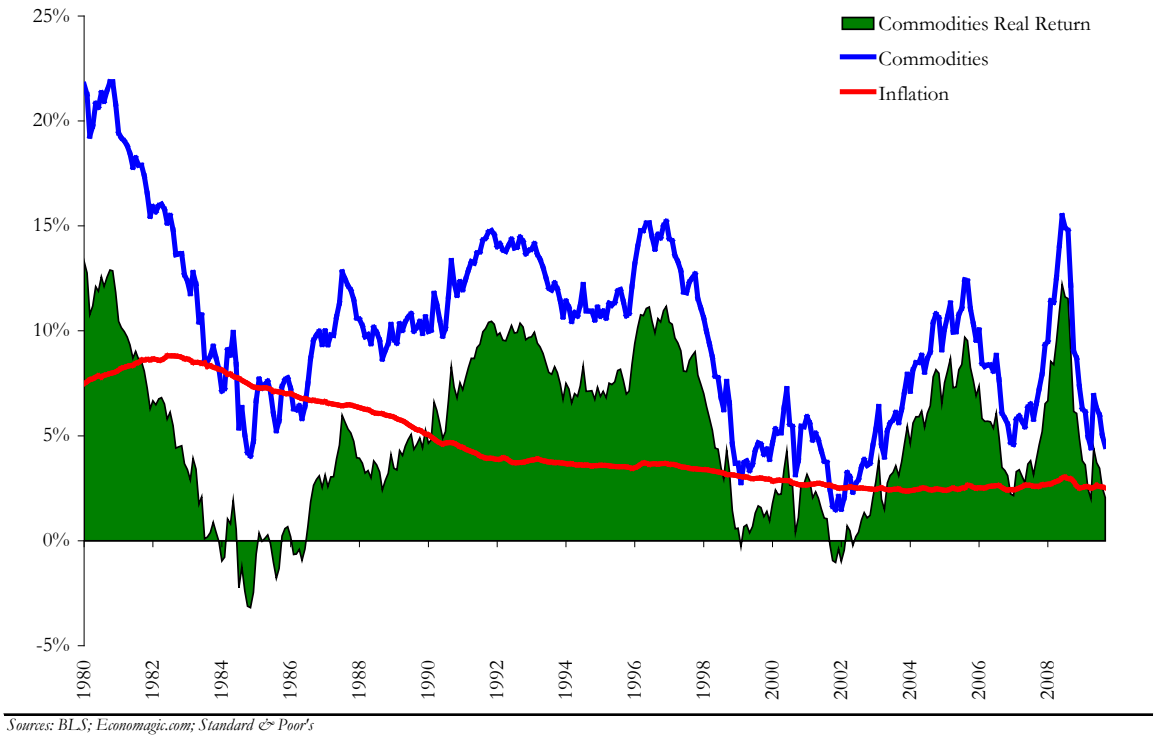
Figure 19: Commodity Indices
as of December 31, 2008

	S&P GSCI	Dow Jones-UBS
Inception Date	1970	1998
Number of Commodities	24	19
Weighting Methodology	Production	Production and Liquidity
Energy		
Crude Oil	32.0%	13.2%
Bent Crude	12.7%	0.0%
Unleaded Gasoline	3.4%	3.8%
Heating Oil	4.8%	3.8%
Gas Oil	4.4%	0.0%
Natural Gas	7.9%	12.2%
Total Energy	**65.2%**	**33.0%**
Industrial Metals		
Aluminum	2.6%	7.1%
Copper	2.3%	7.0%
Lead	0.3%	0.0%
Nickel	0.7%	2.8%
Zinc	0.6%	3.0%
Total Industrial Metals	**6.4%**	**20.0%**
Precious Metals		
Gold	3.5%	7.4%
Silver	0.3%	2.7%
Total Precious Metals	**3.8%**	**10.1%**
Agriculture		
Wheat	5.2%	4.7%
Kansas Wheat	1.2%	0.0%
Corn	4.9%	5.7%
Soybeans	3.2%	7.6%
Soybean Oil	0.0%	2.8%
Cotton	1.1%	2.5%
Sugar	1.8%	3.2%
Coffee	0.9%	3.0%
Cocoa	0.5%	0.0%
Total Agriculture	**18.8%**	**29.5%**
Livestock		
Feeder Cattle	0.6%	0.0%
Live Cattle	3.4%	4.9%
Lean Hogs	1.8%	2.5%
Total Livestock	**5.8%**	**7.4%**
Total	**100.0%**	**100.0%**

Sources: Standard & Poor's; Dow Jones

Figure 20 illustrates how commodity futures have performed over rolling ten-year periods since January 1970. As indicated by the green shaded area of the graph, commodity futures have exhibited positive real returns over the majority of time periods, with the exception being in the early to mid 1980s when inflation was declining from its peak.

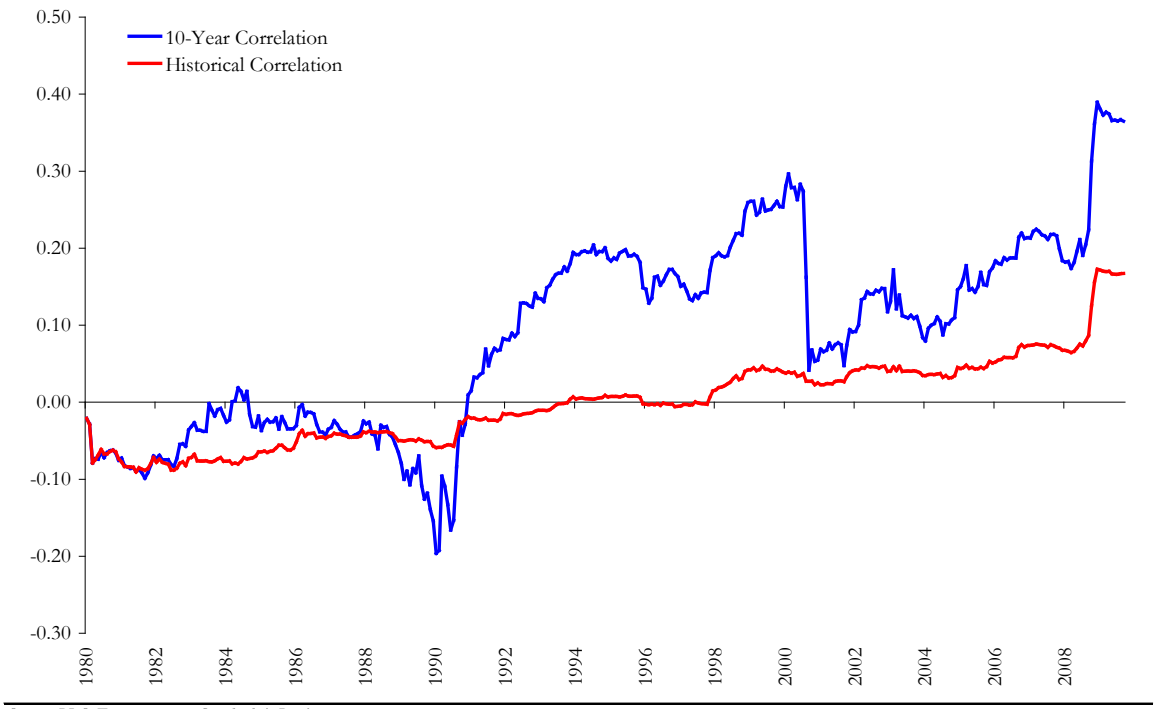
Figure 20: Commodities Returns Compared with Inflation
January 1970 - July 2009 (Rolling 10-Year Periods)



Sources: BLS; Economagic.com; Standard & Poor's

As for the correlation with inflation (see **Figure 21**), it has been increasing over time, starting from slightly negative to positive (with the ten year correlation having a much stronger correlation to inflation).

