Long-Term and Short-Term Inflation Risks for Endowments

In an attempt to build a portfolio that is fortified against inflationary risks, it is important to distinguish between long-term inflation trends and short-term inflation shocks.

TIAA Endowment & Philanthropic Services

All long-term investors face the same inflationary headwinds in trying to maintain and grow the purchasing power of their assets over time. In this paper, we address the causes of both short-term and long-term inflation, how to effectively hedge against inflation across different time horizons, and the virtues and shortcomings of various inflation-protecting assets.

Introduction

Two types of inflation risks are of concern to endowments:

1. **Long-term inflation trends** that erode real purchasing power over time
2. **Short-term inflation surprises** that potentially disrupt the adequacy of endowment payouts to meet organizational spending needs

These two risks are quite different and require distinct inflation hedges. More importantly, not distinguishing between the two can cause confusion in the asset allocation process.

While inflation is an oft-considered topic in endowment management, we believe the conversation and analysis should be more fine-tuned to ensure that appropriate asset allocation and portfolio construction decisions are made.

For endowments, long-term inflation risk is paramount because the goal is to maintain and grow the portfolio's real purchasing power over time. In the long run, most assets deliver positive real returns because an inflation risk premium is embedded in the long-term nominal returns. In other words, most asset classes should compensate investors for inflation risks over the long run.

Among all asset classes, equities offer the highest long-term real return, and indeed, most endowments rely on equities to provide real growth. Historical data confirm that equities tend to outpace inflation over the long run, and the risks of equities underperforming inflation decrease as the time horizon increases. In a way, a long time horizon can minimize the impact of inflation risk on a portfolio.

Data also suggest that the periods of negative real returns for equities are usually economic recessions with low inflation, not high inflation.

Because endowments can endure business and inflationary cycles, they usually have a relatively high tolerance for short-term inflation shocks; however, that tolerance is not unlimited. Spending policy, reliance on payouts, and other budgeting factors drive the institution's overall vulnerability to short-term inflation shocks. This vulnerability, combined with market risk tolerance, should determine the appropriate allocation to inflation-sensitive assets, or real assets, that might prove resilient during short-term inflation spikes.

For endowments with inflation-linked spending policies, a strategic allocation of 65/5/30 Equity/Real Assets/Bonds provides a solid balance to protect against long-term inflation erosion, short-term inflation surprises, and deflation. The overall market risk profile is consistent with a 70/30 Equity/Bond portfolio, which provides a reasonable balance between short-term and long-term risk constraints for a typical endowment (see our white paper: "Asset Allocation with Short-Term and Long-Term Risk Objectives").

Exhibit 1: Strategic Asset Allocations

Asset Class	Weight	Portfolio Role
Equity	65~70	Long-Term Inflation Protection
Real Assets	0~5	Short-Term Inflation Protection
Bonds	25~30	Deflation Protection/Risk Control

In this paper, we study the causes of both long-term and short-term inflation, how to effectively hedge against them, and some virtues and shortcomings of different inflation-protecting assets. We also offer an example of how to determine the appropriate asset allocation for endowments that use inflation-linked spending policies.

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Background on the Causes of Inflation

Inflation is a general increase in the overall price level of goods and services in the economy. In order to measure the overall price level, we need to track a group of goods and services.

There are several different price indexes that serve this purpose, such as the U.S. Consumer Price Index (CPI), the Personal Consumption Expenditures Price Index (PCE), and the GNP/GDP Deflator. They each track different products and services, assign different weights, use different assumptions for aggregating and smoothing, follow different data sources, and are published by different government agencies. There are arguments both supportive and critical of each of them.

The relevance of each price index to a specific institution will vary depending on how its liabilities are linked to the underlying basket of goods and services that make up the price index. In this paper, we focus our analysis on the CPI (see **Appendix 1**),[1] which remains the standard proxy for measuring inflation. Our view is that while there may potentially be more relevant inflation measures, CPI serves as a decent proxy for general inflation and will be highly correlated with the inflation sensitivity of most institutions' liabilities (see **Appendix 2**).[2] It also offers the longest historical data which is beneficial for studying long-term trends.

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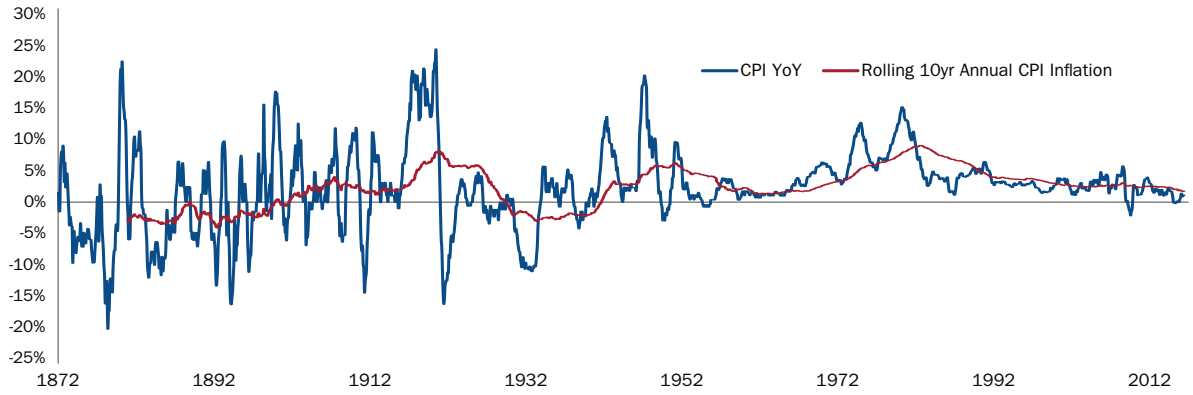
Long-term inflation occurs when the prices of goods and services continually increase over long periods of time. There seems to be a consensus about the causes of long-run inflation: the gap between the growth rate of money supply and the growth rate of output. Continuing inflation occurs when the growth rate of the money supply consistently exceeds the growth rate of total output. Theoretically, a 2–3% rate of money growth matches the natural growth of output (real GDP) and is consistent with stable prices.

It is important to point out the difference between the money supply and the monetary base. A central bank can always increase the monetary base by purchasing assets from private financial institutions. But for those funds to leave the financial sector, banks must lend them to someone in the real economy. The money supply (M2) then expands beyond the monetary base to include other assets in a less liquid form. If banks decide to keep more excess reserves, the number of times that the monetary base is used in transactions (i.e., the money multiplier) declines.

In the U.S., there has been a significant increase in the monetary base as the Fed has pursued monetary stimulus; however, the money supply has only increased in line with historical trends (see **Appendix 3**). This is perhaps one of the reasons why inflation has remained low in recent years.[3]

Short-term inflation can fluctuate considerably around its long-term trend from year to year.

Exhibit 2: Rolling Annual CPI Inflation: 1 Year vs. 10 Year



In contrast to long-run inflation, short-term inflation is only partially understood. Money growth is usually not the primary driver. Instead, short-term inflation comes in various forms, such as demand-pull inflation, supply-push inflation, or a combination of the two.

- **Demand-pull inflation** might appear when there is a shift in aggregate demand from government, business, and consumers. For example, inflation rose to above 5% in the late 1960s, possibly as a result of increased government spending related to the Vietnam War and the "Great Society" programs.
- **Supply-push**[4] **inflation** usually occurs due to short-term imbalances in the supply and demand of raw materials, particularly energy and food. The theory is that the relative prices of certain goods, e.g., oil prices, rise by unusually large amounts in a short period of time.[5] Because consumers have to spend more money on oil, they have less income to spend on other goods and services. The prices of non-oil goods need to decrease to offset the increases in oil prices in order to keep the overall price level constant. However, companies are usually slow to adjust prices downward. Thus, the offsetting decreases in the relative prices of non-oil goods might not fully occur in time and the overall price levels of all goods increase.[6] For example, as a result of a sharp rise in food prices and the OPEC cartel raising oil prices, inflation rose to above 10% in the U.S. from the mid to late 1970s.[7]

Interestingly, in both the demand-pull case in the late 1960s and the supply-push case in the 1970s, high inflation was quite persistent and did not return to its long-term trend naturally. In both cases, the Federal Reserve had to tighten to fight inflation, which ultimately produced economic recessions.

