

# Inflation Concerns and the Role of Commodities

## FQ Perspective

Investment Team



There is a long-standing debate about whether commodities hedge inflation. On one side, investors point to the fact that commodities have a solidly positive correlation to inflation, and that it is the prices of commodities that largely make up the definition of inflation in the first place. On the other side, investors point to the fact that commodities have not outperformed inflation meaningfully over the past few decades, and even worse, they've provided a volatile ride along the way. The first group of investors argues that commodities are a good inflation hedge and the second group argues that they are not. Neither of these conclusions is wrong, and this paper explains how both can be right simultaneously. In order to provide a more complete picture of the relationship of commodities to inflation, we describe the strikingly different results from different analysis approaches, explain their differences, and ultimately identify which types of inflation concerns commodities address and which types they do not.

Different investors have different concerns about inflation. Two investors who both say they are concerned about inflation may actually be concerned about quite different issues. Inflation has a number of different effects, and it is important for each investor to identify the specific reason(s) for their concern. This specificity will ultimately help investors deal with their concerns in a more targeted and successful fashion. Some possible reasons investors might be concerned with inflation are:

**Inflation erodes the purchasing power of money.**

- Investors care about the value of money to buy goods. Since inflation causes prices to rise, if an investor's money does not grow more than prices, they cannot consume as much.

**Inflation uncertainty poses a risk to prices of financial assets, most importantly bonds.**

- The uncertainty of variations in inflation causes volatility in financial asset prices. In particular, bond portfolios are negatively affected by increases in inflation.

**Asset vs. liability disconnects**

- Institutional portfolios are financially based while liabilities are often referenced explicitly to inflation which is largely physically based. With physical assets comprising a large part of the definition of inflation, but financial assets being positively or negatively affected by inflation, this disconnect poses a risk.

**Inflation is an important part of economic growth.**

- Investors seeking to capture economic growth need to consider that growth is made up of both inflationary and real components. Staying positively exposed to inflation is thus an important part of staying positively exposed to economic growth.

Commodities trading involves substantial risk of loss.  
Past performance is no guarantee of future results. Potential for profit is accompanied by possibility of loss.

## Different Concerns, Different Measuring Tools

These sample concerns are quite different in nature. They include both long-term and short-term concerns (erosion of purchasing power vs. inflation uncertainty), both direct and indirect effects of inflation (asset/liability disconnects vs. the effects on financial asset prices themselves), and with both risk and opportunity (avoiding negative impacts on financial assets vs. capturing a component of economic growth). We will show that it is an unfortunate reality that there is no single asset class solution for addressing all of these concerns simultaneously, so when an investor is “concerned about inflation”, more specificity is required. In addition, due to this lack of an inflation magic bullet, if an investor harbors multiple concerns, a total portfolio solution including multiple types of real assets may be required to address them all. This multi-faceted nature of inflation’s effects is ultimately what lies at the heart of the debate about the role of commodities with inflation.

## Quantifying the Concerns

Different inflation concerns necessitate different ways of quantifying those concerns. For example, if an investor is most concerned with the long-run purchasing power of money, the Consumer Price Index (CPI) is a good measuring tool. However, if an investor is concerned about the negative impacts of inflation on their financial assets, the prices of those financial assets themselves are a better measuring tool. In other words, for some concerns, inflation as classically embodied by the CPI is indeed the best measuring tool against which to stack investment solutions, but in others, inflation really just acts as a middle man for a concern about the effects of inflation on something else. If an investor is concerned about an effect of inflation, it is more appropriate to address this effect directly than to confound the issue by using inflation as a proxy concern. Hypothetically, if an asset existed that went up every time bonds went down, for

