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Hedging inflation risk in fixed income portfolios using commodities

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Introduction

Kartik Ghia, PhD
kghia6@bloomberg.net
212-617-5649

Michael K. Donat, CFA
mdonat2@bloomberg.net
212-617-5509

Zarvan Khambatta, CFA, CAIA
zkhambatta4@bloomberg.net
212-617-5418

An important risk factor in fixed income investing is inflation. Rising and/or high inflation erodes purchasing power and can be particularly detrimental to those relying on bond income. One approach to managing inflation risk in core fixed income portfolios is to allocate a proportion of the portfolio to assets which display returns that are positively correlated to inflation. This may be in the form of an investment whose payout is linked to the inflation rate (e.g. inflation protected securities) or has historically displayed such return characteristics (e.g. real estate and commodities).

In a prior publication, we analyzed the inflation hedging characteristics of commodities (*Inflation and Commodities: Examining the Link, April 2019*). While the efficacy of each sector varied over time, the broad-based takeaways were (1) the Bloomberg Commodity Index (BCOM) and Bloomberg Commodity Energy Index were the most effective hedges and (2) accounting for roll yield was important in enhancing returns. In this publication we explore the inflation hedging properties of the constituents of the energy sector more closely. The analysis includes (1) constructing an energy portfolio based on regression analysis and (2) assessing the impact of adding exposure to this portfolio for U.S. fixed income investors.

Data

We use the index data from the BCOM family of indices starting in March 1985. The Bloomberg Terminal tickers for all constituents referred to in the remainder of the analyses are listed in Figure 1.

Figure 1: Energy constituents: Bloomberg tickers

Commodity	Front (ER)	3-Month (ER)	3-Month (TR)
WTI	BCOMCL Index	BCOMCL3 Index	BCOMCL3T
Brent	BCOMCO Index	BCOMCO3 Index	BCOMCO3T
Heating Oil	BCOMHO Index	BCOMHO3 Index	BCOMHO3T
Gasoline	BCOMRB Index	BCOMRB3 Index	BCOMRB3T
Gas Oil	BCOMGO Index	BCOMGO3 Index	BCOMGO3T
Natural Gas	BCOMNG Index	BCOMNG3 Index	BCOMNG3T

Source: Bloomberg

The reader should be mindful that start dates for the indices do vary. In later sections, when we refer to the 'energy portfolio', we introduce successive commodities when they become available. The Bloomberg Commodity Energy index (the ticker on the Bloomberg Terminal is BCOMEN Index) is henceforth referred to as BCOM Energy.

Please note that prior to the 'Assessing performance' section, all the analysis is carried out using excess returns (over funding); subsequently we use total returns.

As with our prior publication on the topic, the inflation rate is measured as the quarterly percentage change in the original (not seasonally adjusted) U.S. Consumer Price Index for All Urban Consumers (CPI-U). The BLS periodically revises historical CPI data. In this publication we use the revised data, not the originally published data.