It is believed that **inflation expectations** play an important role in the link between short-term and long-term inflation. Crucially, inflation expectations are self-fulfilling. High current inflation increases inflation expectations, which causes companies to set prices and wages higher, which then further pushes inflation higher.[8] The Survey of Professional Forecasters shows that a rise in current inflation tends to lead to higher forecasted inflation (see **Appendix 4**). The correlation between one-year realized inflation and the concurrent one-year inflation expectation is 0.9.

It is not entirely clear why inflation expectations behave this way. For example, high (low) inflation could lead to a low (high) inflation expectation if it followed a mean-reversion fashion, which is perhaps closer to the situation post the 2008–2009 global financial crisis. Post-2009, inflation expectations seemed to become well anchored at 2% and did not react to short-run blips in inflation. Such stable inflation expectations tend to further stabilize inflation, acting as a kind of gravitational pull against other economic forces such as the output gap and the unemployment rate.

One could argue that because asset prices should have already incorporated inflation expectations, it is the surprise that moves the markets in the near term. In other words, if the market price of goods and services already reflects the consensus view for future inflation, only a deviation from the consensus will lead to re-pricing.

For example, high inflation might not be detrimental to bond returns if the expectations have already been incorporated into bond prices. In fact, the annual returns of the Bloomberg Barclays U.S. Aggregate Bond index were more than 30% during each month between August 1982 and April 1983 when the realized one-year inflation averaged around 4% and the forecasted inflation averaged around 7.5%. With the clarity of hindsight, realized inflation surprised on the downside when forecasted inflation remained high. Thus, many researchers focus on **unexpected inflation**, which is defined as the difference between realized inflation and forecasted inflation for the same period.[9]

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Exhibit 3A plots the one-year realized inflation rate and the one-year forecasted inflation rate for the same periods. The difference between the two lines is unexpected inflation or the short-term inflation surprise, which is plotted in **Exhibit 3B**.

Exhibit 3A: Realized Inflation vs. Forecasted Inflation

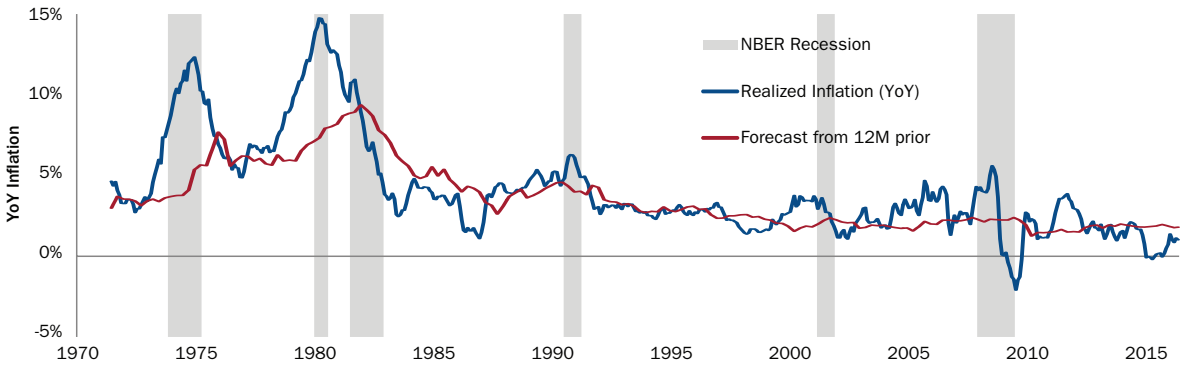
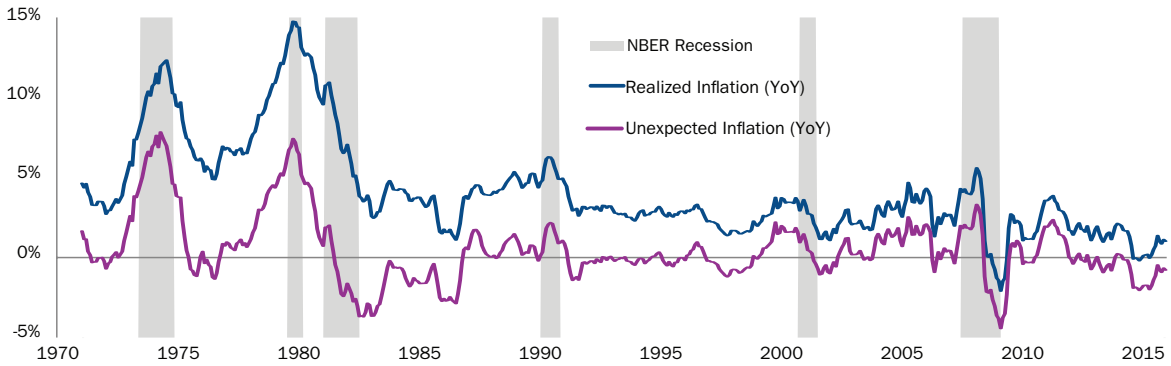


Exhibit 3B: Realized Inflation vs. Unexpected Inflation



It is worth pointing out that realized inflation is likely the driver of unexpected inflation. High unexpected inflation is usually caused by (surprisingly) high realized inflation and relatively moderate forecasted inflation. The case of moderate realized inflation and (surprisingly) low forecasted inflation causing high unexpected inflation is very rare. The correlation between unexpected inflation and realized inflation is about 0.8 (**Exhibit 3B**), while the correlation between unexpected inflation and forecasted inflation is only about 0.1. For our research, we considered both short-term unexpected inflation and realized inflation shocks; our conclusions are consistent regardless of which definition we use.

Long-Term Inflation Hedging

Although equities are usually the largest exposure in endowment portfolios, they are generally underappreciated as an inflation hedge. There are two opposing forces that drive an asset's value in response to rising inflation.

- On one hand, rising prices could result in **rising future cash flows**, which have a positive impact on the asset's value. On top of that, public companies usually issue debt at fixed rates and so can take advantage of inflation on the liability side of their balance sheets.
- On the other hand, rising inflation could also **drive up the discount rate** used to calculate the present value of future cash flows.[10] Higher discount rates lead to lower present values.

In the short term, the higher discount rate effect probably plays a bigger role for equities. Over the long run, however, companies should have the pricing power to keep cash flows growing in line with inflation. Inflation should be a wash for equities from a long-term perspective as these two forces largely offset each other.

The U.S. equity market returned 9.1% annually[11] between January 1871 and June 2016 with a volatility of 16.4%; inflation was 2.1% over the same period. The difference between the two implies a real annual return of about 7% for U.S. equities over the last 145 years (see **Appendix 5**).[12]

Exhibit 4: Annual Returns for U.S. Stocks

1871–2016	Annual Return	Volatility
U.S. Stocks	9.1%	16.4%
CPI	2.1%	3.6%

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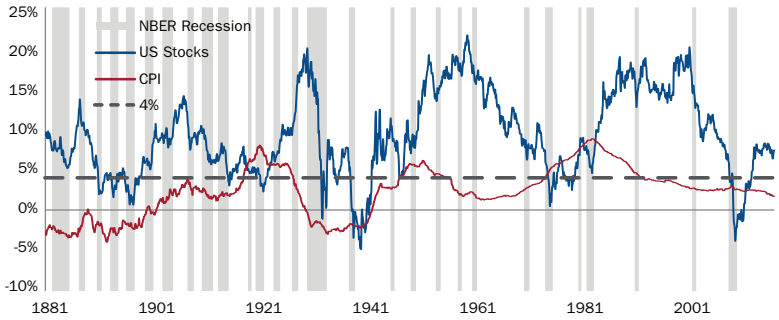
On a rolling basis, equities also outperformed inflation most of the time. In **Exhibit 5**, we show the rolling 10-year annual returns of both stocks and inflation. When the blue line is above the red line, stocks outperformed inflation in the prior 10 years.