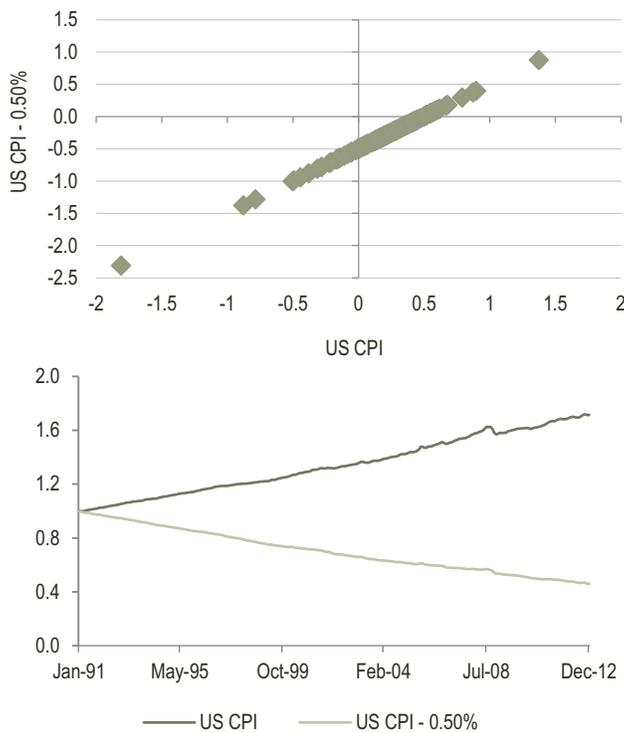
example, investors would probably care less about what caused their bonds to go down (rising inflation being just one possibility) than they would care about including that mythical asset in their portfolio. While disaggregating effects is a truly helpful endeavor from the standpoint of understanding, in the world of investing in which Arrow-Debreu securities do not exist<sup>1</sup>, a more direct approach to measuring and addressing the underlying concern is more applicable.

We have determined that the different types of inflation concerns require different measuring tools; but investors still need to quantify how good an investment solution is at addressing their concerns. If the price of some financial asset is the tool we want to use to quantify a concern, for example, what formula do we plug that price into for the quantification? This ultimately comes down to a question of time scale, and answers are different for different time scales. If an inflation concern is for a short to medium time scale (say one quarter to a few years), correlations are the best way to quantify. Correlations tell investors how similar (or dissimilar) variations in returns of two assets away from their own averages are to each other. When calculating correlation between two data sets, the average of each set is removed, and the remaining excess returns over the average are compared to each other. Over short to medium time scales in which the variability of returns (aka volatility) regularly dominates the long-run average return, identifying assets with meaningful correlation to an asset of concern is thus a relevant exercise to determining which assets provide the best hedges.

Long time scales (five or more years) are surprisingly different, and a simple example drives this point home. If one calculates the correlation between inflation and inflation minus 0.50%, the result is 1.0 over any time scale, i.e. a perfect correlation. If these two sets of returns are accumulated, however, they look drastically different with cumulative inflation shooting up and cumulative inflation minus 0.50% shooting down. In other words, even a perfect correlation is insufficient to guarantee that cumulative

returns track each other. The plots below show this result graphically. On the left is a scatter plot of inflation vs. inflation minus 0.50%, and it is easy to see that the correlation between these two is a perfect 1.0. On the right are the same two sets of returns accumulated over time and we can see they do not track each other at all.

**EXHIBIT 1: SEASONALLY ADJUSTED US CORE CONSUMER PRICE INDEX FOR ALL URBAN CONSUMERS ALL ITEMS**  
[January 1991 - December 2012]



Sources: FRED, First Quadrant, L.P.

An introductory result from stochastic calculus helps identify the missing ingredient in getting cumulative returns to track each other. The end point of a set of cumulative returns has an average given by:

$$E(\log(CVA_T)) = \left(\mu - \frac{1}{2}\sigma^2\right)T$$

CVA stands for Cumulative Value Added,  $\mu$  is the average of the set of returns,  $\sigma^2$  is the variance of the set of returns, and  $T$  is the number of time periods over which the returns are accumulated.  $E(\bullet)$  is the expectation operator, i.e. the average. Since the variance of returns is often much smaller than the mean (recall that a volatility of 10% implies a variance of 1%), what the formula says is that the end point of a set of cumulative returns is primarily determined in practice by the average. In other words, in the long run, the trajectory of cumulative returns is primarily determined by exactly the thing that correlations explicitly strip out! We thus need a different way to quantify inflation concerns at long time scales than at short time scales.