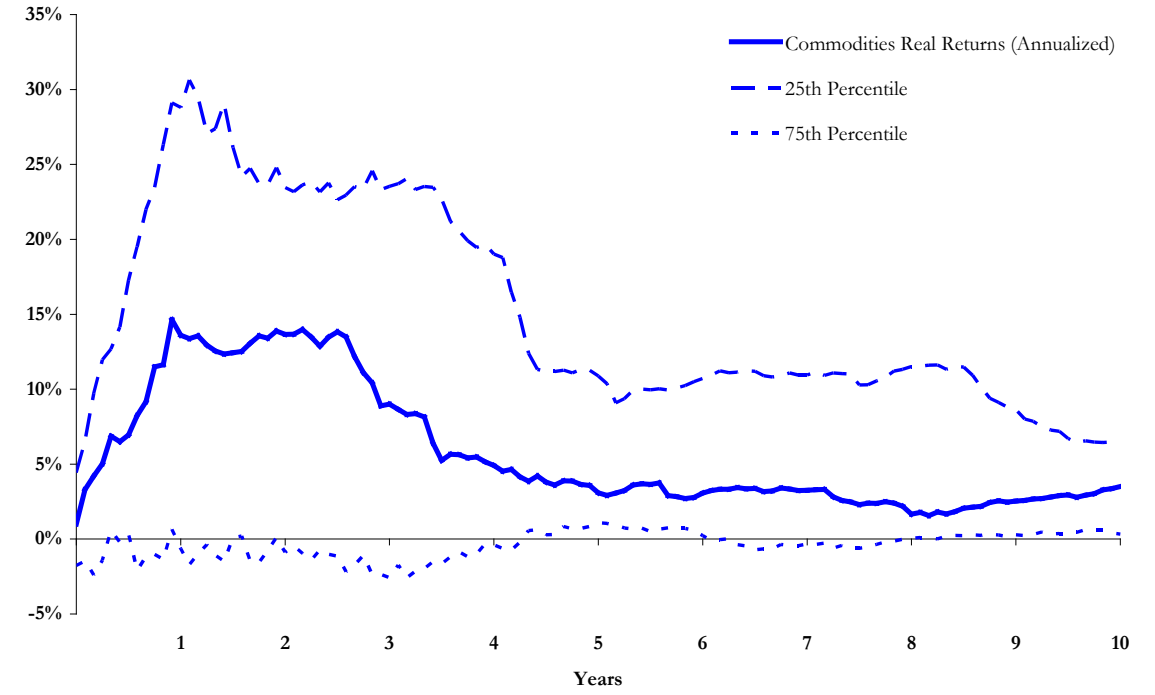
Figure 21: Commodities Correlation with Inflation
January 1970 - July 2009



Sources: BLS; Economagic.com; Standard & Poor's

Figure 22 examines how commodity futures react to periods of elevated inflation. In this test, commodity futures performed well during the early stages of higher inflation and gave some of their real return back during the later stages of the periods. Attié and Roache (2009) had similar results in their work; however, their analysis had commodity futures ending the twenty year period with negative real returns. Therefore, their finding was that commodities provided a better short-term hedge than a long-term one.

Figure 22: Commodities Real Return (Annualized) During Inflationary Periods
10-Year Periods



Sources: BLS; Economagic.com; Standard & Poor's

When examining the hedging properties of commodity futures, the ability to add real returns in inflationary environments is beneficial to the investor. However, the exposure of commodities in inflation measures (approximately 40 percent of the U.S. CPI is commodity related), as well as other return drivers, brings additional risks[22] not solely related to inflation into the portfolio. These risks must be understood and carefully weighed by the investor only then will the investor be able to determine if the additional real return characteristics of commodity futures compensate the portfolio appropriately.

Privately Held Commercial Real Estate

When looking to hedge against inflation, it is natural to incorporate the various components of the inflation measure in order to capture the exposure. Housing, more specifically rent, is the largest component of CPI, accounting for approximately 43.4 percent[23] of the U.S. CPI.

[22] Additional risks associated with commodity futures: basis risk associated with commodity futures and CPI; liquidity of underlying contracts; risks associated with rebalancing frequency (monthly, quarterly, annually, etc.); changing investor expectations; risks associated with markets trading in contango versus backwardation; reconstitution of indices or inflation measures; etc.
[23] See **Figure 1**.

Therefore, an investment that captured rent/leases could be a beneficial addition when hedging inflation.

Private commercial real estate is real estate owned directly by an investor or through a private partnership (i.e. limited partnership or private REIT). The objective of this investment is to earn income generated by the underlying property's leases and to eventually capture property appreciation when the investor exits the investment. According to the National Council of Real Estate Investment Fiduciaries (NCREIF), the private commercial real estate market (approximately $254.1 billion as of June 30, 2009) can be broken down by the following property types:

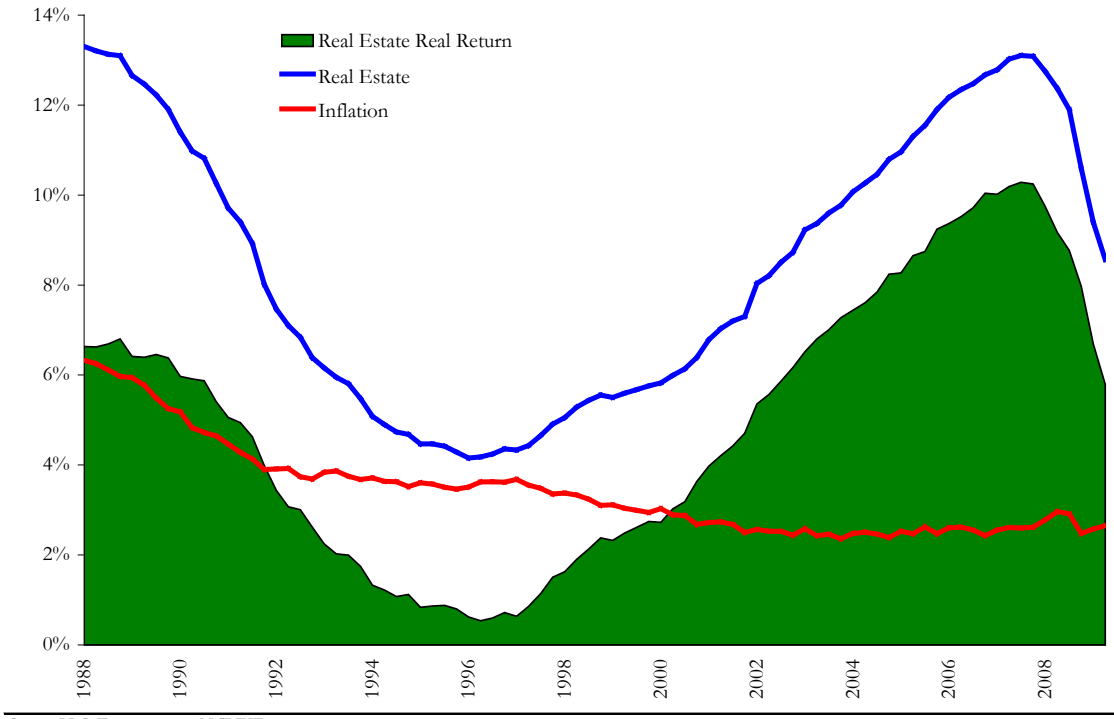
- Apartment ($61.1 billion or 24.0 percent)
- Hotel ($5.0 billion or 2.0 percent)
- Industrial ($39.0 billion or 15.3 percent)
- Office ($92.9 billion or 36.6 percent)
- Retail ($56.1 billion or 22.1 percent)

David Swenson (2000) describes the return pattern of real estate as a hybrid of debt and equity. The debt characteristics stem from the leases, which create a steady cash flow for the property, and the equity characteristics stem from the ownership of the property in which the price can appreciate. Intuitively one would think that these characteristics would make this asset an inefficient inflation hedge because debt and equity are not very efficient hedges against inflation (as discussed in early sections); however, the nature of the lease payments vary from the interest payments of bonds. Leases generally are shorter in duration than bonds; therefore, they are able to reset more quickly to the current level of prices in the economy. This provides the asset class with a certain level of inflation pass-through[24] effect that bonds do not provide.

Commercial real estate has exhibited positive real returns since 1978 (see **Figures 23a** and **23b**); however, it is beneficial to breakdown the return stream into its components. Conventional wisdom holds that the price returns should track with inflation (over the long-term), thus leaving the income return to provide the real yield associated with this asset class. However, the historical data doesn't support this theory. Historically, the price return has been 1.3 percent versus inflation of 4.0 percent. Income on the properties has earned 7.7 percent per annum, thus providing for the inflation pass-through. The price appreciation and remainder of the income provides the investor the real yield to compensate for the non-inflationary risks associated with this asset class (i.e. credit risk, liquidity risk, etc.).