On a rolling 10-year basis, U.S. stocks outperformed CPI about 88% of the time. The success rate of stocks beating inflation increases as the time horizon increases. The chance of stocks beating inflation on a rolling 20-year basis is historically 100% (see **Appendix 6**).[13] In a way, an extended time horizon can minimize the impact of inflation risk on a portfolio.

Exhibit 5: Rolling 10-Year Annual Returns: U.S. Stocks vs. CPI



Probability of Stocks > CPI	
Rolling 5 year	80.5%
Rolling 10 year	88.1%
Rolling 20 year	99.9%

In historical terms, extended inflation spikes are relatively rare. In **Exhibit 5**, we see that since 1871, there have only been three extended inflation spikes during which the 10-year annual inflation rate reached 4% or higher. While inflation spikes are rare, recessions are not.[14] The gray areas in **Exhibit 5** mark the NBER recession periods, which are usually associated with the dips of the blue equity line.

In **Exhibit 5**, we see that the far more common scenario for equity lagging inflation is a bear market with moderate inflation (<4%). When equities underperform inflation, it is always preceded by a recession. And recessions tend to be disinflationary. Among all the extended equity bear markets, the only obvious case for an inflation-induced recession is the 1973–1975 oil crisis, during which commodities, especially energy-related real assets, outperformed broad equity markets. When recessions are driven by other factors, such as asset bubbles or cuts in government spending, all risk assets are likely to fall in nominal terms and even more in real terms. In other words, the biggest risk of an endowment portfolio[15] losing purchasing power (see **Appendix 7**) is a bear market or a recession that erodes returns, often in a contained inflation environment, as opposed to a high inflation environment.

Short-Term Inflation Hedging

As established earlier, for short-term inflation protection, it makes more sense to focus on periods of unexpected inflation. To evaluate the potential effectiveness of different real assets, we studied their performance under different inflation regimes. To define inflation regimes, we created quartiles for the entire period (monthly data[16] from June 1971 to May 2016) based on one-year unexpected inflation.[17]

Exhibit 6: Forecasts of Inflation in Inflation Quartiles

	Q1	Q2	Q3	Q4
Low	-4.4%	-0.5%	0.1%	1.3%
High	-0.5%	0.1%	1.3%	7.9%
Mean	-1.7%	-0.2%	0.7%	3.1%

In the lowest unexpected inflation quartile Q1, forecasters on average overestimated future inflation by 1.7%.[18] In the highest quartile Q4, subsequent one-year realized inflation turned out to be on average 3.1% higher than the consensus forecasts. The largest underestimation was 7.9%. In this situation, market participants and business managers would experience a near 8% inflation surprise. We think such extreme situations, i.e., the top quartile of unexpected inflation, present the biggest challenge to the markets and businesses in terms of asset pricing and budgeting. We want to find asset classes that can better protect the portfolio against the largest unexpected inflation surprises, i.e., the top quartile of unexpected inflation.

We examined several broad and well-established inflation sensitive asset classes,[19] including commodity futures, energy stocks, REITs, and TIPS.[20]

- For **commodity futures**, we use the returns of the S&P GSCI index. It is the oldest major investable commodity index including the most liquid commodity futures, with about an 80% exposure to energy.
- For **energy stocks**, we use the energy sector return stream from the Fama-French 10-industry benchmarks that offer the longest data history since 1926. It includes oil, gas, and coal extraction and products companies listed in the U.S. based on their Compustat SIC code.
- For **REITs**, we use the FTSE NAREIT All Equity REITs index. It is a market cap-weighted index including all tax-qualified REITs listed in the U.S.
- **Treasury Inflation Protected Securities (TIPS)** are U.S. government bonds whose principal and coupons are adjusted for changes in the CPI. We use the Bloomberg Barclays U.S. TIPS return stream with a starting point in 1997 when TIPS were first introduced in the U.S.

The performance of each asset class reflects the net impact of two opposing forces: higher cash flows via pass-through of inflation versus an increase in the discount rate used to calculate the present value of the cash flows. **Exhibit 7** shows the average annual real returns in the four inflation quartiles. Over the entire period, as unexpected inflation increases, the real returns of equities and bonds decrease. Only equities and bonds ended up with negative real returns in the highest quartile of unexpected inflation.

Exhibit 7: Asset Class Returns in Quartiles of Unexpected Inflation

		Unexpected Inflation Quartiles			
	Annual Real Return	Q1	Q2	Q3	Q4
Entire Period	U.S. Equity	11%	12%	8%	-1%
	U.S. Bonds	10	4	3	-2
	Commodities	-14	0	13	22
	Energy Stocks	0	8	13	15
	REITs	10	14	13	2
	TIPS	1	3	6	4

Over the entire period, all four inflation-sensitive asset classes delivered positive real returns in the top two quartiles of unexpected inflation. In general, as unexpected inflation increases, the real returns of commodity futures, energy stocks, and TIPS increase. REITs performed more like equities in low inflation regimes, but were also able to deliver positive real returns in the highest quartile.

Besides inflation, we believe that economic growth is the dominating force that drives returns. We separated each inflation regime into economic recessions and expansions using the definitions of the National Bureau of Economic Research (NBER). Inflation can occur in periods of overheated as well as stagnating economies with very different effects. In **Exhibit 8**, we can see that economic growth clearly has a strong influence. During economic expansions, except for commodity futures in the bottom quartile and bonds in the top quartile, all asset classes delivered positive real returns across all inflation regimes.

Exhibit 8: The Impact of Economic Growth

		Unexpected Inflation Quartiles			
	Annual Real Return	Q1	Q2	Q3	Q4
Recessions	U.S. Equity	-20%	-18%	-14%	-13%
	U.S. Bonds	9	6	6	-4
	Commodities	-27	-29	1	24
	Energy Stocks	-31	-14	0	3
	REITs	-22	9	4	-14
	TIPS	-3	10	10	7
Expansions	U.S. Equity	16%	13%	10%	6%
	U.S. Bonds	10	4	3	-2
	Commodities	-12	1	15	22
	Energy Stocks	5	9	14	21
	REITs	15	14	14	9
	TIPS	2	3	5	4

In contrast, we see a lot of negative real returns across asset classes and inflation regimes during recessions. Bonds held up well during recessions but only in low unexpected inflation environments. Commodities and energy stocks were able to generate positive real returns in the highest quartile of unexpected inflation, but this is partially biased by the limited data history which includes two oil crisis-induced recessions.

Each of the inflation-sensitive assets has distinct virtues and shortcomings. In the following pages, we provide more detail about each of the four inflation-hedging asset classes that we identified in **Exhibits 7 and 8**. We then provide a framework to help compare and contrast these four different asset classes.

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Commodity Futures

Commodities are often seen as an effective inflation hedge due to their direct links to some important inputs to the CPI basket, such as crude oil, agricultural products, and industrial metals. Commodities can be a direct cause of inflation, and commodity prices can rise faster than inflation. Traded in the form of highly liquid futures, commodity prices tend to adjust more quickly to changes in economic conditions and expectations than the prices of the final consumer goods. Some research also suggests that commodities have the ability to "front-run" consumer price changes and thus offer a good inflation hedge.[21] However, this observation is mostly due to the experience of the 1970s and the domination of energy in the S&P GSCI index. It is crucial to own the "right" commodity that experiences a massive supply shock in order to effectively hedge the supply-shock inflation. If you hold the "wrong" commodities, such as copper and corn in the 1970s, the hedging power will be inadequate.[22]

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There is an ongoing debate over the expected returns of commodities. Given the very limited data history, it is questionable that commodities are effective against broad short-term inflation shocks. However, we think commodity futures, especially energy-related commodities, could be effective against short-term inflation shocks caused by geopolitical crises and energy crises, which historically have driven substantial changes in the CPI. On top of that, there is also evidence of diversification benefits from owning commodity futures (see **Appendix 10**). Strategically, investors need to be cautious and thoughtful when allocating to commodity futures due to their low expected returns, high volatility, potential negative roll yield as well as their narrow use as an inflation hedge.