For long time scales, the easiest way to compare returns is simply by subtracting them. Just taking the difference does not tell us much about how “good” the return is, however, so we have to evaluate this difference relative to some aspect of return quality. If an investor is worried about beating inflation in a risk-efficient manner, for example, an “inflation Sharpe ratio” is a relevant quantifier. In an “inflation Sharpe ratio”, the numerator contains the average difference between returns on an asset and inflation, and the denominator contains the volatility of returns of that asset. Alternatively, for an investor concerned about beating inflation in the most consistent manner, an “inflation Sortino ratio” might be a more relevant quantifier. In an “inflation Sortino ratio”, the numerator contains the average difference between returns on an asset and inflation, and the denominator contains the downside volatility of that asset with inflation as the target return.

### Addressing the Concerns

We are now armed with an arsenal of hammers to address various inflation concerns, so we can start hitting some nails. We begin by defining some specific metrics related to various inflation concerns and determine how different assets stack up against these metrics. Our metrics are as follows:



- Correlation to inflation. Positive scores on this metric indicate that an asset is a good hedge to inflation changes over short to medium terms.
- Correlation to unexpected inflation. Several agencies, public and private, forecast inflation on a regular basis. We use the Cleveland Federal Reserve Bank's one year ahead inflation forecast as a measure of expected inflation, and define unexpected inflation as the difference between realized inflation and this expected inflation. Positive scores on this metric indicate that an asset is a good hedge to unexpected inflation changes over short to medium terms.
- Correlation to world bonds, inverted. Nominal bonds are well known to be inversely sensitive to inflation changes and are generally core holdings in investors' portfolios. Positive scores on this metric indicate that an asset is a good hedge against the effects of inflation on fixed income over short to medium terms.
- Correlation to the trade-weighted dollar, inverted. From a purchasing power parity perspective, if inflation in the US is stronger than inflation in Europe, for example, the US dollar should weaken relative to the euro. Positive scores on this metric indicate that an asset is a good hedge against the effects of inflation on the US dollar (and by extension US dollar denominated assets) over short to medium terms.
- Correlation to world economic growth. Inflation is one of the two major components of economic growth. Inflation thus represents an opportunity that an investor might want to capture in their portfolio. Positive scores on this metric indicate that an asset is a good way to capture this opportunity over short to medium terms.
- Inflation Sharpe ratio as defined above. Positive scores on this metric indicate

that an asset provides a way of beating inflation risk efficiently over the long term.

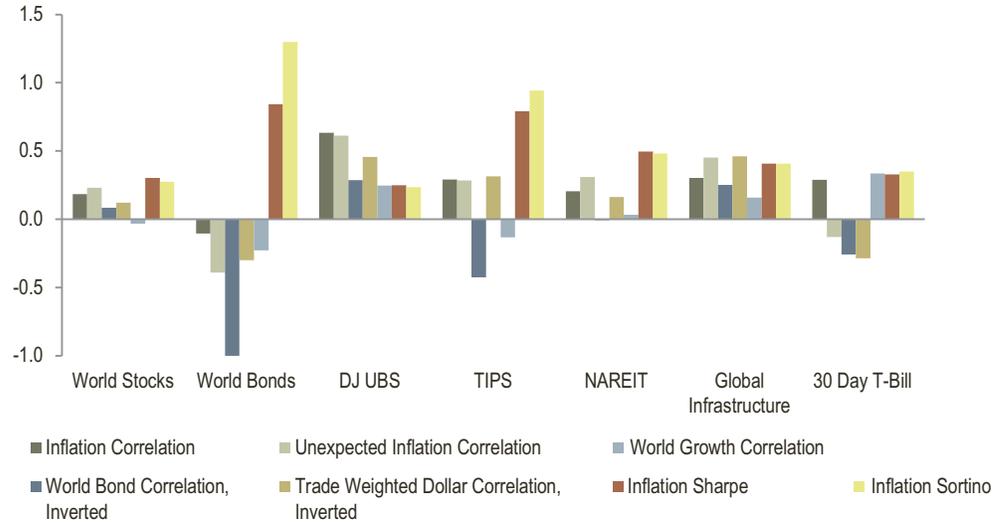
- Inflation Sortino ratio as defined above. Positive scores on this metric indicate that an asset provides a way of beating inflation consistently over the long term.

All of these metrics are calculated using rolling annual data. We consider a year to be about the shortest time scale over which inflation concerns of any type in the developed world are likely to have a meaningful impact on a portfolio.