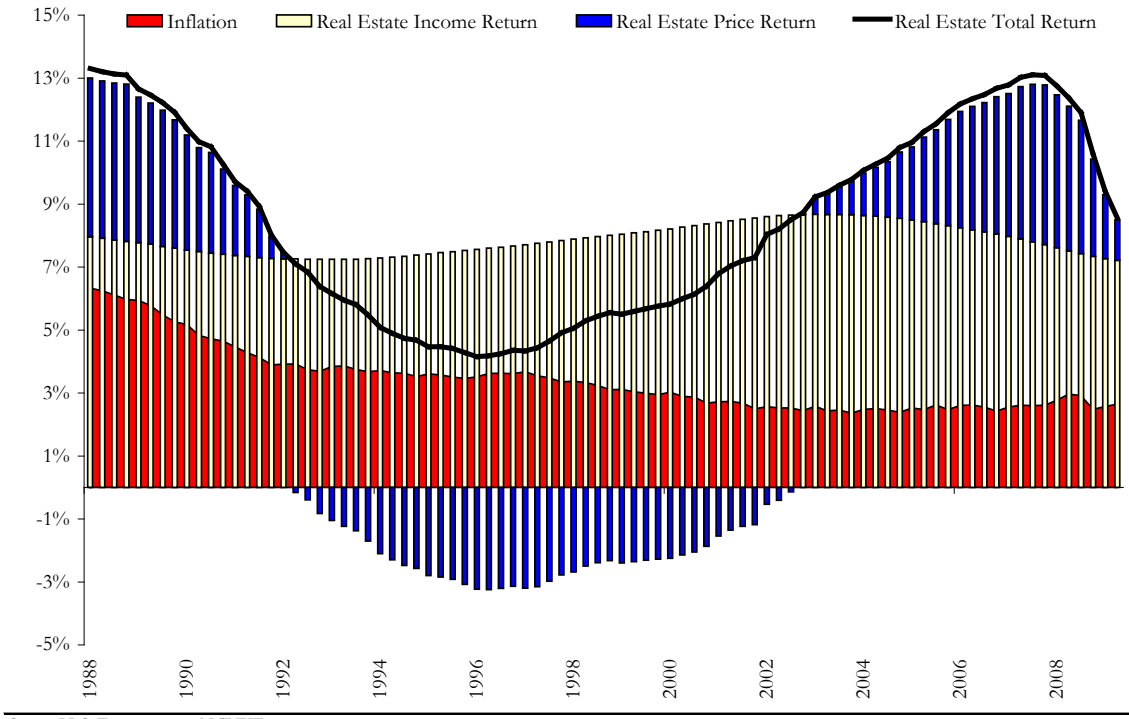
[24] It is also important to note that leases also contain additional income to compensate the owner for the other risks associated with lease, i.e. credit worthiness of the lessee.

Figure 23a: Commercial Real Estate Returns Compared with Inflation
January 1978 - June 2009 (Rolling 10-Year Periods with Quarterly Periodcity)



Sources: BLS; Economagic.com; NCREIF

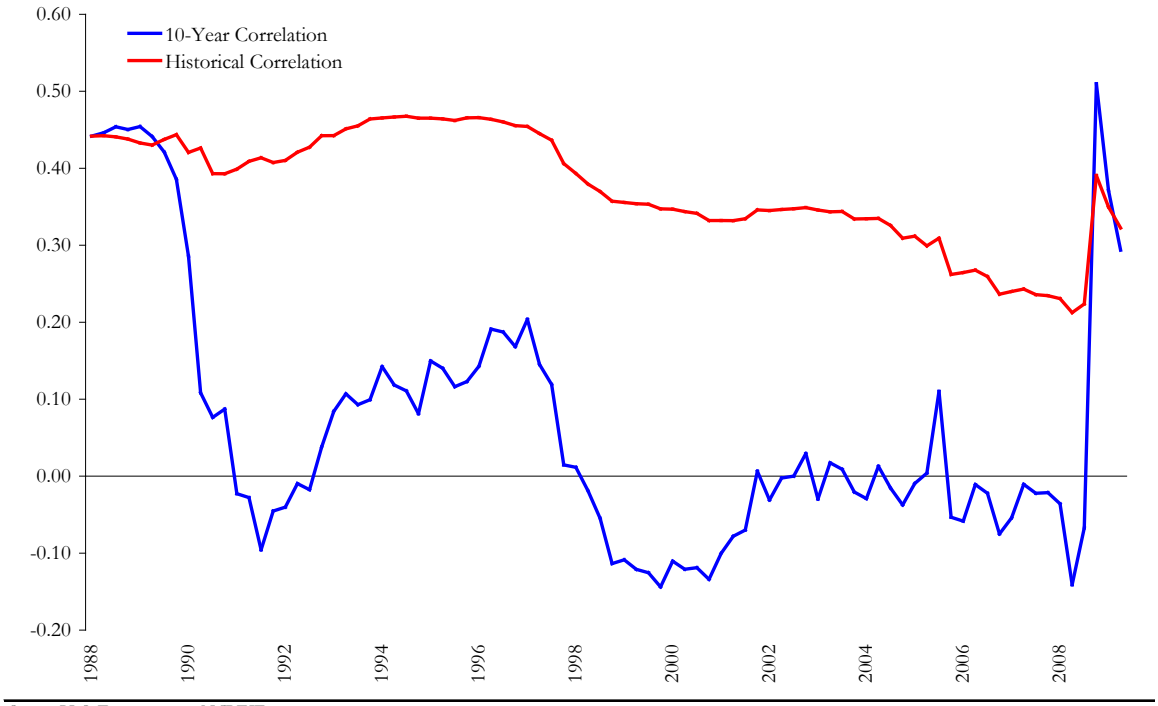
Figure 23b: Breakdown of Commercial Real Estate Returns Compared with Inflation
January 1978 - June 2009 (Rolling 10-Year Periods with Quarterly Periodcity)



Sources: BLS; Economagic.com; NCREIF

Since commercial real estate doesn't contain all of the components of inflation, the correlation to inflation would be expected to be low. However, looking at historical correlation with inflation (see **Figure 24**), the correlation has been higher than most asset classes.

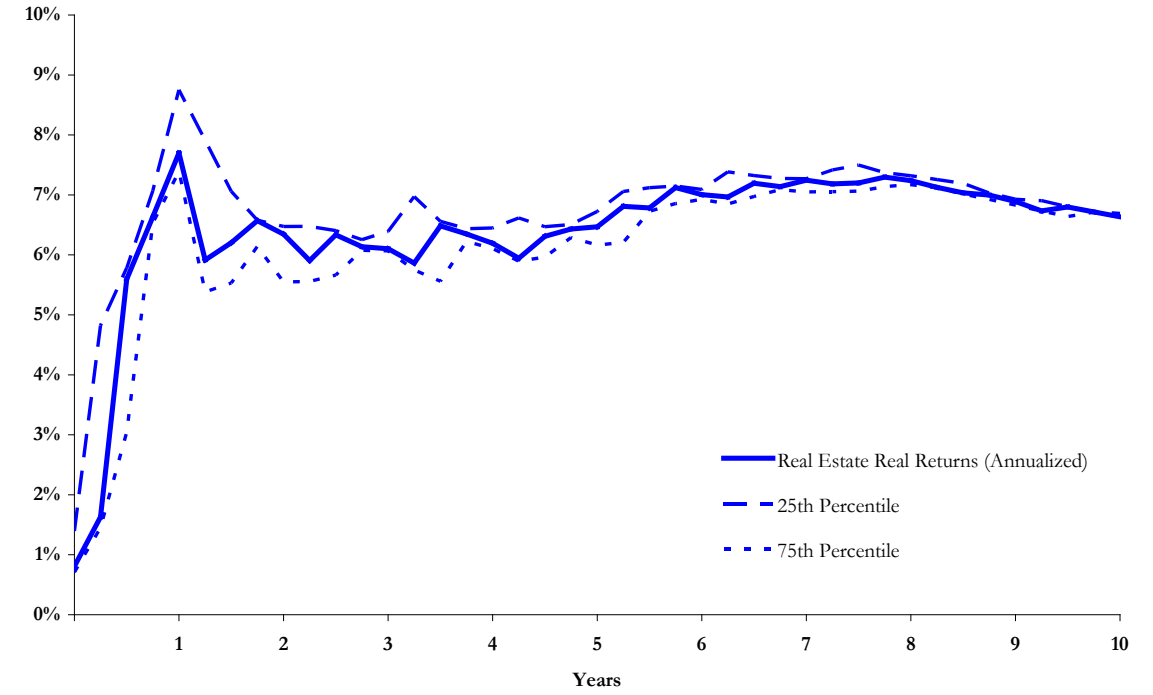
Figure 24: Commercial Real Estate Correlation with Inflation
January 1978 - June 2009 (Quarterly Periodcity)



Sources: BLS; Economagic.com; NCREIF

The number of long inflationary environments in which there is a record of commercial real estate returns is limited; therefore, it is difficult to have strong convictions (based on historical data) on how this asset class will truly react to another long-term inflationary environment. However, **Figure 25** illustrates that over the observable periods of higher inflation, commercial real estate has provided protection from the erosion of purchasing power.

Figure 25: Commercial Real Estate Real Return (Annualized) During Inflationary Periods
10-Year Periods (Quarterly Periodcity)



Sources: BLS; Economagic.com; NCREIF

Hudson-Wilson et al (2003) stated in their analysis of the real estate market that institutional investors could benefit from investing in real estate due to the following characteristics of real estate: (1) non-correlative returns compared to traditional stocks and bonds; (2) the ability to achieve higher absolute returns than the risk-free rate; (3) the ability to hedge against inflation; (4) it is a reasonable reflection of the overall investable universe; and (4) the ability to deliver strong cash flows. Looking at these characteristics and the historical performance of this asset class in extended inflationary environments (recognizing that the performance record is short) with the structure and drivers of underlying performance, it appears as commercial real estate should be included in an investment portfolio and should provide the investor with protection against higher levels of inflation.