Energy Stocks

Driven mostly by supply shocks rather than long-term fundamentals, most commodity price spikes have been short-lived and they were often followed by drastic declines. In fact, over the long run, spot commodity prices have low correlations to inflation and the real prices of many commodities have declined.[23] Rather, it is the interest earned on the collateral and the roll yield that generated most of the S&P GSCI total returns.

Natural resource equities and commodity producers could benefit from both short-term supply shocks as well as long-term price trends based on fundamentals. With proper operating leverage, natural resource companies can act as a leveraged play on commodity spot prices and price expectations. In addition, active investing can further take advantage of idiosyncratic opportunities by selecting low-cost producers that can perform more consistently across commodity price cycles. Unlike commodities, there is little debate that natural resource equities possess a risk premium and can create value independent of commodity cycles. However, the downside of being a part of the equity markets is that natural resource equities could be highly correlated to and negatively affected by the broader equity markets, especially during recessions.[24]

Natural resource equities and commodity producers could benefit from both short-term supply shocks as well as long-term price trends.

As an example, we focus on the energy sector as opposed to the energy-dominated S&P GSCI index.[25] Over the entire period, energy stocks outperformed the S&P GSCI index in all of the inflation regimes except for the top quartile (refer to the difference between energy stocks and commodities in **Exhibit 7**), during which they underperformed by 7%. The underperformance of energy stocks relative to commodities is most pronounced during recessions with a difference of 21% (**Exhibit 8**). This is possibly because investors might have incorporated long-term oil price trends under certain mean-reversion assumptions when valuing energy stocks. There was also likely some drag from the broad equity markets during recessions. In other words, energy stocks could lag oil prices in the short term but might still provide sufficient and more consistent performance over the longer term. It is worth noting that investors normally get energy exposure from their global equity portfolios. The MSCI ACWI index has historically had an exposure to energy ranging between roughly 6% and 15%. Investors should take into consideration other parts of their portfolios when choosing assets for short-term inflation protection.

Real Estate Investment Trusts (REITs)

Real Estate Investment Trusts (REITs) span the continuum from pure debt to pure equity. On the debt side, mortgage investors only receive the fixed contractual payments and none of the inflation-hedging benefits. Thus, we focus on equity REITs, where rental income cash flows rise as a lease matures and new leases incorporate inflationary increases.[26]

Additionally, the market values of high quality properties should also increase along with rising price levels as the replacement costs are partially driven by materials and labor which are linked to inflation. A REIT is a public equity that owns or finances income-producing real estate. REITs provide investors with an extremely liquid stake in real estate, and they usually pay out a high percentage of their taxable income as dividends, making them an attractive option for income-seeking investors. Equity REITs generate income through the collection of rents on, and from sales of, the properties they own.[27]

Equity REITs behave uniquely (cash flow from rents plus appreciation potential) and could possess good inflation-hedging properties under the right conditions, depending on whether their valuations are reasonable.[28] Extreme valuations and/or excess supply and demand, however, can cause real estate values and inflation to decouple, as was the case in 2007. Compared to energy stocks, equity REITs make up a smaller proportion of the MSCI ACWI index at around 3%, and therefore a sizeable position in REITs would naturally translate into a meaningful overweight versus the market. From a top-down allocation perspective, a dedicated allocation to REITs would only make sense for certain portfolios.

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Treasury Inflation Protected Securities (TIPS)

Treasury Inflation Protected Securities (TIPS) are U.S. government bonds whose principal and coupons are adjusted for changes in the CPI. Assume a $1,000 U.S. TIPS purchased with a 2% coupon rate:

- If inflation is 10% over the next year, the principal would be adjusted to $1,100 and the annual interest payment would be $22.[29]
- On the other hand, if deflation occurs, the reverse would hold—the principal and interest payments would decrease based on the falling CPI. However, at maturity, the investor is never at risk of losing the principal. Investors would receive either the original principal of $1,000 or a higher adjusted principal if applicable.[30]

It is worth noting that the adjustments to face value are subject to federal income tax in the years they occur, although the investors will not receive the money until the bond matures. Thus, non-tax-exempt investors who hold individual TIPS should be aware of the tax on "phantom income."[31]

U.S. TIPS were first auctioned in 1997 and for the majority of their existence, they have outperformed the CPI measure of inflation. However, they have not existed in a period of high inflation. When first introduced in 1997, as a relatively new investment vehicle with a relatively small market size and low liquidity, the real yield on 10-year TIPS was about 3.3%. The yield rose steadily over the next few years to roughly 4.3% (see **Appendix 8**). Since then, real yields have been trending lower despite a noticeable spike in 2008. During the 2008–2009 financial crisis, the Bloomberg Barclays U.S. TIPS index suffered an annual loss of 7%, possibly as a result of liquidity-induced sell-offs, while the broad Bloomberg Barclays U.S. Treasury index gained 10% annually as of November 2008. During 2010–2011, as a result of the large-scale asset purchases from the Fed, the 10-year Treasury nominal yield dropped below the 2% forecasted inflation and the real yield[32] on 10-year TIPS fell into negative territory.

If held to maturity and assuming no default risk, we believe TIPS could be a good long-term inflation hedge. However, as demonstrated in the 2008 scenario, the short-term mark-to-market value of TIPS is subject to real interest rate risks and might not fully hedge short-term inflation. It is possible that TIPS returns and inflation are even negatively correlated in the short-term if the Fed raises real rates in response to an unexpected inflation shock. In this situation, nominal yields could rise faster than expected inflation. Also, the protection offered by TIPS does not come cheaply (see **Appendix 9**). We see in **Exhibit 7** that while TIPS generated positive real returns in the top quartile of unexpected inflation, they lagged other asset classes during periods of low unexpected inflation. And the longer durations of the more popular and liquid TIPS[33] make them more interest rate-sensitive and potentially exposed to nontrivial losses in a rising rate environment.

Summary Comparison of Four Potential Inflation-Hedging Assets

As we can see, some real assets might perform better than others under certain inflationary environments. Because the causes and impacts of short-term inflation shocks are vastly different from one period to the next, one cannot effectively predict the source or timing of "unexpected" inflation. Also, because valuation plays an important role, it is important to be nimble when selecting assets based on asset valuations as well as inflation drivers.

Compared to illiquid real assets,[34] we think liquid real assets are better short-term inflation hedges as they allow for dynamic allocations. Also, we believe it is better to have a diversified inflation portfolio including two or more liquid real assets, such as commodity stocks and REITs, compared to relying on a single asset class. Natural resource equities and commodity producers could benefit from short-term supply shocks as well as long-term price trends based on fundamentals. Real estate investments are likely to benefit from cyclical inflation pressures caused by rising wages and labor costs as home prices and rents accelerate. Commodities would benefit from a depreciating dollar as well as supply shocks and geopolitical conflicts. If the Fed does not tighten fast enough in response to the inflation pressure caused by new fiscal stimulus, TIPS would perform well.

In **Exhibit 9**, we evaluate the four inflation sensitive assets in three main categories: opportunity cost, diversification potential, and protection effectiveness. When evaluating opportunity cost and diversification potential, we compare the first three assets to equities as the allocation to inflation-hedging assets should be taken from the equity portfolio. We compare TIPS to bonds, because the allocation should be taken from the bond portfolio. This approach will help maintain the desirable risk profile of the total portfolio. We use +, -, 0 to represent good, bad and neutral. It is worth noting that the limited data make it difficult to draw definitive conclusions. Thus, we combine both historical data and our own judgments in the analysis below.