The assets considered here are both the traditional assets of world stocks and world bonds, but also assets commonly thought to be good inflation hedges of one type or another. These assets include commodities, TIPS, real estate, infrastructure, and 30-day T-bills. For our purposes, we will use the DJUBS Commodity Index to represent commodities, the NAREIT Index to represent real estate, and the DJ Brookfield Global Infrastructure Index to represent infrastructure. (Due to lack of data availability, the DJ Brookfield Global Infrastructure Index returns data is backfilled with the returns of the UBS Global Infrastructure & Utilities 50/50 Index before 2003.) The plot below shows how each of these seven assets stacks up against each of the seven inflation-related metrics from above.

What we see in the plot is precisely what lies at the heart of the debate about whether commodities are a good inflation hedge or not. For almost every one of the short- to medium-term metrics (i.e. the correlation metrics), commodities are the strongest performer, but for both of the long-term metrics (i.e. the relative performance metrics), commodities are the worst. In other words, what we find is that commodities are simultaneously the best and worst inflation hedge, the distinguishing characteristic being the time horizon over which an investor is evaluating. Contrastingly, the assets that show strong performance on the long-term metrics have at least a few short-term metrics for which they are poor or even negative performers. Indeed it may come as a surprise that bonds have actually been the best way to beat inflation

**EXHIBIT 2: INFLATION HEDGING POTENTIAL OF VARIOUS ASSET CLASSES**  
 (January 1991 - December 2012)



World Stocks is MSCI World Index (local currency). World Bonds is Citigroup World Government Bond Index (local currency). DJUBS is Dow Jones-UBS Commodity Index. TIPS is BofA ML US Inflation-Linked Treasury Total Return Index. NAREIT is the FTSE Nareit All REIT Index. Global Infrastructure is the DJ Brookfield Global Infrastructure Index. Cash is Ibbotson US 30-Day T-Bill.

Source: Bloomberg, First Quadrant, L.P.

over the long term over the past few decades even though they have a negative correlation to inflation on all of our short- to medium-term metrics. It seems, therefore, that we cannot address all inflation concerns with any single asset class, and so the problem of inflation hedging must be addressed separately on short- to medium-term and long-term horizons.

**Getting Granular**

The analysis shows that commodities are the best asset to hedge the uncertainty of inflation in the short term although they are among the worst to hedge the long-term erosion of principal due to inflation. Let us dig into this issue of long-term principal erosion momentarily. Recall that the long-term comparisons above were based on the relative returns of the assets to inflation without any reference to the cause of the assets' returns. In other words, over the long term, being able to beat inflation

does not require that we have to derive returns from inflation itself. We simply have to generate returns that are greater than inflation. This is a critical observation. As long as returns of the overall portfolio are greater than inflation, an investor can be said to have hedged their long-term inflation risk. This can be accomplished with a single asset class as in the above analysis, an active overlay on top of a single asset class, or it can be accomplished through the strategic asset mix of an overall portfolio. This embedded flexibility about how to beat inflation in the long-term makes the issue easier to deal with. It is thus the short- to medium-term inflation risk, i.e. the risk of changes in inflation and its effects, which is generally the more difficult issue to address. Here investors have less flexibility in how to address the issue because they explicitly need assets that move in tandem with inflation, i.e. assets with high correlation to inflation and its effects.

### COMMODITY SECTORS CORRELATIONS (January 1991 - December 2012)

Energy	1					
Grains	0.142	1				
Industrial Metals	0.165	0.125	1			
Livestock	0.429	0.171	0.186	1		
Precious Metals	-0.077	0.423	0.480	-0.059	1	
Softs	0.132	0.309	0.339	0.027	0.384	1
	Energy	Grains	Industrial	Livestock	Precious Metals	Softs

Sources: Bloomberg, First Quadrant, L.P.

We have already found that commodities are the best way to hedge inflation in the short to medium term, so it is worth digging into this result and asking if certain commodities are better at doing this than others. Commodities are a very diverse asset class with only weak relationships between different commodity sectors. The table above shows correlations between each of the six commodity sectors.