Privately Held Farmland

Investing in farmland is when an investor purchases farmland and then leases the farmland to operators to produce agricultural commodities on the land. The leases are typically two years in duration with semi-annual payments (first payment at the beginning of the growing season and the second payment at the time of harvest). This arrangement is beneficial for both parties as it takes the equity risk of the land away from the farmer, allowing them to

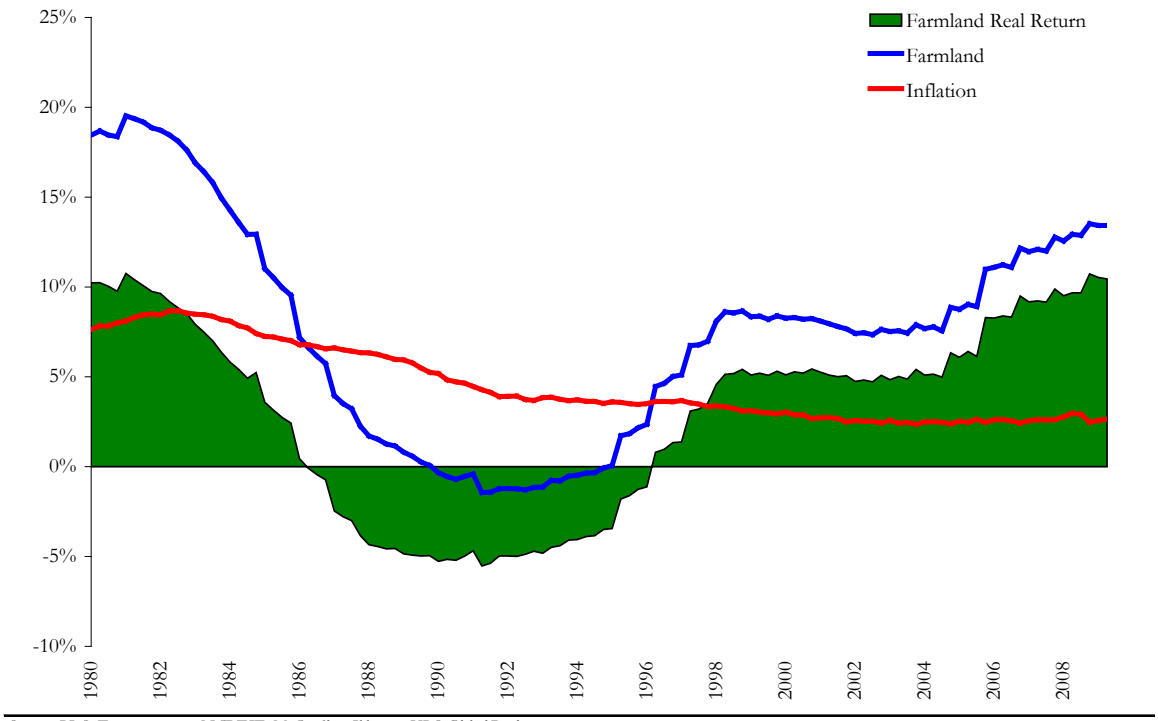
focus on producing the crop. The investor benefits from the cash flow produced from the use of the land.

Farmland is a hybrid investment that allows investors to gain exposure to both the commodity markets and the real estate markets. It has exposure to the commodity markets because the leases on the farmland are derived by supportable commodity prices. For example, a lease for a farm producing corn will be based on the sustainable corn prices. The leases are typically two years in duration; therefore, the investor is allowed to smooth out the volatility of the commodity markets, while still participating in the longer term direction of the market. The real estate market exposure is gained through the direct ownership of the land and a lease structure similar to most other real estate property types.

Figure 26 illustrates the performance[25] of farmland versus inflation since January 1970. Farmland has produced a real return of 9.8 percent per year since inception, which represents a real return of 5.1 percent annually. Unlike commercial real estate, the price return is within 30 basis points of inflation over the long-term (4.2 percent versus 4.5 percent for inflation). The return generated from the leases has added 5.4 percent annually, which roughly represents this asset class's real yield.

[25] The farmland index utilized in this analysis is a combination of three separate data streams provided by UBS Global Realty and NCREIF. From 1970 through 1982, data from McCandless and Ibbotson was combined. From 1982 to 2009, the NCREIF Farmland Index was used. Prior to 1982, quarterly data was interpolated from annual data.

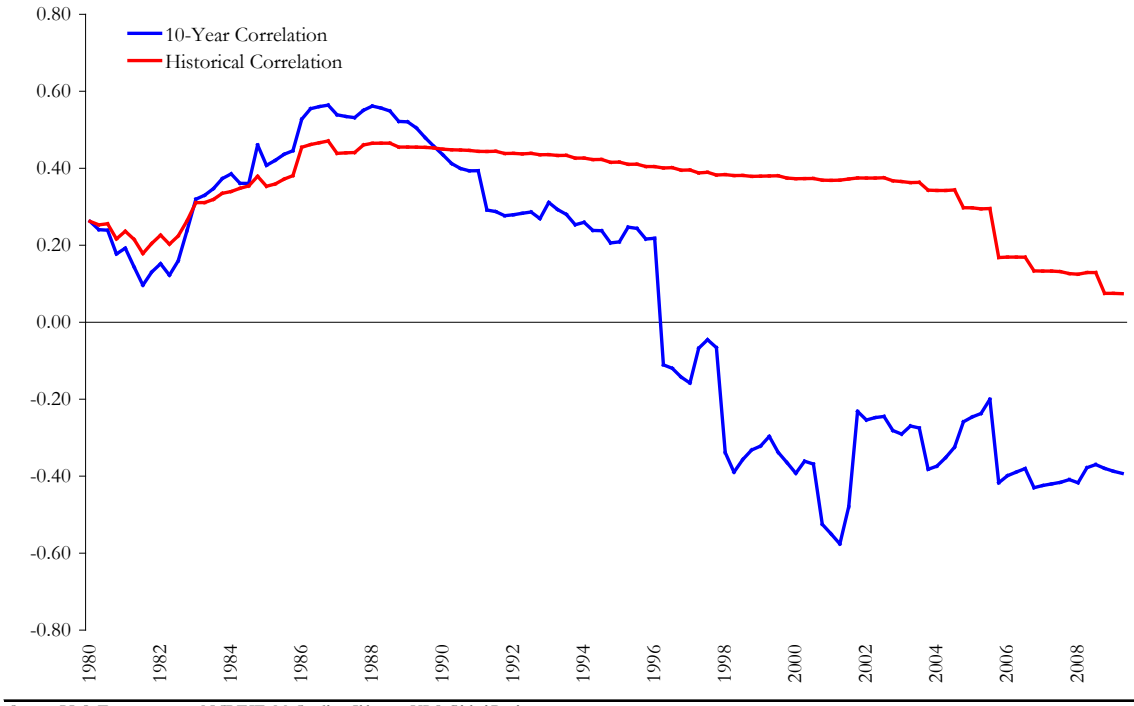
Figure 26: Farmland Returns Compared with Inflation
January 1970 - June 2009 (Rolling 10-Year Periods with Quarterly Periodcity)



Sources: BLS; Economagic.com; NCREIF; McCandless; Ibboston; UBS Global Realty

Although farmland has produced a real return since 1970, the asset class is roughly uncorrelated versus inflation over the period (see **Figure 27**).

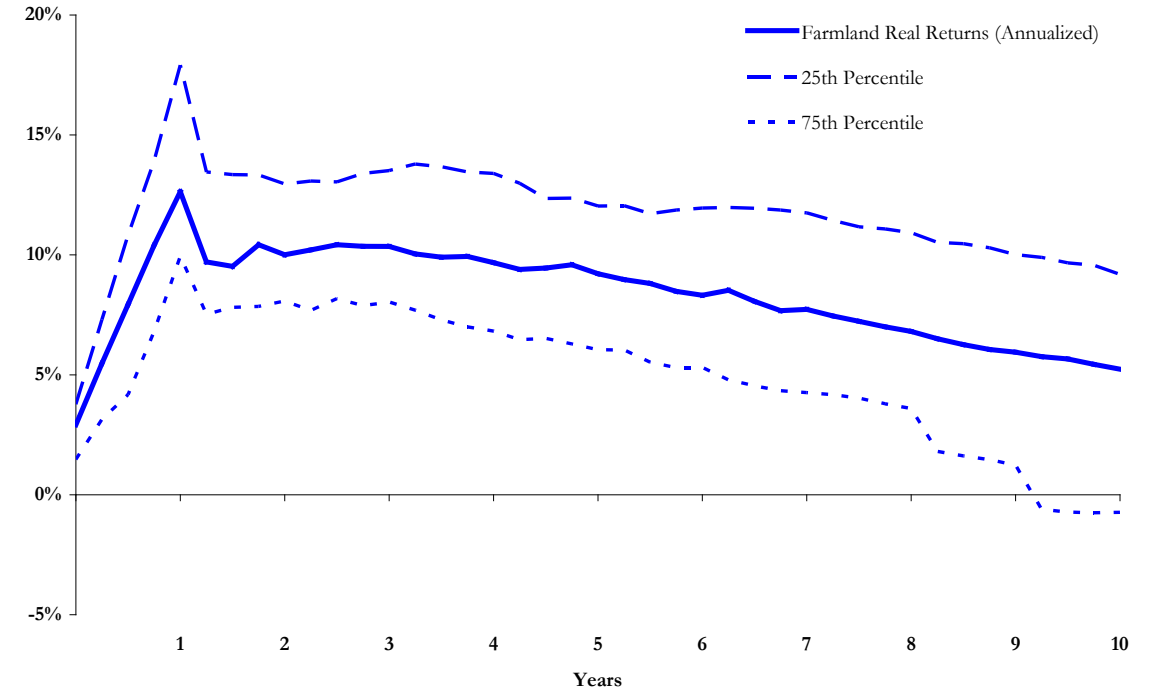
Figure 27: Farmland Correlation with Inflation
January 1970 - June 2009 (Quarterly Periodcity)