Exhibit 9: Comparison of Four Inflation-Hedging Assets

	Commodities	Energy Stocks	REITs	TIPS
Performance-Long Term				
Risk-adjusted Performance	–	+	+	++
Opportunity Costs vs Equity (Bonds for TIPS)	–	+	+	0
Diversification				
Risk Exposures Overlap with Equity (Bonds for TIPS)	+	-	0	-
Correlations to Equity (Bonds for TIPS)	+	-	-	-
Protection-Extreme Short-Term Inflation				
Recessions/Geopolitical Risks/Supply Shocks	+	0	-	+
Expansions/Demand Pulls	+	+	+	-

1. Commodities scored best in the diversification and protection categories as they have the lowest correlation to equities and are potentially better positioned during supply-shock induced recessions and other geopolitical risk events. But they have the highest opportunity cost compared to equities, as historically they earned the lowest long-term return. (Going forward, they are also likely to have a low expected return.)
2. Both energy stocks and REITs delivered superior long-term returns and acceptable short-term inflation protection (better when the economy is in an expansion). However, being part of the equity markets means they have high correlations to the broad equity markets; therefore, the diversification benefits are limited.
3. TIPS also share many of the same risk drivers as nominal bonds, such as real interest rate risk. As a result, TIPS also scored poorly in the diversification category. Interestingly, compared to bonds, the opportunity cost of holding TIPS is quite low as suggested by historical returns. We think this is likely biased by their short history and the initial mispricing by the market. Going forward, we think the cost of allocating to TIPS from defensive bond holdings is neutral and TIPS could hold up against inflation in a recession.

Compared to illiquid real assets, we think liquid real assets are better short-term inflation hedges as they allow for dynamic allocations.

Allocation to Short-Term Inflation Protection

In addressing the short-term inflation surprises, an investor faces a trade-off between higher long-term expected returns and providing protection against unexpected inflation. Specifically, asset classes that might be more effective at hedging unexpected inflation shocks, such as commodity futures and TIPS, also have lower expected returns across normal environments, so they might not provide as effective long-term inflation protection as equities. Protection against unexpected inflation has a cost in terms of forgone returns. In this section, we offer a simple example to estimate what is a reasonable allocation to these inflation-sensitive assets given the need to balance short-term inflation protection and long-term real purchasing power.

Exhibit 10 shows the nominal returns of each asset class across inflation regimes similar to **Exhibit 7**. The only difference is that we are reporting nominal returns here instead of real returns. Note that both equity and bonds delivered positive annualized nominal returns across all periods (despite negative real returns) even in the top quartile of unexpected inflation.

Exhibit 10: Asset Class Nominal Returns in Inflation Quartiles

		Unexpected Inflation Quartiles					
		Q1	Q2	Q3	Q4	Total Return	Volatility
Nominal Return (Average Annual)	U.S. Equity	14%	15%	13%	6%	10%	15%
	U.S. Bonds	13%	7%	7%	4%	8%	5%
	Commodities	-11%	3%	18%	31%	7%	20%
	Energy Stocks	3%	11%	17%	23%	11%	20%
	REITs	13%	17%	17%	9%	12%	17%
	TIPS	2%	5%	8%	8%	6%	6%

Exhibits 6 and 10 give a numerical sense of the range of unexpected inflation and asset classes returns in each historical inflation regime. Focusing on the highest unexpected inflation regime, we assume the markets experience a 3% unexpected inflation shock, which is roughly the average magnitude in the top quartile. The university's annual expenses thus need to increase **3%** from the normal expense of $1,000 to $1,030. If the endowment payout rate is **5%** and the payout covers **40%** of the university's annual expense, then normally the endowment payout should be **$400** (1,000*40%) and the size of the endowment should be **$8,000** (400/5%). Assume that the university requires the endowment to fully cover the $30 increase in annual expense linked to the inflation shock, relying on the short-term inflation insurance portfolio.[35] Assuming the short-term insurance portfolio could generate 9% nominal annual return during the inflation shock,[36] we can estimate the weight of the short-term inflation insurance portfolio as **~4.2%** ($30/9%/$8,000).

Leaving enough margin for error and being conservative, we think a 5% allocation to real assets is reasonable and sufficient for a typical university endowment to cover the potential extra payout linked to a sharp rise in unexpected inflation. In the above analysis, we used an inflation-linked spending policy as an example. Endowments with other spending polices, such as a moving-average rule, will have different unexpected inflation risk tolerances. Each institution should calibrate the allocation based on its own unique needs and expectations considering spending policy, budgeting process, revenue generation, and other inflation-linked liabilities and assets.

Conclusions

1. **Equity is the best long-term inflation hedge.** We think long-term investors such as endowments should focus more on pursuing long-term purchasing power, i.e., positive long-term real returns. In the long run, most asset classes should earn returns high enough to overcome the erosion in purchasing power due to inflation. Among asset classes, equities offer the highest long-term real return and indeed most endowments rely on equities to provide real growth. Historical data confirm that equities do a decent job beating inflation over the long run and the risk of equities underperforming inflation decrease as the time horizon increases. In a way, a long time horizon can minimize the impact of inflation risk on a portfolio. Data also suggest the causes of periods of negative real returns for equities are usually economic recessions with low inflation, not high inflation.

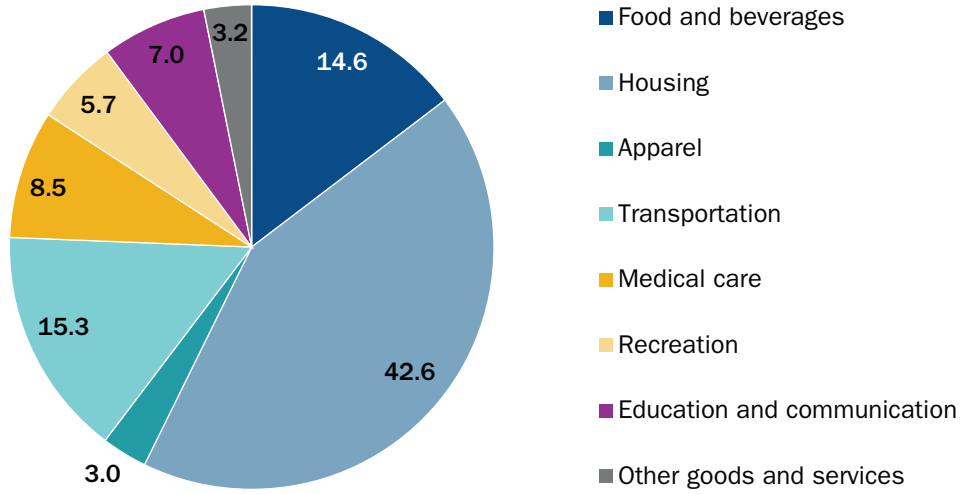
2. **Short-term inflation sensitivity is distinct and should be evaluated by each institution.** Because endowments can endure business and inflationary cycles, they usually have a relatively high tolerance for short-term inflation shocks; however, their tolerance is not unlimited. To the extent that institutions care about the short-term impact of inflation on their operating expenses, including inflation sensitive assets in the endowment makes sense. The spending policy, the university's reliance on spending, and other budgeting factors determine the university's overall vulnerability to short-term inflation shocks.

3. **A 5% allocation to real assets might be a prudent way to protect an endowment portfolio from short-term inflationary risks.** We believe a 5% strategic allocation to liquid real assets as insurance against short-term inflation shocks is important and appropriate for a typical endowment. However, like any insurance, there will be a cost, which is likely to lower the total portfolio return in the long run. For many endowments, a strategic allocation of 65/5/30 Equity/Real Assets/Bonds provides a good balance protecting against long-term inflation erosion, short-term inflation shocks, as well as deflation.