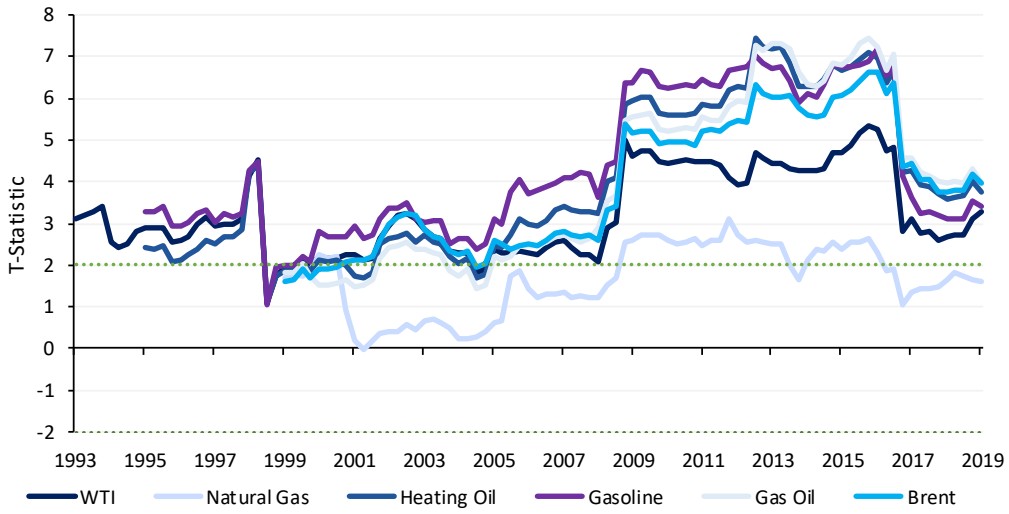
Energy portfolio

The energy sector within the BCOM index consists of six constituents – five of which belong to the petroleum sub-sector (WTI, Brent, Gasoline, Gas Oil and Heating Oil). While the energy basket (given by BCOMEN Index) does display a strong relationship with inflation[1], it might not be the case for all of its constituents.

Selecting constituents

Based on changes in CPI and individual commodity returns, we run rolling, univariate regressions over eight years[2] of quarterly data. In all the regression figures we display the ±2 t-stat thresholds, since they refer to the commonly used significance level of 0.05. Thus, a t-stat greater than 2 or less than -2 implies a statistically significant relationship over the preceding eight years.

Figure 2: Contrasting degrees of significance for petroleum and natural gas



Source: Bloomberg

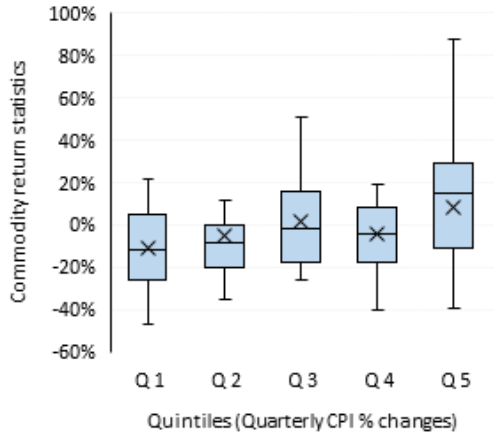
The regression reveals not only the time-varying nature of the relationships but also highlights the difference between petroleum products and natural gas. Aside from brief periods, returns of the petroleum-based indices display a statistically significant linear relationship to changes in CPI. In contrast, natural gas returns display sporadic, weaker significance.

To confirm the difference between natural gas and petroleum constituents, we look at a quintile-based analysis using the full sample. Quarterly changes in CPI are ranked in ascending order and the corresponding index returns are calculated. Figures 3 and 4 show the results for natural gas and one representative of the petroleum sub-index (gasoline). The box-and-whisker plots include a summary of the key statistics of each quintile. These

[1] See Inflation and Commodities: Examining the Link, April 2019
[2] To account for the length of the average business cycle

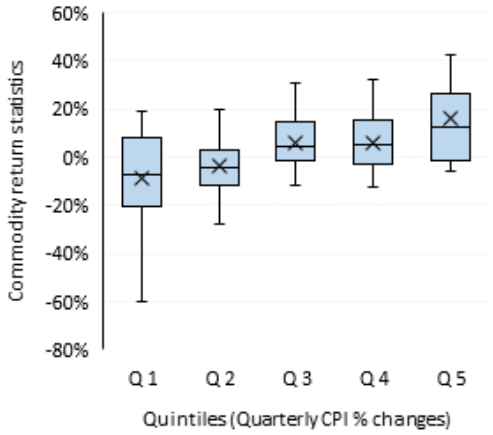
include the mean (marked by a cross), the median (horizontal line) and the interquartile range (displayed box). The lines extended on either side display up to 1.5x the interquartile range. For display purpose, observations outside this range are winsorized. The dispersion in returns (and the general lack of a consistent pattern between quintiles) displayed by natural gas supports the results of the regression analysis. Based on this, we restrict the portfolio to the five petroleum constituents.