Sources: BLS; Economagic.com; NCREIF; McCandless; Ibboston; UBS Global Realty

Examining how farmland performs in higher inflationary periods (see **Figure 28**), the asset class performs well at the beginning of the period, giving back some of those gains over the longer term. This is much the same pattern as commodities, without some of the volatility.

Figure 28: Farmland Real Return (Annualized) During Inflationary Periods
10-Year Periods (Quarterly Periodcity)



Sources: BLS; Economagic.com; NCREIF; McCandless; Ibboston; UBS Global Realty

Farmland has exhibited the characteristics for an effective inflation hedge that allows investors to access both commodity and real estate exposure in the same investment; however, this asset class is far from perfect. The market is limited in size due to the nature of the ownership of the land. Although the farmland market is approximately $1.2 trillion[26], the vast majority of the land is owned and operated by families, not institutional investors. Additional risks associated with farmland include: (1) credit risk; (2) illiquidity risks; (3) climate risks; (4) supply/demand imbalance risks; etc. While broad diversification can mitigate some of these risks, they cannot be totally eliminated. Given the risks associated of this asset class, it can be difficult for institutional investors to make a dedicated allocation to this asset class.

Privately Held Timberland

It is generally thought that timberland is a good place in which investors could protect purchasing power during times of higher inflation. Its inflation hedging properties were thought to derive from the basic drivers of performance: (1) land valuations that track inflation over long periods of time; (2) timber prices which are a component of inflation; and

[26] Figure provided by UBS Global Realty s of December 31, 2008.

(3) natural growth of the trees on the land that offer positive growth no matter how investment markets are acting throughout the world. All of these factors intuitively seem to point to an efficient hedging asset class; however, returns for this asset class have not been tracked over very long periods[27]. This makes proving timberland's hedging capabilities through empirical evidence difficult.

Washburn and Binkley (1993) set out in their analysis to reconstruct timberland's return history[28] and determine, empirically, if the inflation hedging theory of timberland held up. They concluded that timberland did in fact exhibit inflation hedging characteristics; however, not all timberland was efficient in hedging inflation. The analysis determined that the location of the timberland was important and that certain regions (South and West) were far better at hedging inflation during periods of higher expected inflation, but they were also subject to overpricing during the same period. Northeast timberland was a better region during steady inflation, as these forests often reflected proper inflation expectations and were less likely to become overpriced during inflationary periods. The analysis was updated by the authors in 2006 and had the same conclusions as their original paper.

Looking at the underlying drivers of performance, Greer (2006) was able to examine the underlying drivers of performance and concluded that the drivers were:

- **Price**: the entry price in timberland was extremely important and that overpaying for the land could have a large negative impact on the investor's return. This is due to relatively low absolute return and a long holding period.
- **Management**: how the forest is managed also has a profound effect on the investor's total return. The choices of the asset manager (a.k.a silvicuture) are extremely vital and consist of: (1) what trees will be valuable in the future; (2) when to fertilize; (3) when to harvest; (4) manage undergrowth or not; etc.
- **Time**: when the trees are cut is also an important factor for the investor. This decision mainly centers on when the trees are harvested, but can also involve rotational harvesting or clear-cutting.
- **Exit**: when and how to exit the timberland.

Examining the short history of the NCREIF Timberland Index, the track record has been strong, generating a real return of 11.8 percent per year since 1987. Although this short track record has provided limited evidence of real returns and the empirical analysis by Washburn and Binkley have provided the theoretical empirical evidence (over longer time periods) of real returns, the structure in which investor's access this asset class can be a hindrance to institutional investors. The most common way in which to invest in timberland is through private equity (limited partnerships) vehicles that are very long-term (due to the characteristics of timberland) and can be difficult to measure the success of the investment

[27] The inception date for the NCREIF Timberland Index is 1987.
[28] The study reconstructed timberland's performance from 1955 to 1987.

until after the holding period. This makes it difficult to add timberland to an institutional investor's portfolio and therefore limits the ability of this asset class to be utilized.

Infrastructure

Infrastructure is an investment that many associate with emerging economies, but often overlook the on-going need for infrastructure development in developed countries. For example, the U.S. has large infrastructure needs to sustain a vast network of roads, airports, utilities, etc. The American Society of Civil Engineers (ASCE) published a report card on the state of America's infrastructure which grades and estimates funding needs for the several infrastructure categories. **Figure 29** summarizes their findings.

Table 29: Summary of U.S. Infrastructure Needs
(amounts in billions)

Category	5-Year Need	Estimated Spending	Stimulus Spending	5-Year Est. Shortfall
Aviation	87.0	45.0	1.3	(42.0)
Dams	12.5	5.0	0.1	(7.5)
Drinking Water and Wastewater	255.0	140.0	6.4	(115.0)
Energy	75.0	34.5	11.0	(40.5)
Hazardous Waste and Solid Waste	77.0	32.5	1.1	(44.5)
Inland Waterways	50.0	25.0	4.5	(25.0)
Levees	50.0	1.1	0.0	(48.9)
Public Parks and Recreation	85.0	36.0	0.8	(49.0)
Rail	63.0	42.0	9.3	(21.0)
Roads and Bridges	930.0	351.5	29.0	(578.5)
Schools*	160.0	125.0	0.0	(35.0)
Transit	265.0	66.5	8.4	(198.5)
Total U.S.**	**$ 2,109.5**	**$ 904.1**	**$ 71.9**	**$ (1,205.4)**

* The amount of stimulus spending for schools was not known the time the report card was published
** Totals differ slightly from actual report due to rounding.
Source: 2009 ASCE Report Card

Furthermore, Weisdorf (2007) concluded that developed governments do not have the funds available to fund these projects because the increasing of social programs (i.e. Medicare, Social Security, etc.) in their annual budgets and the inability to increase taxes to cover their escalating needs. This means that in the future; governments will rely more heavily on private investment in infrastructure projects in order to meet the needs. This is not a new concept, as there have been several projects done this in the past. Weisdorf (2007) gives several examples: Chicago Skyway, Indiana Toll Road, Dulles Greenway, Pocahontas Parkway in Virginia, State Highway 130 in Texas, State Road 91 in Orange County California, Northwest Parkway in Colorado, and Ponciana Parkway in Florida.

The return from infrastructure projects is generated off of the cash flow from the underlying investment (i.e. the collections on a toll road, fees on water transmission, etc.). The contractual arrangement on each individual investment varies; however, each contract usually carries a stated annual inflation adjustment. The investor also benefits from any

additional usage of the project, thus the investment earns an inflation return plus any additional organic growth of the project.

Infrastructure investments can be difficult to gain access to by investors. Investors can get the exposure through: (1) private equity vehicles; (2) publicly traded master limited partnerships (MLP); or (3) publicly traded equities[29].

As for the asset class's actual performance, the only available index is one which tracks MLPs. This makes it difficult to empirically test the hedging capabilities of this asset class; therefore, the investor must rely on the way in which the infrastructure projects are structured (i.e. inflation adjustments in the contracts with the government) in order to project this asset class's hedging capabilities.

Similar to timberland, the lack of historical performance and private equity nature of this asset class makes it difficult for most investors to implement in their overall investment strategy. Therefore, the inflation hedging characteristics of infrastructure is limited to those investors that can sustain the additional risk associated with private investments.

Implementing Inflation Hedges

The previous sections reviewed the need for investors to have inflation sensitive investments in the strategic portfolio asset allocation. The different types of inflation hedging asset classes were also reviewed on an individual stand-alone basis. This section will focus on the interaction of inflation hedging asset classes within a portfolio context and will examine the most efficient method in which to implement inflation hedging into a traditional portfolio.[30]

This analysis will utilize the traditional asset allocation discussed earlier in this paper (see page 19) as a base line. Different allocations will then be examined using a constrained mean-variance optimization model in order to determine the return/volatility profile[31] of each of the different allocation options (please refer to **Figures A3** and **A4** for a summary of the return, volatility, and correlation assumptions utilized in this analysis).