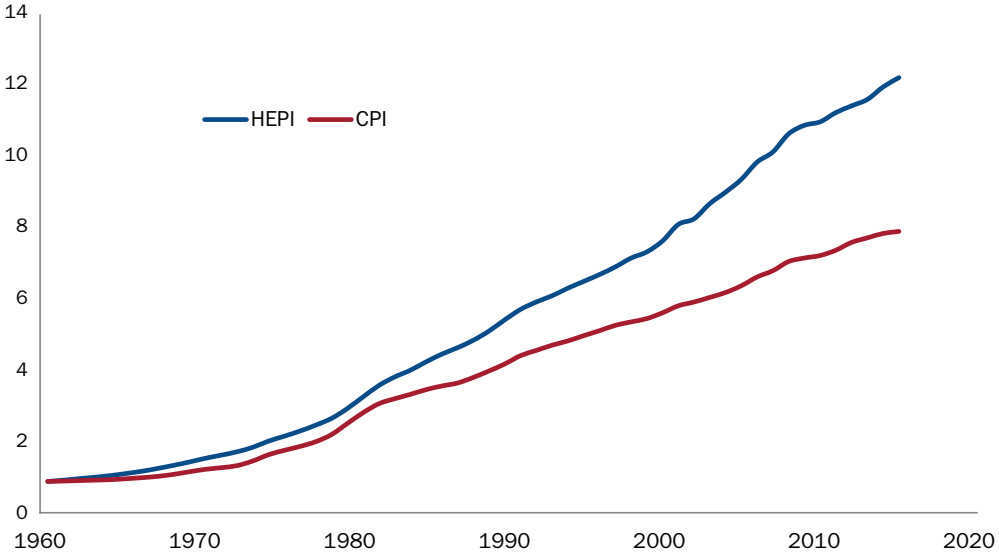
4. **Short-term inflation comes in various forms and shapes, as well as demand-pull and supply-push inflation.** We think the key is to have a diversified basket of assets that are selected based on the current inflationary environment as well as the assets' valuations.

For many endowments, a strategic allocation of 65/5/30 Equity/Real Assets/Bonds provides a good balance protecting against long-term inflation erosion, short-term inflation shocks, as well as deflation.

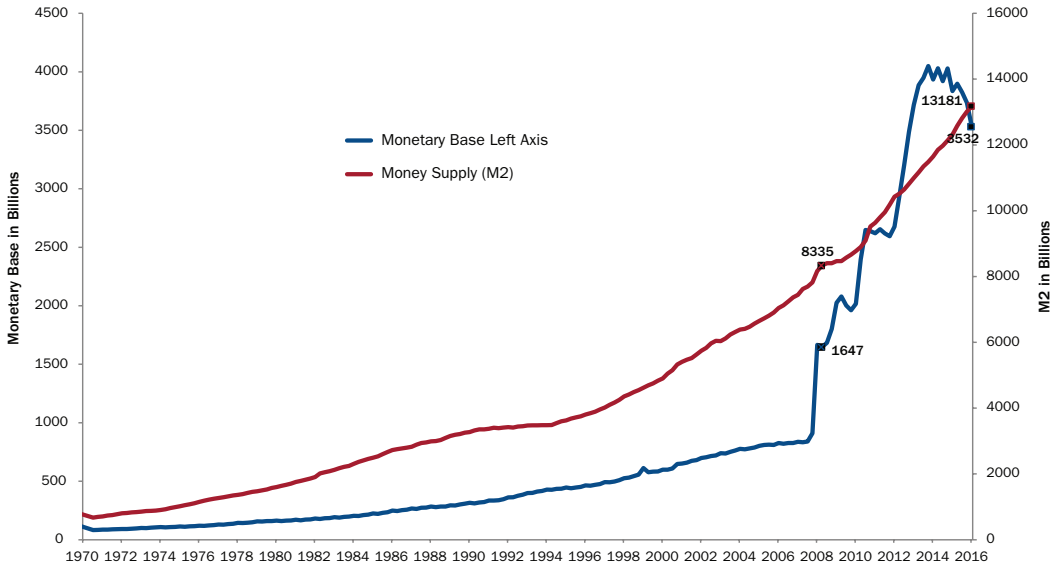
Appendix 1: Consumer Price Index Components (2017)

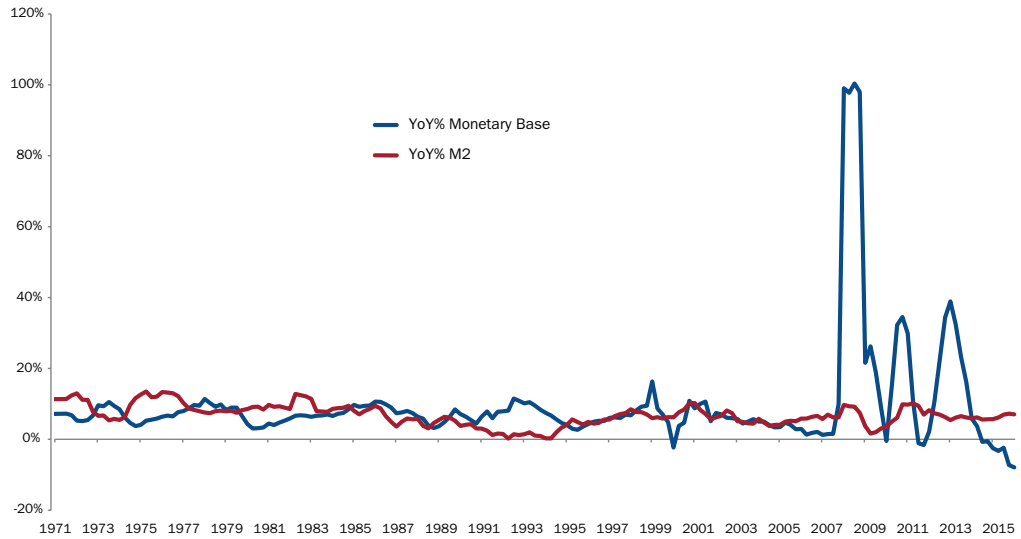


Appendix 2: Comparison of the Higher Education Price Index (HEPI) and the Consumer Price Index