Figure 3: Natural gas (1991 – 2019)



Source: Bloomberg

Figure 4: Gasoline (1987 – 2019)



Source: Bloomberg

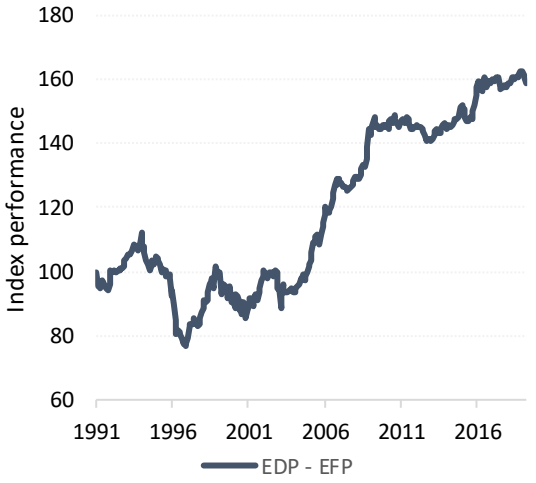
Investment instruments

An important aspect of commodities investing is accounting for the roll return derived from commodities futures ("*Structural sources of excess returns*", *2011*). Depending on the shape of the curve, the accrued roll return can either be positive or negative. Historically, the dynamics of the commodities market are such that (1) for non-seasonal commodities the absolute size of the slope tends to decrease as you move further out in the curve and (2) a long position in a deferred contract has tended to provide higher returns than the nearby contract. The drivers of returns for this outperformance including elements of hedging dynamics incorporating producer and consumer behavior.

Using data starting in January 1991, we compare the performance of an equally weighted, monthly-rebalance portfolio consisting of front contracts and 3-month deferred contracts. (Constituents and tickers are given in Figure 1). The composite portfolios are labeled the energy front portfolio (EFP) and energy deferred portfolio (EDP).

The impact of roll-yield can be illustrated by constructing a long/short portfolio comprising of a long position in the energy deferred portfolio and short position in the energy front portfolio (Figure 5). The correlation (using monthly returns) between the two portfolios is 0.98 over the full sample. Figure 6 provides a side-by-side performance comparison of the long-only portfolios (excess returns). For the remainder of this publication, we use the portfolio comprising of the 3-month deferred indices. Since our data for the deferred indices begins from 1991, in order to extend our historical analysis, for the period 1985-1990 inclusive, we use the nearby portfolio as a proxy.

Figure 5: Long/short portfolio (EDP – EFP)



Source: Bloomberg

Figure 6: The impact of roll yield

1991 - 2019	EFP	EDP
Annualized return	3.1%	6.0%
Volatility	28.6%	25.2%
Sharpe ratio	0.11	0.24
Drawdown	-83%	-78%
Skewness	-0.50	-0.57

Source: Bloomberg

Introducing the inflation hedge

While the key feature of a suitable passive hedge is the ability to maintain the purchasing power of the core fixed income portfolio during times of high/rising inflation, providing diversification benefits is an important consideration. Some common choices include real estate, commodities, Treasury Inflation Protected Securities (TIPS) and equities.

We assess the impact of using the energy-based portfolio (from the section above) as an inflation hedge for investors benchmarked to the Bloomberg Barclays US Aggregate Total Return Unhedged USD index (LBUSTRUU Index) and the Bloomberg Barclays US Treasury Total Return Unhedged USD index (LUATTRUU Index). From here onwards, we refer to these two benchmark indices as the US Aggregate and US Treasury indices respectively.