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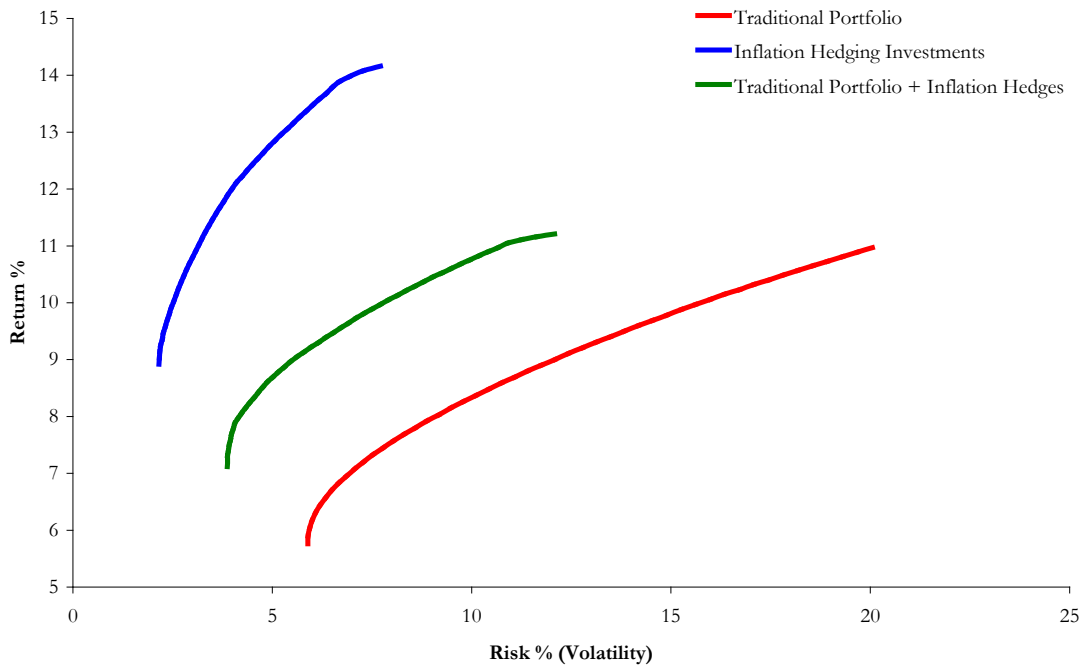
[29] While publicly traded equities seem like a desirable method of access, the ability to gain pure infrastructure exposure is limited. For example, investing in Caterpillar (NYSE: CAT) will give the investor exposure to infrastructure expansion, but will also give the investor exposure to other industries/strategies not necessarily associated with infrastructure.

[30] This implementation method of this strategy is ultimately determined by each individual investor's risk profiles; therefore, this analysis is not attempting to make a recommendation that would be beneficial for all investors. Each investor should seek the advice of his/her investment advisor in order to determine his/her investment strategy and how to implement that strategy.

[31] The return, risk, and correlation assumptions utilized were historical in order to illustrate the actual interaction between each of the asset classes. This method is entirely backward looking and is by no means meant to be a forecast for future performance. In order to properly implement any strategy in this analysis, each investor should examine his/her own future expectations for each asset class and determine the appropriate allocation.

Figure 30 graphs the efficient frontiers for three different strategies. First, the red line in the graph represents portfolios constrained only to traditional stocks and bonds. The blue line consists of portfolios made up entirely of inflation hedging investments, where no single asset class can represent more than one third of the portfolio. The green line represents a traditional portfolio that incorporates inflation hedging strategies. The constraints on this portfolio are: (1) inflation hedging investments cannot make up more than 30 percent of the total portfolio; (2) private investments cannot constitute more than 35 percent of the total allocation; and (3) each individual inflation hedging asset class cannot be more than 10 percent of the total portfolio. The inflation hedging asset classes are a more efficient opportunity set than the traditional portfolio, as the blue line is further to the left and higher than the red line. Intuitively it would seem that traditional asset classes would be abandoned all together in favor of a portfolio consisting entirely of inflation hedging assets; however, this would create a portfolio that has too few asset classes and is too heavily concentrated in private investments for most investors. Therefore, a mixture of traditional and inflation hedging strategies (the green line) becomes the opportunity set in order to determine the most optimal portfolio.

Figure 30: Efficient Frontiers



Sources: Wilshire Compass

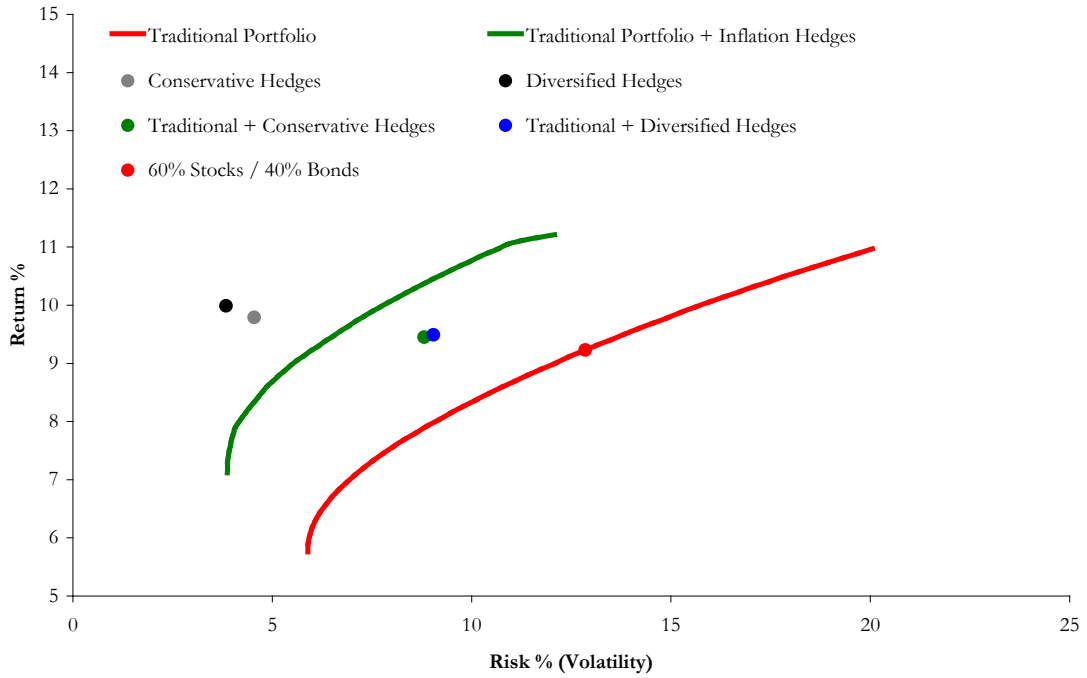
While the green line in **Figure 30** illustrates the most efficient allocations, the mean-variance optimization model has a tendency to allocate more heavily to private investments due to their lower volatility and correlations to traditional assets. While this appears to be optimal, it is not necessarily achievable for most investors; therefore, a level of judgment needs to be applied to the process.

Figure 31 graphs several different portfolios in which an added level of judgment was applied. The first portfolio (grey dot) was one in which only more traditional inflation hedging assets were used. These were inflation-linked bonds, publicly traded real estate, private commercial real estate, and commodity futures. These asset classes were chosen because by and large they are either more liquid or they are more widely utilized by institutional investors (i.e. private commercial real estate). The asset allocation mix was 30 percent inflation-linked bonds; 30 percent private commercial real estate; 20 percent publicly traded real estate; and 20 percent commodity futures.

The next portfolio (black dot) was one which incorporated all available inflation hedging strategies; however, limiting the amount invested in farmland, timberland, and infrastructure. This allocation was 30 percent inflation-linked bonds; 20 percent publicly traded real estate; 25 percent private commercial real estate; 10 percent commodity futures; 5 percent farmland; 5 percent timberland; and 5 percent infrastructure.

Finally, the two inflation hedging portfolios were then incorporated into a traditional portfolio at approximately 30 percent of the overall portfolio. These two portfolios are represented by the green and blue dots in **Figure 31**. Interestingly, the diversified hedges portfolio (black dot) dominates the conservative hedges portfolio (grey dot) on a stand-alone basis, but the two are virtually identical when incorporated with traditional assets (green and blue dots).

Figure 31: Risk / Return Trade-Off on Differing Allocations



Sources: Wilshire Compass

Figure 32[32] lays out each of the allocations' risk/return profiles[33]. The results in **Figure 31** can be seen more clearly in the underlying data in **Figure 32**. The inflation information ratios for the diversified hedges are higher on a stand-alone basis (1.54 versus 1.46 for the conservative hedges and 0.47 for the traditional portfolio); however, once these strategies are incorporated into the portfolio, their benefit becomes diluted and the conservative hedges become more beneficial. Comparing both hedging strategies to the traditional portfolio, it is clearly evident that the additional assets improve the efficiency of the overall portfolio.