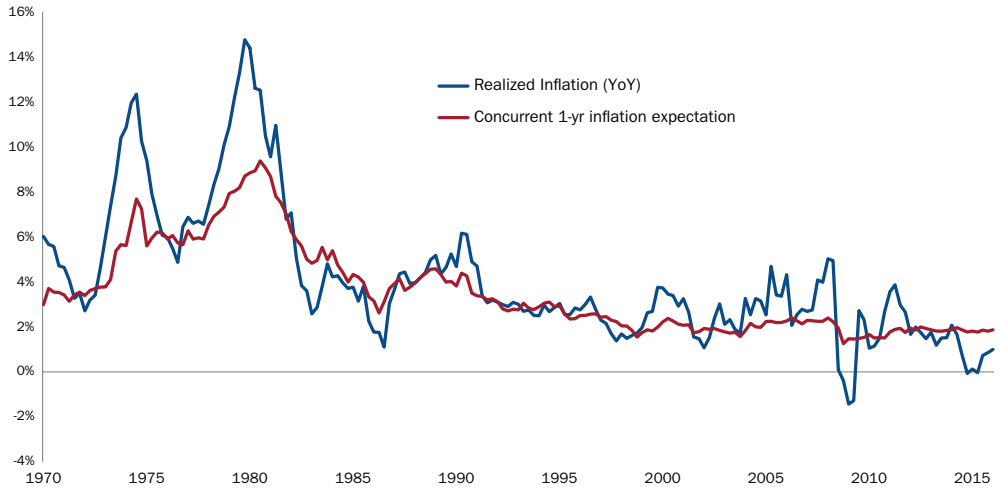


Appendix 3: Historical Money Supply Trends

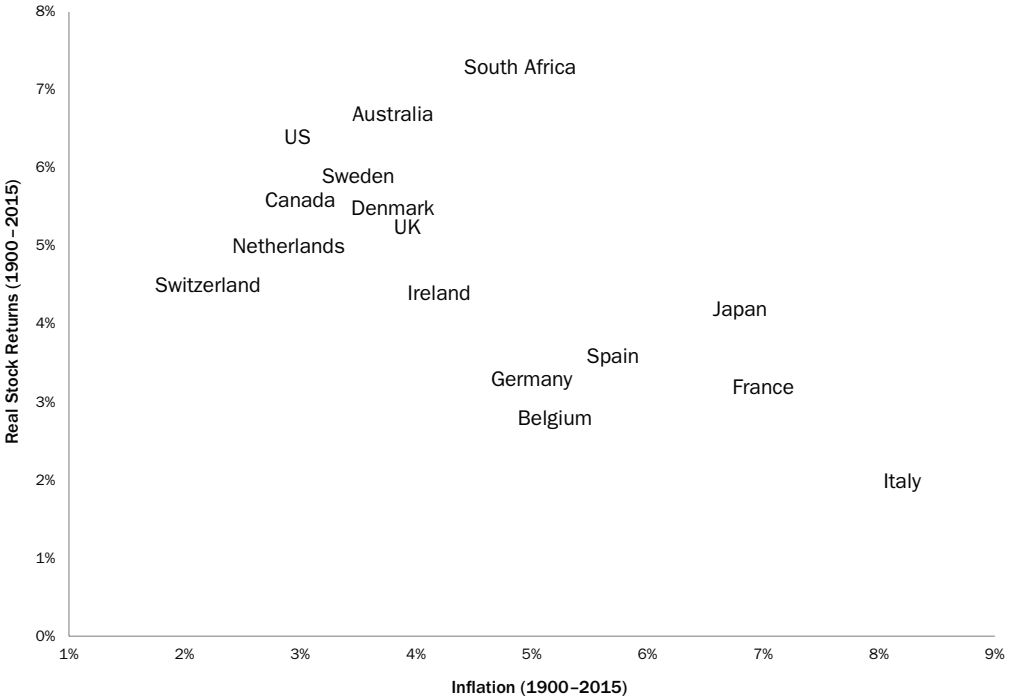




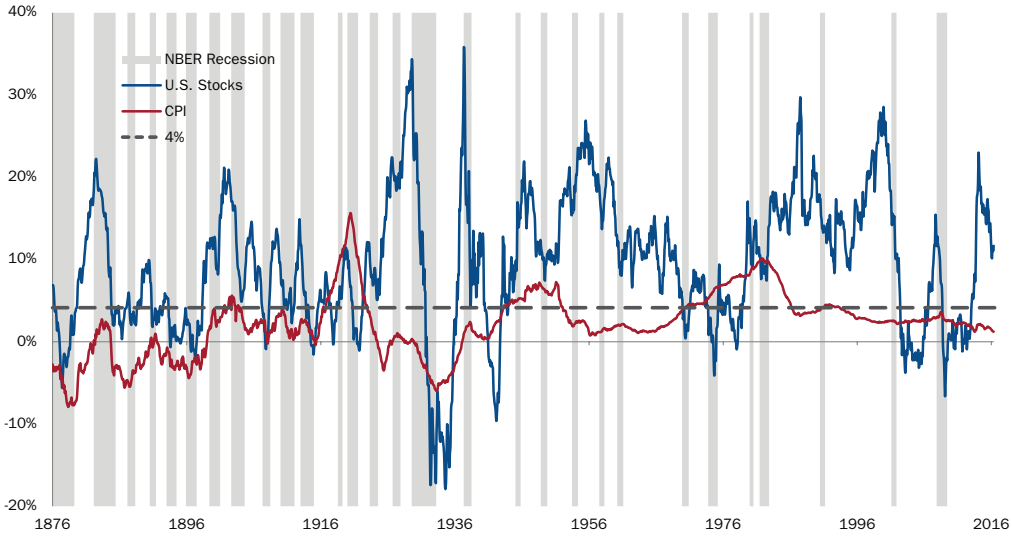
Appendix 4: Historical Trend of Realized Inflation vs. Simultaneous Inflation Expectations

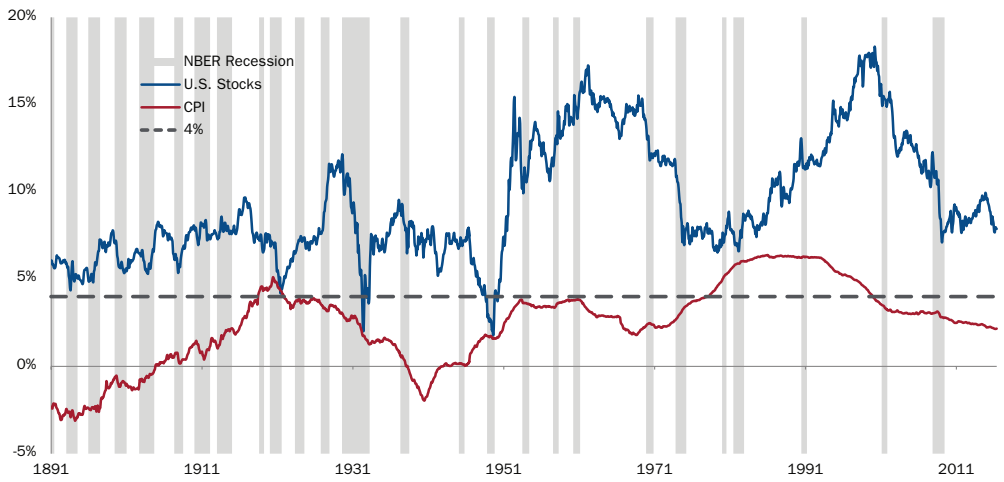


Appendix 5: International Equity Returns as a Long-Term Inflation Hedge[37]



Appendix 6: Rolling Equity and CPI Returns (5- and 20-Year)



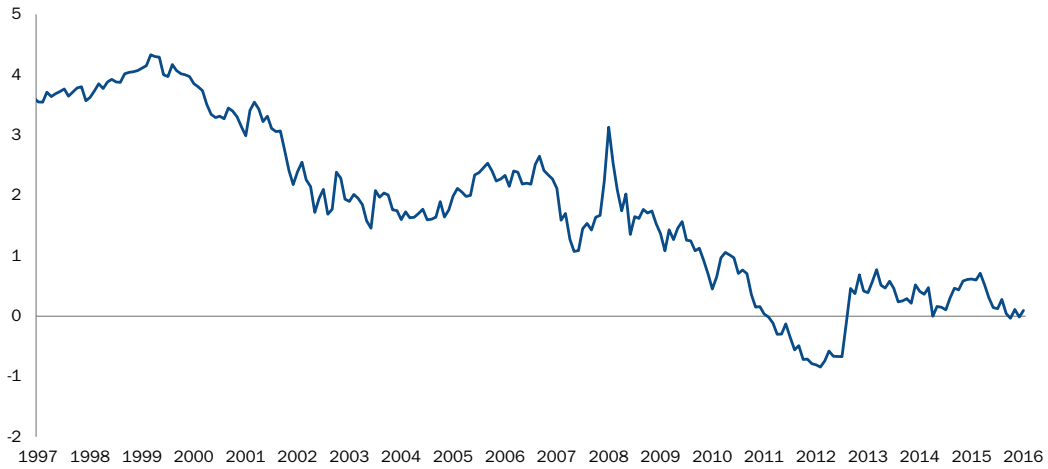


Appendix 7: Representative Endowment Portfolio Return Statistics (70/30 Equity/Bond)

1926–2016	Annual Return	Volatility
U.S. Stocks	10.1%	18.9%
U.S. Bonds[38]	5.4%	4.3%
70/30	9.1%	13.4%
CPI	2.9%	1.9%