Portfolio considerations

The diversification characteristics of the EDP can be assessed by looking at the correlation of returns to the two fixed income benchmarks. Correlations are based on excess returns (measured as total return minus the funding rate) and calculated over the full sample 1991 – 2019. Since many investors might already have exposure to the BCOM index, we include this as a reference point.

Figure 7: Asset correlations: Excess returns spanning 1991 to 2019

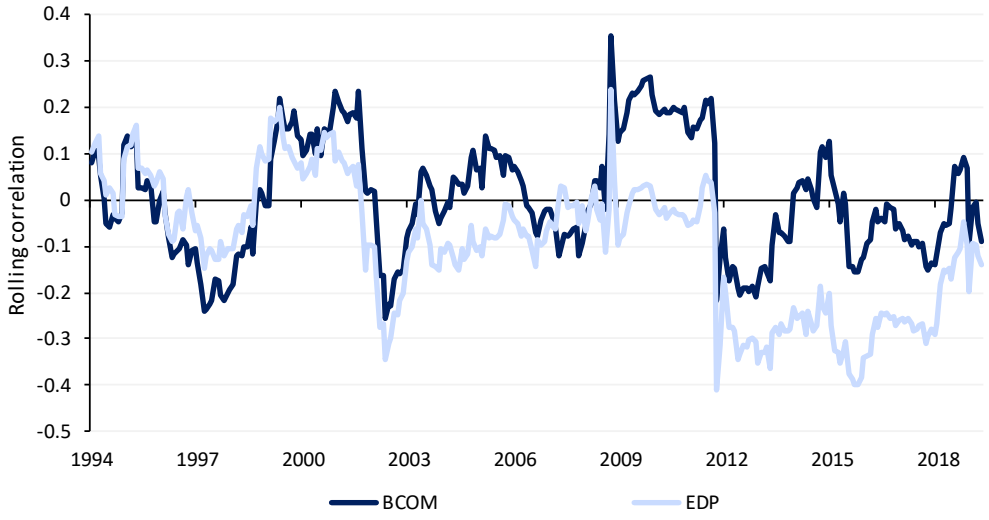
	BCOM	EDP	US Aggregate	US Treasury
BCOM	1	0.77	0.03	-0.08
EDP		1	-0.08	-0.17
US Aggregate			1	0.93
US Treasury				1

Source: Bloomberg

The key takeaways from Figure 7 are (1) the traditional BCOM portfolio and the EDP are highly correlated and (2) both portfolios are broadly uncorrelated with the US Aggregate and US Treasury indices. This suggests using the EDP maintains the diversification

benefits of the broad-based BCOM index. Rolling correlations highlight the time-varying nature of the correlation between commodities and fixed income (Figure 8). Based on 36-months of returns, the correlation varies between -0.4 and 0.4

Figure 8: Time varying correlations of EDP and BCOM versus the US Aggregate index



Source: Bloomberg

Sizing commodity exposure

The size of the commodities allocation is impacted by two related considerations – the relative volatility of commodities versus the core portfolio and the need to maintain the broad behavioral properties of the core fixed income portfolios (e.g. correlations to other asset classes).

The full sample volatility of the US Aggregate and US Treasury indices are 4% and 4.6% per annum respectively. Over the same period, the volatility of the energy portfolio was 29%. To do full justice to the question of sizing a hedge would necessitate a separate discussion – including whether it should be dynamic rather than static (i.e. based on return characteristics or the economic environment). In this publication, we illustrate the impact on portfolio returns when using a statically-sized position. We explore alternatives to this later in the research series.

An inflation beta of 1 implies that a 1% increase in inflation is accompanied by a 1% increase in asset returns. The rolling (inflation) beta for the energy portfolio ranges between 10 -25 over the sample period 1985 - 2019. Based on these observations, we assume a static 5% allocation to the energy portfolio.