What we see is that none of the correlations break above 0.5, and a full 60% of them are under 0.2. With such a diverse group of sectors, it stands to reason that different sectors would have different abilities in hedging inflation and its various effects.

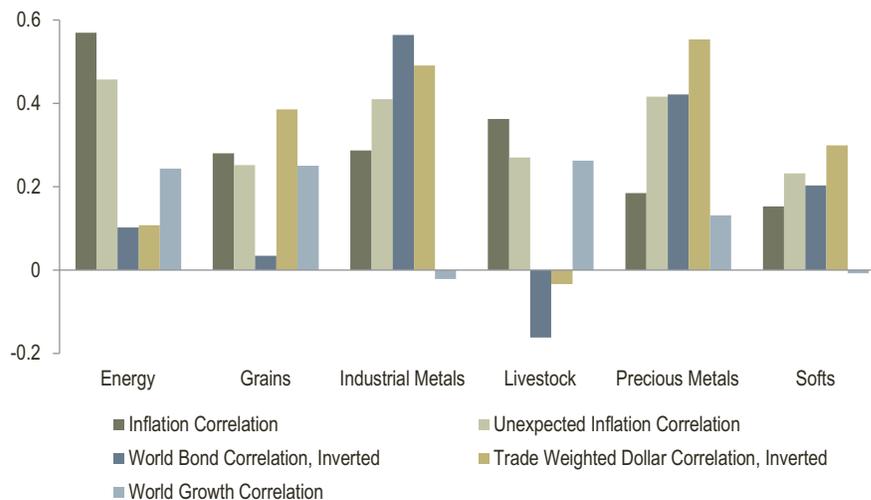
The plot below stacks each of the six commodity sectors against each of the five short- to medium-term inflation-related metrics discussed above.

We indeed find that different commodity sectors respond differently to the various inflation-related metrics. Furthermore, we find that the results are quite varied within each individual sector. There is no one sector that is universally the best, or even universally good, across all the different metrics, nor is there any one sector that is universally the worst, or even universally poor, across all the different metrics. Each sector is strong in some metrics, but weak in others. It seems that not only do commodity sectors diversify each other well in terms of returns, as we found in the correlation table above, but they also diversify each other well with regards to their inflation hedging abilities.

#### Balance Begets Balance

Since commodity sectors have varying

### EXHIBIT 3: INFLATION HEDGING POTENTIAL OF COMMODITY SECTORS (January 1991 - December 2012)



Sources: Bloomberg, First Quadrant, L.P.

abilities to hedge inflation in different ways, this leads one to ask if there are more effective ways of constructing portfolios of commodities to hedge inflation than the DJUBS Commodity Index used as our commodity proxy above. If an investor had just one precisely defined concern with regards to inflation, they could design a custom-built commodity portfolio to suit their needs, but what if they wanted an ability to balance all of these different concerns at once? Since no one sector is dominant across all these different metrics, a balanced allocation may provide a potentially effective solution. Unfortunately, the DJUBS Commodity Index is not such a balanced allocation. It is largely dominated by energies and industrial metals, which together account for nearly 70% of the variability of returns of the index as a whole, so we must create a balanced portfolio from scratch.

A complication in achieving such a balanced portfolio is the drastically different levels of risk of each sector. These risks range from an almost 40% volatility for energies to just 15% volatility for livestock. Since it is the risk contribution of an asset, rather than the capital invested in an asset, that ultimately governs how much an asset contributes to variability of portfolio returns, we must take care to balance the risk coming from each sector, rather than the capital invested in each sector, in order to properly balance the portfolio. In order to achieve risk equivalency,