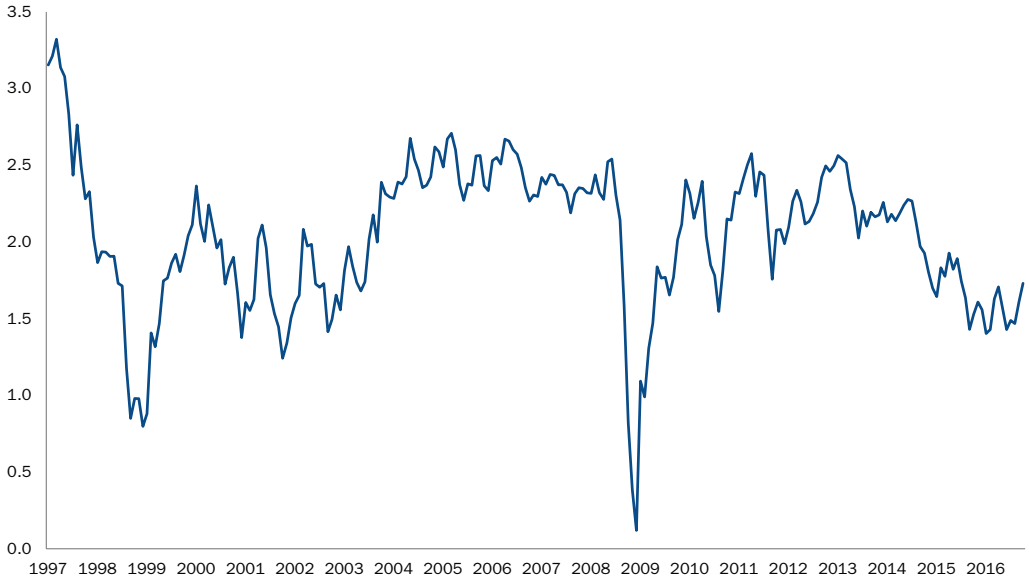
Probability of 70/30 > CPI	
Rolling 5 year	78.9%
Rolling 10 year	87.7%
Rolling 20 year	100.0%

Appendix 8: 10-Year TIPS Real Yield



Appendix 9: The Cost of Owning TIPS

The difference between the (lower) real yield of TIPS and the (higher) nominal yield of U.S. Treasuries of the same maturities is called the break-even rate. It can serve as an indicator of the cost of using TIPS as inflation protection.[39] If an investor has a higher 10-year expected inflation forecast than that implied by the break-even rate, the 10-year TIPS would be more attractive to the investor.



Appendix 10: Asset Class Correlations Matrix

1997.3–2016.5	U.S. Stocks	U.S. Bonds	Commodities	REITs	Energy Stocks	TIPS
U.S. Stocks	1.0	0.0	0.3	0.6	0.6	0.0
U.S. Bonds		1.0	0.0	0.2	-0.1	0.8
Commodities			1.0	0.2	0.6	0.2
REITs				1.0	0.4	0.2
Energy Stocks					1.0	0.1
TIPS						1.0

Endnotes

[1] U.S. All Items CPI Urban Consumers (see Appendix 1).
[2] For example, some universities link their annual spending to the Higher Education Price Index (HEPI), whose annual growth rate has outpaced that of CPI by about 0.8% on average since 1961 with a correlation of 0.9 (see Appendix 2).
[3] There is also evidence that money velocity has declined recently.
[4] Also called a price shock.
[5] Based on the theory, a slow and steady increase in prices, such as healthcare costs or higher education expenses, might not cause inflation because the prices of the other goods and services adjust downward sufficiently.
[6] Also, historically the Fed often allowed money growth to rise, thereby accommodating increased inflation initially.
[7] Unemployment also rose and real output fell, which created the stagflation scenario.
[8] Deflation is generally perceived by the Fed as a worse outcome than moderate inflation. So, historically the Fed often allowed money growth to rise accommodating increased inflation expectations, thus, expectations were self-fulfilled. However, the Fed could interfere by tightening money growth, which is usually at the cost of a possible recession, such as the case of Paul Volcker in the 1970s.
[9] If forecasters possessed perfect foresight then there would be no unexpected inflation.
[10] Investors' required rate of return may increase if inflation expectations rise. Monetary authorities may seek to combat inflation increasing real interest rate.
[11] Estimate includes dividends; data are aggregated from Robert Shiller Online Data, Center for Research in Security Prices (CRSP) and Bloomberg.
[12] Long-term international data also support equities as a long-term inflation hedge. See Appendix 5.
[13] See Appendix 6 for rolling 5- and 20-year charts.
[14] We see that the frequency of U.S. economic recessions is lower post World War II.
[15] See Appendix 7 for a 70/30 equity/bond portfolio.
[16] Quarterly inflation forecast survey data are linearly interpreted monthly.
[17] Conclusions are consistent based on one-year realized inflation.
[18] Recall that Unexpected Inflation = Realized Inflation – Forecasted Inflation. Unexpected Inflation is negative when Forecasted Inflation is bigger than Realized Inflation.
[19] For this study, we exclude "Alternatives" due to the lack of homogenous or definable return streams. We think each alternative strategy requires in-depth research on a case-by-case basis.
[20] For gold, please see *The Golden Dilemma* by Erb and Harvey for a detailed analysis on gold as an inflation hedge.
[21] Mellon Capital "Unexpected Inflation Hedging: A 3D Super Approach." The final consumer products, such as gasoline, are much further down the production chain and usually incorporate other fixed costs as well as variable costs that are less sensitive to inflation, such as retail margin and taxes. As a result, a 20% increase in crude oil prices usually tends to lead to less than a 20% increase in gasoline prices.
[22] GMO "No Silver Bullets in Investing."
[23] RS Investments "A Closer Look at Commodity Price Inflation."
[24] Investors should also consider existing exposures to natural resource equities in their equity portfolios.
[25] The energy sector also offers broader opportunity sets and longer data history compared to other sectors such as metal or agriculture within natural resource equities.
[26] Buildings with long leases can be less sensitive to inflation because rents cannot be raised.
[27] www.reit.com.
[28] *Pioneering Portfolio Management* by David Swensen.

[29] In reality, the coupons are usually paid semi-annually. To simplify the analysis, we assumed an annual coupon payment.

[30] An embedded principal "floor" serves like a call option on inflation with a strike price of CPI at the time of issuance.

[31] TIPS mutual funds usually pay out both interest income and the income from face value adjustments to investors monthly. Although investors still need to pay the federal tax, they are receiving the income.

[32] The real yields on TIPS are roughly equal to the differences between nominal Treasury bond yields at the same maturities and expected inflation for that time horizon.

[33] The duration of the benchmark Bloomberg Barclays U.S. TIPS index was around 5–7 years in the last several years.

[34] We think illiquid real assets have a role in the portfolio and provide diversified equity growth to enhance long-term returns.

[35] Contributions to the endowments and university's other revenue sources should also be correlated with inflation. The actual extra payout from the endowment is likely to be less than $30. If the rest of the portfolio, i.e., the equity/bonds mix, could generate a nominal return of more than 5%, the endowment will not lose nominal value. But for now, we assume the goal of the short-term inflation insurance portfolio is to generate the extra payout linked to an inflation shock, not to preserve the nominal or real value of the portfolio in any single year, especially in recessions.

[36] The average nominal annual return of the four inflation sensitive asset classes in the top quartile is 18%, while the lowest value of 8% is from TIPS. At this point, we do not make any explicit assumptions about the underlying mix of the assets and assume a 9% nominal annual return, which is the average of the four asset classes with a 50% discount to be conservative.

[37] GMO White Paper "No Silver Bullets in Investing"; Data sources: Dimson, Marsh, Staunton (2016); Credit Suisse Global Investment Returns Yearbook 2016.

[38] Data are aggregated from Ibbotson Associates Intermediate-term Bond Total Return (pre-1976) and Bloomberg Barclays U.S. Aggregate Index.

[39] They partially reflect the expected inflation and also contain other premiums such as the inflation premium (inflation volatility), the liquidity premium, and the real term premium (duration risk). See AQR Capital Management: *Inflation in 2010 and Beyond?*

The extended version of the paper will be published in *Financial Analyst Journal*.

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