The final portfolio can be constructed via two approaches – the first adds unfunded commodities exposure to the core fixed income portfolio while the second employs a fully funded approach. Since the first approach uses leverage which might not be permissible for all investors, we use the latter. A 5% funded allocation is made to the energy deferred portfolio (EDP) with the remaining 95% comprising the core fixed income portfolio. For ease of exposition, we construct portfolios with fixed weights that are rebalanced on a monthly frequency. The portfolio is rebalanced to the target weights at the end of each month.

We refer to the standalone fixed income indices as Core portfolios and the portfolios comprising of 95% fixed income indices and 5% commodities as the Core Plus portfolios.

Assessing performance

The addition of commodities to the US Aggregate index raises the risk-adjusted returns from 1.7 to 1.8 while providing an additional 30 bps of annualized returns. The performance enhancement carries over both sub-sample periods while leaving asset class correlations approximately unchanged (see bottom of Figure 9).

Figure 9: Performance statistics: The impact of adding commodities to a core fixed income allocation

	US Aggregate		US Treasury	
	Core	Core Plus	Core	Core Plus
Full sample (1985 - 2019)				
Ann returns	6.8%	7.1%	6.4%	6.8%
Volatility	4.0%	3.9%	4.6%	4.4%
Return/Volatility	1.70	1.84	1.38	1.56
Drawdown/Vol	1.29	1.48	1.17	1.07
1st half (1985 -2002)				
Ann returns	9.2%	9.6%	8.8%	9.3%
Volatility	4.4%	4.3%	4.9%	4.6%
Return/Volatility	2.07	2.26	1.82	2.01
2nd half (2002 - 2019)				
Ann returns	4.4%	4.7%	4.1%	4.4%
Volatility	3.4%	3.4%	4.3%	4.0%
Return/Volatility	1.31	1.41	0.94	1.09
Asset class correlations				
US Treasury (LUATTRUU)	0.95	0.86	1.00	0.95
US Corporates (LUACTRUU)	0.90	0.87	0.75	0.75
US Equities (GDDUUS)	0.14	0.17	-0.03	0.00
Commodities (BCOM)	-0.06	0.22	-0.14	0.10
Equity volatility (VIX)	-0.08	-0.13	0.11	0.06
Inflation (CPI changes)	-0.13	0.25	-0.19	0.14

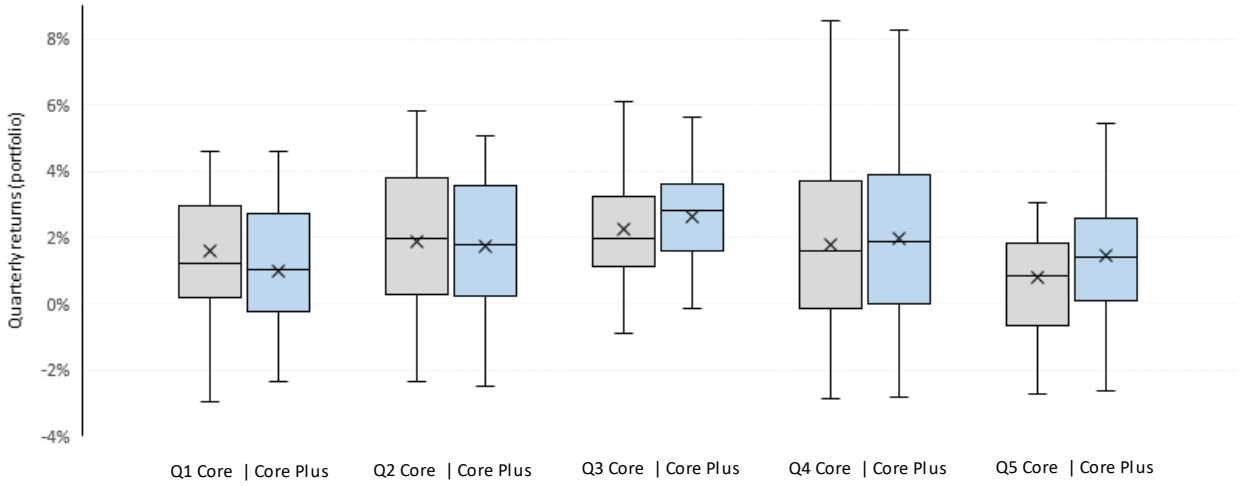
Source: Bloomberg, MSCI

In the case of the US Treasury index, the performance enhancement is even more pronounced – with the addition of commodities increasing returns by 40 bps annually while raising risk adjusted returns from 1.4 to 1.6. Once again, the Core and Core Plus portfolios display similar asset class correlations.