[32] The inflation information ratio in **Figure 32** is a standard information ratio in which the inflation rate is the benchmark. It is similar to the Sharpe Ratio except inflation is substituted for the risk-free rate.
[33] Based on the historical analysis outlined in **Figures A3** and **A4**.

Figure 32: Statistical Analysis

		Inflation Hedges		Traditional + Inflation Hedges	
Asset Class	Traditional	Conservative	Diverisifed	Conservative	Diversified
Cash	0.0%	0.0%	0.0%	0.0%	0.0%
Bonds	40.0%	0.0%	0.0%	30.0%	30.0%
Inflation-Linked Bonds	0.0%	30.0%	30.0%	9.0%	9.0%
Stocks	60.0%	0.0%	0.0%	40.0%	40.0%
Public Real Estate	0.0%	20.0%	20.0%	6.0%	6.0%
Private Real Estate	0.0%	30.0%	25.0%	9.0%	7.5%
Farmland	0.0%	0.0%	5.0%	0.0%	1.5%
Timberland	0.0%	0.0%	5.0%	0.0%	1.5%
Commodities	0.0%	20.0%	10.0%	6.0%	3.0%
Infrastructure	0.0%	0.0%	5.0%	0.0%	1.5%
Return	9.2%	9.8%	10.0%	9.5%	9.5%
Volatility	12.9%	4.6%	3.8%	8.8%	9.0%
Information Ratio	0.47	1.46	1.54	0.72	0.69

Source: Wilshire Compass; see also ***Figures A3*** *and* ***A4***

Based on this analysis, it appears that the investor is not appropriately compensated for taking on the additional risk of investing in farmland, timberland, or infrastructure. Therefore, most investors[34] could implement an inflation hedging strategy by incorporating the more liquid, commonly utilized assets, and significantly improve the return/volatility trade-off of a portfolio consisting only of traditional portfolios.

Conclusion

This analysis examined inflation in a historical context in order to gain an understanding of the key drivers that cause it to occur in the economy. Next, the effect of inflation has on traditional investments/portfolios was studied and concluded that inflation has detrimental effects on the investments most readily available (and most commonly utilized) by investors today. Once this was established, this analysis then inspected inflation-hedging investments and determined their ability to protect investor's purchasing power during sustained inflationary environments. This review of inflation-hedging investments revealed that they indeed protect investors during inflationary periods and also provide non-correlative returns that also benefit investors during periods of normalized inflation, improving the overall effectiveness of the portfolio by increasing expected return and decreasing expected volatility. Also, this analysis came to the conclusion that the more conservative inflation hedging strategies provide as much portfolio enhancement as the more diversified strategies; therefore, most investors do not need to take on additional risks in order to provide the necessary inflation protection.

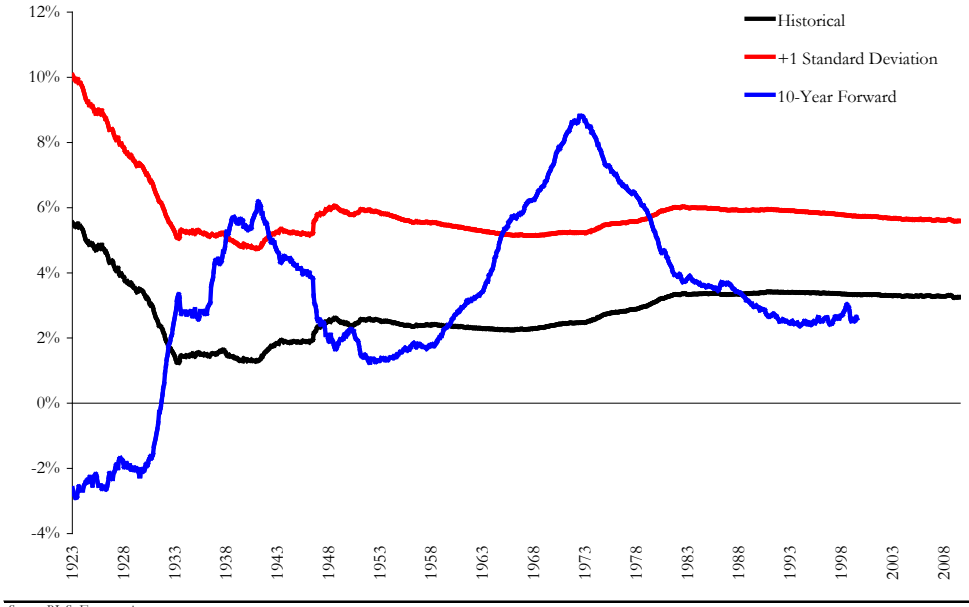
[34] In order to implement this strategy appropriate in an investor's portfolio, each investor should seek the advice of his/her financial advisor. The conclusion in this analysis is not a recommendation and should not be implemented without analyzing each individual investor's risk profile.

Appendix

Figure A1: Index Information

Index	Source	Periodicity	Date Range	Comments
Inflation				
CPI	Bureau of Labor Statistics	Monthly	January 1913 - July 2009	All Items Non-Seasonally Adjusted
PPI - Commodities	Bureau of Labor Statistics	Monthly	January 1913 - July 2009	Non-Seasonally Adjusted
PPI - Durable Goods	Bureau of Labor Statistics	Monthly	January 1947 - July 2009	Non-Seasonally Adjusted
PPI - Nondurable Goods	Bureau of Labor Statistics	Monthly	January 1947 - July 2009	Non-Seasonally Adjusted
PCE Deflator	Bureau of Economic Analysis	Quarterly	January 1947 - June 2009	Seasonally Adjusted
GDP Deflator	Bureau of Economic Analysis	Quarterly	January 1947 - June 2009	Seasonally Adjusted
Cash				
90-day U.S. Treasury Bill	Wilshire Compess	Monthly	January 1926 - July 2009	Total Return
Fixed Income				
Barclays Capital Aggregate Bond	Barclays Capital	Monthly	January 1926 - July 2009	Total Return
Barclays Capital U.S. TIPS	Barclays Capital	Monthly	March 1997 - July 2009	Total Return; Treasury Inflation Protected Securities
Publicly Traded Equity				
S&P 500	Robert Shiller; Standard and Poor's	Monthly	January 1900 - July 2009	Robert Shiller's data from January 1900 - December 1949, Standard & Poor's data from December 1949 - July 2009.
Real Estate				
FTSE NAREIT US Real Estate Index	FTSE NAREIT	Monthly	January 1972 - July 2009	Total Return
NCREIF Property Index	NCREIF	Quarterly	January 1978 - June 2009	Total Return; Privately Held Non-Levered Commercial Real Estate
NCREIF Fund Index - ODCE	NCREIF	Quarterly	January 1978 - June 2009	Total Return; Open End Diversified Core Real Estate Funds
Ibboston Farmland Index	Ibboston	Annual	1970 - 2009	Total Return based on USDA's National Farmland Prices and Farm Income Numbers..
NCREIF Farmland Index	NCREIF	Quarterly	January 1992 - June 2009	Total Return; Privately Held Non-Levered Farmland
NCREIF Timberland Index	NCREIF	Quarterly	January 1987 - June 2009	Total Return; Privately Held Non-Levered Timberland
Commodities				
S&P - GSCI	Goldman Sachs	Monthly	January 1970 - July 2009	Total Return; Production Weighted
Dow Jones - UBS	Dow Jones	Monthly	February 1991 - July 2009	Total Return; Liquidity and Productin Weighted
Reuters-CRB Futures Price Index	Commodites Research Bureau	Monthly	January 1960 - July 2009	Total Return; Equally Weighted
Infrastructure				
S&P MLP	Standard & Poor's	Monthly	August 2001 - July 2009	Total Return on Publicly Traded Master Limited Partnerships
Hedge Fund of Funds				
HFRI Fund of Funds Composite	Hedge Fund Research	Monthly	January 1990 - July 2009	Total Return

Figure A2: Identifying Inflationary Periods
January 1913 - July 2009



Source: BLS; Economagic.com

Figure A3: Asset Class Return and Volatility Assumptions (10-Year)