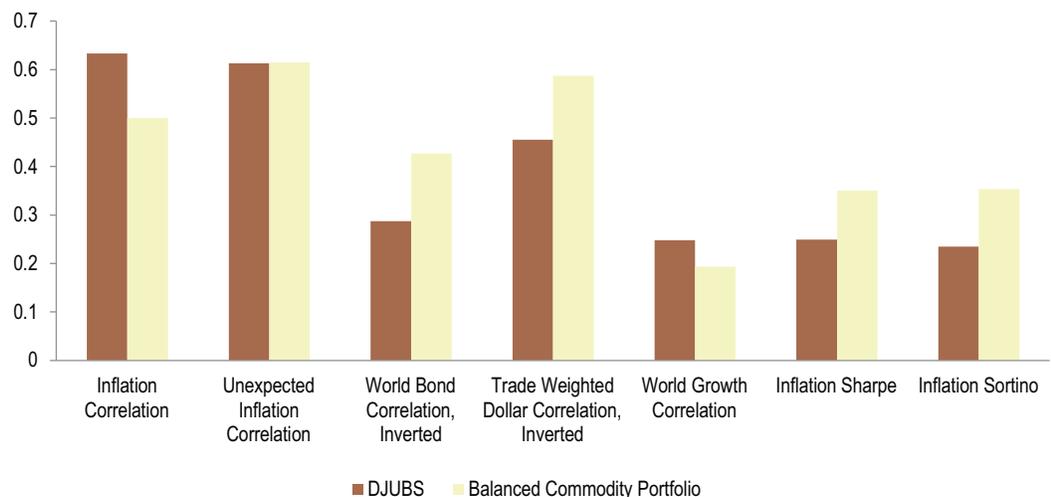
we scale the returns of each sector by dividing by the volatility of the sector returns.

After equalizing the risk of each sector, we must additionally determine a balanced allocation to these sectors. Since we are focused on inflation and its effects, rather than balance across sectors, we want to balance across different types of inflation. We define the different types of inflation here as industrial inflation (made up of energy and industrial metals), food price inflation (made up of grains, softs, and livestock), and monetary inflation (made up of precious metals). The final allocation thus gives an equal risk weight to each of these three types of inflation, and an equal risk weight within each inflation type to the sectors that make it up. (For the sake of this exercise, we use the DJUBS sector returns as our fundamental building blocks rather than additionally questioning the allocation within each sector. This intra-sector allocation question is a worthwhile one to pursue, but is beyond the scope of the current exercise.) Finally, in order to facilitate a comparison, we scale the aggregated portfolio returns to the same level of risk as the DJUBS Commodity Index.

The result of taking this balanced approach on our seven inflation-related metrics is shown in the plot below.

What we find is that the balanced commodity portfolio indeed provides a more balanced hedge to inflation and its various effects than the

**EXHIBIT 5: INFLATION HEDGING POTENTIAL OF BALANCED COMMODITY PORTFOLIO VS DJUBS (January 1991 - December 2012)**



Sources: Bloomberg, First Quadrant, L.P.



DJUBS Commodity Index. Although the DJUBS Commodity Index has a higher correlation to inflation itself and to world growth, the balanced portfolio has an equal correlation to unexpected inflation, a stronger inverse correlation to bonds and the dollar, and higher quality inflation relative returns in both risk adjusted (inflation Sharpe) and consistency (inflation Sortino) terms. Ultimately, we believe investors care more about the effects of inflation than they do about inflation itself per se, and would thus argue that a balanced portfolio is preferable in light of this analysis.

### Conclusion

We have discussed various inflation concerns that investors may have and demonstrated that they segregate into short- to medium-term and long-term types. After developing several metrics to evaluate the potential of different assets to address these different concerns, we showed that there is no single asset that can address both short- to medium-term and long-term concerns simultaneously. As long-term concerns were found to primarily depend on the aggregate return-generating potential of the portfolio as a whole – a goal that can be achieved through a variety of potential mechanisms unrelated to

inflation – we focused on the more difficult issue of hedging inflation over the short to medium term. Here, we found that commodities were the best asset amongst those we evaluated to address the concerns discussed. Digging deeper into the commodity asset class, we found that no single commodity sector was responsible for providing all of the various inflation-hedging characteristics found for the asset class as a whole. In fact, the variability of inflation-hedging characteristics amongst different sectors was so great that a balanced allocation across commodity sectors was proposed in order to attempt to enhance the inflation-hedging characteristics of a commodity portfolio as a whole. We found that, indeed, taking a balanced approach to allocating within the commodity asset class provided a more balanced set of inflation-hedging characteristics across the various metrics discussed.

### Endnotes

<sup>1</sup> An Arrow-Debreu security is a hypothetical security that pays off \$1 in one particular state of the world and \$0 in every other state. They are useful mathematical constructs used to provide an economic understanding of parts of financial market theory. They do not exist in reality.