To complete the full picture, we decompose returns quarterly and look at the breakdown in performance controlling for inflation. The quintile-based approach (ordering on the quarterly change in CPI) illustrates the difference between the Core and Core Plus portfolios. In the case of the US Aggregate (Figure 10), the Core Plus portfolio displays relatively lower median returns in quintiles 1 and 2 while outperforming in quintiles 3 – 5.

The median Q1 and Q2 returns decline from 1.2% and 2.0% to 1.0% and 1.8% respectively, while the median Q4 and Q5 returns rise from 1.6% and 0.9% to 1.9% and 1.4% respectively.

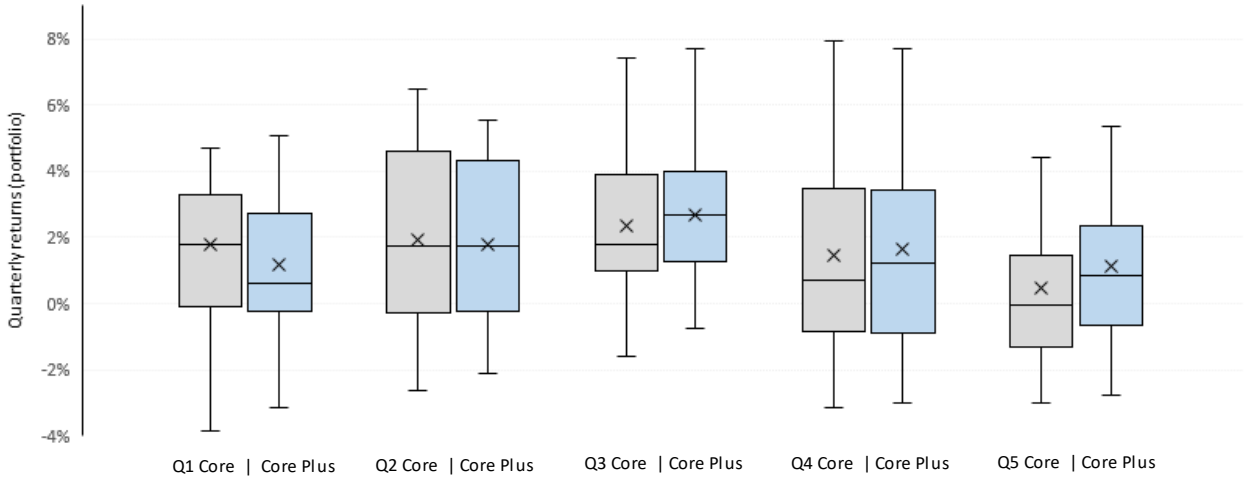
Figure 10: Conditioning on CPI: Summary statistics for US Aggregate portfolios



Source: Bloomberg

In the case of the US Treasury index (Figure 11) the pattern is similar but the impact more pronounced. The median return for quintile 1 declines from 1.8% to 0.6% while the median return for quintile 2 is approximately unchanged (1.7%). In quintiles 4 and 5, where the median US Treasury returns are 0.7% and -0.1% respectively, the addition of commodities increases this to 1.2% and 0.9% respectively. In summary, the (historical) relative outperformance of the Core Plus portfolio is related to the change in CPI.