Asset Class	Index Used	Inception Date	Historical Return	Historical Volatility	Assumptions Return	Assumptions Volatility	Source of Assumptions
Inflation	CPI	January 1913	3.31%	3.28%	3.14%	3.28%	Rolling 10-Year Averages
Cash	U.S. 90 Day T-Bill	January 1926	3.92%	1.65%	4.08%	1.65%	Rolling 10-Year Averages
Fixed Income	Barclays Capital Aggregate	January 1926	5.62%	5.89%	5.69%	5.89%	Rolling 10-Year Averages
TIPS	Barclays Capital U.S. TIPS	March 1997	6.66%	4.43%	6.66%	4.43%	Annualized History
Stocks	S&P 500	January 1900	10.23%	20.05%	10.97%	20.05%	Rolling 10-Year Averages
Public Real Estate	FTSE NAREIT	January 1972	13.56%	14.74%	14.21%	14.74%	Rolling 10-Year Averages
Private Real Estate	NCREIF	January 1978	10.23%	3.40%	8.20%	3.40%	Rolling 10-Year Averages
Farmland	Ibboston/NCREIF Farmland	January 1970	9.53%	7.70%	6.84%	7.70%	Rolling 10-Year Averages
Timberland	NCREIF Timberland	January 1987	15.48%	8.60%	13.59%	8.60%	Rolling 10-Year Averages
Commodities	S&P GSCI/DJ-UBS	January 1970	12.18%	17.99%	10.33%	17.99%	Rolling 10-Year Averages
Infrastructure	S&P MLP	August 2001	18.09%	12.61%	13.59%	12.61%	Timberland Return and Historical Volatility

Sources: See ***Figure A1*** *for information on sources*

Figure A4: Historical Correlations

	Inflation	Cash	Bonds	TIPS	Stocks	Pu RE	Pr RE	Farm	Timber	Comm.	Infra.
Inflation	1.00										
Cash	0.31	1.00									
Bonds	-0.11	0.23	1.00								
TIPS	0.05	-0.07	0.75	1.00							
Stocks	-0.03	-0.02	0.26	-0.52	1.00						
Pu RE	-0.17	-0.07	0.32	0.11	0.58	1.00					
Pr RE	0.24	0.24	-0.17	-0.28	-0.03	0.01	1.00				
Farmland	0.13	-0.07	-0.17	-0.21	-0.02	-0.01	0.24	1.00			
Timberland	-0.10	0.25	0.10	-0.18	0.10	-0.09	-0.20	0.24	1.00		
Commodity	0.21	-0.03	-0.14	0.14	-0.30	-0.24	-0.02	0.04	-0.03	1.00	
Infrastructure	-0.11	0.11	0.25	0.13	0.45	0.39	0.03	-0.23	-0.11	0.12	1.00

Note: Historical correlations were derived from all available information for all asset classes
Sources: See ***Figure A1*** *for information on sources*

References

Allison, Gregory. "Global Infrastructure Investing: The Case Remains Intact." *Wellington Management Featured Publications.* Volume 1 2009: 64-65.

Amenc, Noel, Lionel Martellini, and Volker Ziemann. "Inflation-Hedging Properties of Real Assets and Implications for Asset-Liability Management Decisions." EDHEC Risk and Asset Management Research Centre, 2008.

Attié, Alexander P. and Shaun K. Roache. "Inflation Hedging for Long-Term Investors." IMF Working Paper. International Monetary Fund, 2009.

Barty, James. "Insight: Long Road Back to Normality." *FT.com.* Financial Times, 22 July 2009. Web. 27 July 2009.

Bekkers, Niels, Doeswijk, Ronald Q. and Lam, Trevin W. "Strategic Asset Allocation: Determining the Optimal Portfolio with Ten Asset Classes." 26 March 2009. Web: http://ssrn.com/abstract=1368689.

Bernanke, Ben S. *Essays on the Great Depression.* Princeton: Princeton University Press, 2000.

Bernanke, Ben S., Thomas Laubach, Frederic S. Mishkin, and Adam S. Posen. *Inflation Targeting: Lessons from the International Experience.* Princeton: Princeton University Press, 1999.

Bertram, Robert G. "Balancing the Opportunities in Real Return Investments." *CFA Institute Conference Proceedings Quarterly.* September 2007: 41-49.

Bodie, Zvie. "Common Stocks as a Hedge Against Inflation." *Journal of Finance.* Volume 15 (1976): 459-470.

Burkart, David W. "Commodities and Real-Return Strategies in the Investment Mix." *CFA Institute Conference Proceedings Quarterly.* December 2006: 18-24.

Cavalieri, John and Robert Greer. "Investing in the Era of '-Flation'." *PIMCO.* November 2008.

Carroll, Maryann, Brian Garvey, Santiago Millan, Julius Moschitz, and Jeffrey Saul. "Deflation/Inflation Horizons." *Wellington Management Featured Publications.* Volume 1 2009: 14-19.

Chang, David and Greg LeBlanc. "Commodities Supply Destruction and the Renewal of Global Demand." *Wellington Management Featured Publications.* Volume 1 2009: 23-25.

Cooper, George. *The Origin of Financial Crises: Central Banks, Credit Bubbles and the Efficient Market Fallacy.* New York: Vintage Books, 2008.

_____. "Diversified Inflation Hedges and Real Asset Fund Investor Day." *Wellington Management Viewpoints.* June 2008. Print.

Erb, Claude B. and Campbell R. Harvey. "The Strategic and Tactical Value of Commodity Futures." *Financial Analysts Journal* 62 March/April (2006): 69-97.

Elliot, Scott. "Toward a More Effective Inflation Hedge." *Wellington Management Featured Publications.* Volume 1 2009: 20-22.

Ellis, Charles D. *Investment Policy: How to Win the Loser's Game.* Chicago: Irwin Professional Publishing, 1993.

Gorton, Gary and K. Geert Rouwenhorst. "Facts and Fantasies about Commodity Futures." *Financial Analysts Journal* 62 March/April (2006):47-68.

Grant, James. "'Excess' is the Word." *Grant's Interest Rate Observer.* 27.16 (2009): 1-3.

Grant, James. "State of Credit." *Grant's Interest Rate Observer.* 27.16 (2009): 1-3.

Grantham, Jeremy. "Initial Report: Running Out of Resources." *GMO Quarterly Letter.* July 2009.

Greer, Robert J. *The Handbook of Inflation Hedging Investments: Enhance Performance and Protect Your Portfolio from Inflation Risk.* New York: McGraw-Hill, 2006.

Gundlach, Jeffrey. "Letter from Jeffrey Gundlach." *TCW Group, Inc.* 15 June 2009. Print.

Hoisington, Van R. and Lacy H. Hunt, Ph.D. "Quarterly Review and Outlook: Second Quarter 2009." *John Mauldin's Outside the Box* 13 July 2009.

Hudson-Wilson, Susan, Frank J. Fabozzi and Jacques N. Gordon. "Why Real Estate: An Expanding Role for Institutional Investors" *The Journal of Portfolio Management* Special Issue (2003): 12-25.

Hussman, John P. "Brief Holiday Update." *Hussman Funds – Weekly Market Comment* 9 July 2009.

_____. *Ibbostson SBBI 2008 Classic Yearbook: Market Results for Stocks, Bonds, Bills, and Inflation.* Chicago: Morningstar. 2008.

Jensen, Niels. C. "Make Sure You Get This One Right." *John Mauldin's Outside the Box* 6 July 2009.

Mandelbrot, Benoit B. and Richard L. Hudson. *The (mis)Behavior of Markets: A Fractal View of Risk, Return, and Reward.* New York: Basic Books, 2004.

Mauboussin, Michael J. *More Than You Know: Finding Financial Wisdom in Unconventional Places.* New York: Columbia University Press, 2006.

McCully, Clinton P., Brian C. Moyer, and Kenneth J. Stewart. "A Reconciliation between the Consumer Price Index and the Personal Consumption Expenditures Price Index." Bureau of Economic Analysis and Bureau of Labor Statistics, 2007.

Reilly, Frank K. "The Impact of Inflation on ROE, Growth and Stock Prices." *Financial Services Review.* Vol. 6 No. 1, 1997.

Rodriquez, Robert, Scott Elliott, Brian Garvey, and Julius Moschitz. "Diversified Inflation Hedges and Real Asset Strategies: A Market and Portfolio Update." *Wellington Management Investor Presentation.* Boston, Massachusetts. 28 April 2009. Presentation.

Scherfke, Robert. "Global Economic Outlook." *Wellington Manegement Market Update and Outlook.* Third Quarter 2009. Print.

Shilling, A. Gary. "Slow Long-Term Growth, And Government's Response." *John Mauldin's Outside the Box.* 10 August 2009.

Siegel, Jeremy J. *Stocks for the Long Run: the Definitive Guide to Financial Market Returns and Long-Term Investment Strategies.* New York: McGraw-Hill, 1998.

Skidelsky, Robert. "Economists Clash on Shifting Sands." *Financial Times* 10 June 2009.

Swensen, David F. *Pioneering Portfolio Management: An Unconventional Approach to Institutional Investment.* New York: The Free Press, 2000.

Washburn, Courtland L. and Clark S. Binkley. "Do Forest Assets Hedge Inflation?" *Land Economics* 69. August (1993): 215-224.

Weisdorf, Mark A. "Infrastructure: A Growing Real Return Asset Class." *CFA Institute Conference Proceedings Quarterly*. September 2007: 17-27.

Worah, Mihir. "Roundtable in London." PIMCO Roundtable. London, England. July 2009. Speech.

Zandi, Mark. "U.S. Fiscal Stimulus Revisited." *Dismal Scientist: This Week's Economy* 22 June 2009.