Figure 11: Conditioning on CPI: Summary statistics for US Treasury portfolios

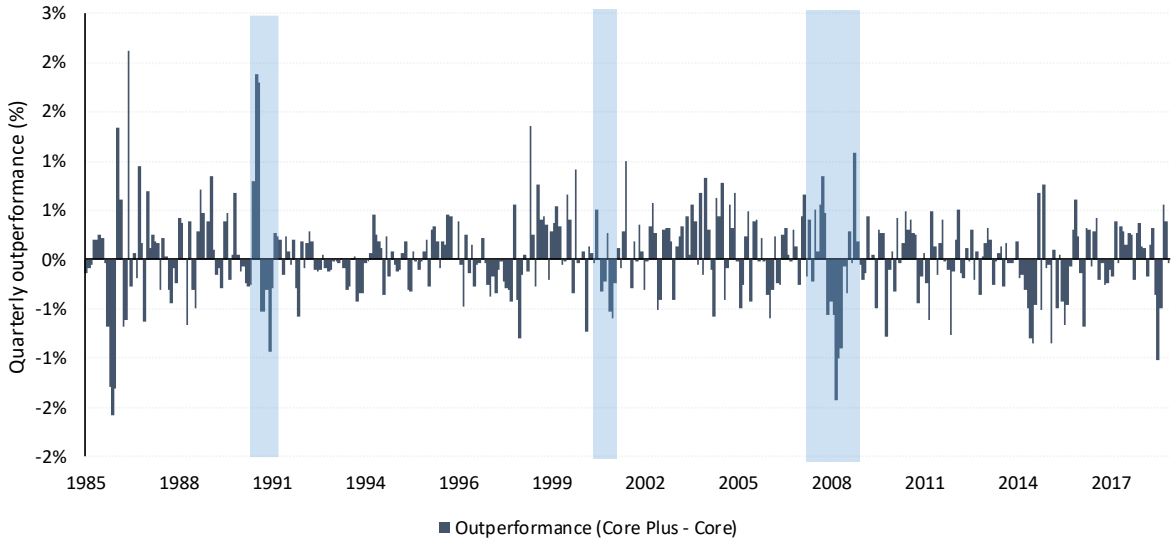


Source: Bloomberg

To further assess the impact of adding commodities exposure, we inspect the quarterly outperformance of the Core Plus portfolio. This is simply defined as the difference between the Core Plus and Core portfolio returns. In the case of the US Aggregate index (Figure 12) there is variation over time and some periods of persistent over/underperformance. Several episodes of relative underperformance coincide with

contractionary economic periods (NBER[3] definition of the business cycle) shown as the shaded areas.

Figure 12: Impact of adding commodities to the US Aggregate: quarterly outperformance (1985 – 2019)



Source: Bloomberg

This tends to fit the common narrative that one driver of commodities (and energy) returns is the level of industrial production and supports the results of Figure 10. In upcoming publications, we delve deeper into the relationship between commodities and the economic cycle – in the process examining the role of commodities in a diversified portfolio.

Conclusion

Petroleum-based commodities returns are positively correlated to changes in US CPI. This relationship can be helpful for fixed income investors looking to insulate their core portfolio during periods of rising and/or high inflation. Incorporating the roll premium embedded in futures instruments, we construct an equally weighted commodities portfolio that can be added to core fixed income exposures. Two examples are provided using the Bloomberg Barclays US Aggregate and US Treasury indices. We have taken particular care in considering the large-scale tradability of all the commodity constituents discussed in this publication. For access purposes and possibly operational ease, many investors get these exposures via a swap format.

The analyses should prove useful for both asset managers looking to reassess their inflation hedges and for asset owners to benchmark the effectiveness of their inflation hedges for core fixed income portfolios.

[3] The National Bureau of Economic Research

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2. Ghia K., Khambatta Z. and Donat M., (2019), "Inflation and Commodities: Examining the Link", Bloomberg LP
3. "Refining Commodity Beta to Protect Against Inflation Shocks", (2014), Bloomberg LP

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